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Some Lessons From Inflation Targeting in New Zealand

by

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[1] The material presented here draws heavily upon the Bank's internal review of the 1991-1998 business cycle, and papers that have been prepared by the Bank for the Independent Review of the Operation of Monetary Policy in New Zealand, which is being conducted by Professor Lars Svensson at the current time. These papers may be obtained at http://www.rbnz.govt.nz/monpol/review/index.html. The author would like to thank in this regard: Adrian Orr, Don Brash, Murray Sherwin, Rod Carr, David Archer, Michael Reddell, Bruce White, Anne-Marie Brooke, John McDermott, Geoff Mortlock, Mike Frith, Tim Ng, Paul Conway, and Dean Minot. Any remaining errors and omissions are the sole responsibility of the author.

1. Introduction

Over the past decade, the number of Central Banks that have adopted formal inflation-targeting regimes has expanded from only one to, at the time of writing, eight. If we include Central Banks that set policy consistent with a formal inflation target, then the set becomes even larger.[2]

Commensurate with the formal or informal adoption of inflation-targeting regimes, there has also been an explosion in the literature on inflation targeting. This literature can be separated into two broad streams. One stream examines the macroeconomic data to assess the performance of the inflation targeters.[3] A focus of this literature is to extract lessons from the inflation targeting experiences of the individual countries concerned. The other stream evaluates inflation targeting as a monetary policy strategy, as characterised by a policy rule. A model of the economy is used to assess the stabilisation properties of a range of alternative policy rules under both deterministic and stochastic disturbances, and increasingly, uncertainty.[4]

In this paper, elements of both strands of the inflation-targeting literature are combined. Some key monetary policy issues that the Reserve Bank of New Zealand faced over the 1990's are analysed using the Bank's economic Forecasting and Policy System (FPS) model. The Bank's policy responses to the specific shocks faced are characterised, and the implications of alternative policy responses both to the specific shocks, and more generalised disturbances, are shown. From this some key lessons that the Bank has learned over the last decade are drawn. First, the importance of pre-empting inflation pressures arising from 'wealth effects' are shown. These sources of inflation pressures are impossible to analyse with the small, 'demand side' models typically used in the literature, as there is no accounting

[2]The Reserve Bank of New Zealand adopted a formal inflation target first with the passing of the Reserve Bank of New Zealand Act 1989. Informally, the Bank had been inflation targeting since 1988. Over the 1990's Australia, Canada, Finland, Spain, Sweden, the United Kingdom, and most recently, the member countries of the European Central Bank have adopted formal inflation targets. Countries that describe themselves as inflation targeters, but not necessarily with explicit, public commitments to specific targets include: The Czech Republic, The Republic of Korea, Israel, Mexico and Chile.

[3]For a recent general assessment on the experience some industrial countries have had with inflation targeting to date see Bernanke et al. (1999). Some recent individual country accounts by central bankers can be found in Allen (1999), Heiksten and Vrdein (1998), Theisen (1998), Stevens (1999), and Sherwin (1999).

[4] This literature is very large. See, for example, the Special Issue of the Journal of Monetary Economics, vol 43, No. 4 and the references therein.

for asset stocks. Second, the problem of using a monetary condition index (MCI) as a guide for policy when economic fundamentals are shifting rapidly is illustrated.

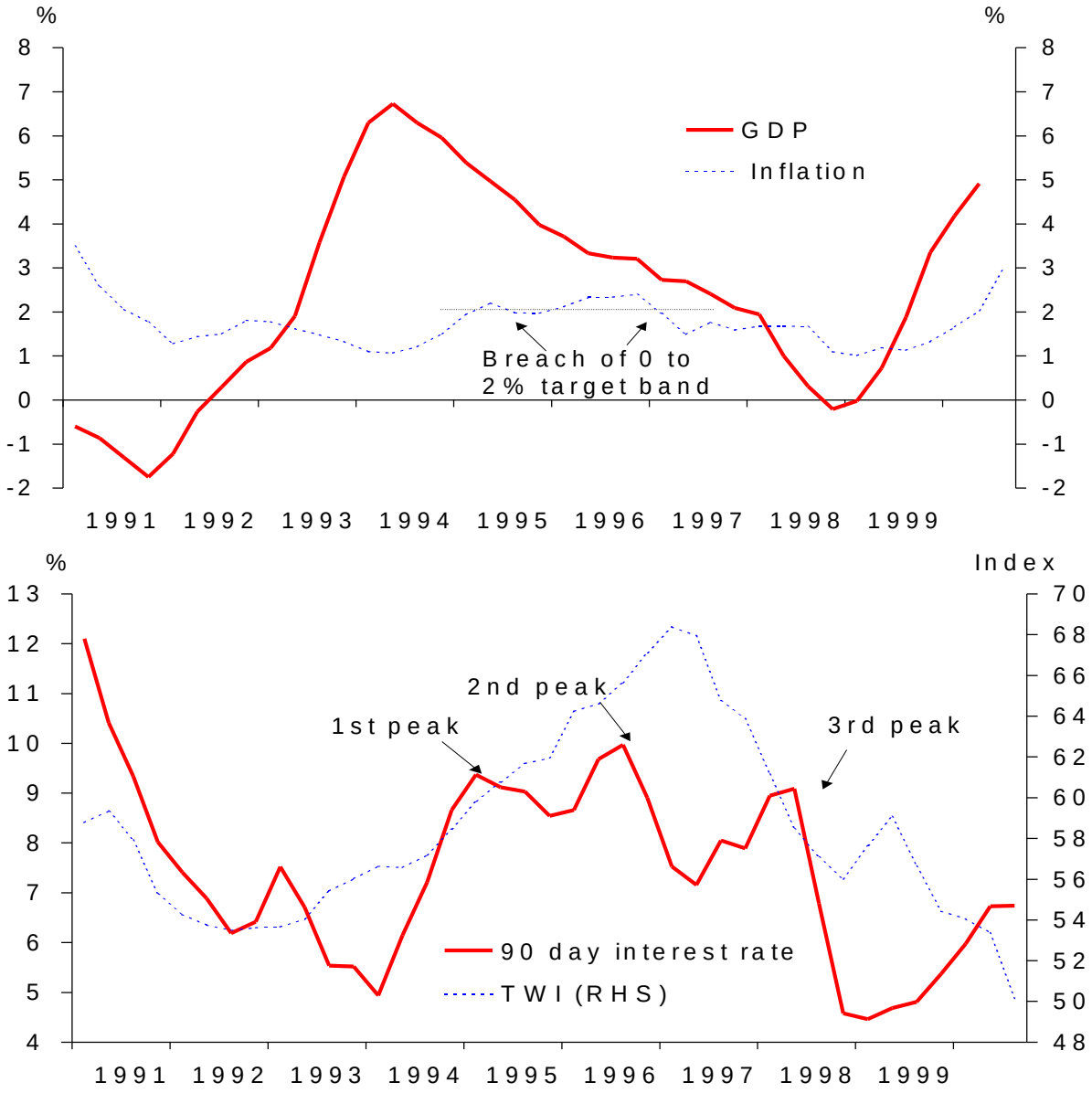
The paper also explores the rationale behind the evolution of monetary policy at the Reserve Bank of New Zealand. As the structure of the economy changes, it is likely that the lags in monetary policy transmission will also change, and policy design should take this into account. Since the early 1990s, the pass-through into local prices of nominal exchange rate changes has become more muted in New Zealand, thereby effectively lengthening monetary policy's lags (by elevating, in a relative sense, the role of the slower part of monetary policy transmission that works through economic activity). As the Bank has observed this development, it has tended to push out the point in the forecast horizon that is use to guide its policy decisions. This factor, and the reduction of both inflation and inflation expectations over the 1990s, has more broadly seen the Bank shift focus towards what are judged to be the more persistent sources of inflation pressures when deciding upon the stance of monetary policy.

The remainder of this paper is structured as follows. Section 2 provides a brief snapshot of the New Zealand macro data. This is followed in section 3 by an overview of the business cycle experienced in New Zealand over the 1990s. In Section 4, the impact of specific shocks on the economy, at the Bank's policy responses to those shocks are examined, as are the potential trade-offs inherent in being more, or less, flexible in policy making. Concluding comments are provided in section 5.

2. The New Zealand data record

Before discussing the role of monetary policy in New Zealand, it is useful to briefly review the broad macroeconomic characteristics of the 1990s. Figure 1 shows how inflation, GDP growth, 90-day interest rates and the trade-weighted exchange rate evolved after 1990. These are discussed in turn.

Figure 1 Real GDP growth, CPI target measure of inflation, 90 day interest rates and the nominal TWI



Source: Statistics New Zealand, Reserve Bank of New Zealand.
Notes on figure 1:
(1) GDP growth is an annual average per cent change.
(2) Inflation is measured as an annual per cent change.
(3) The inflation series is a spliced series of the CPI measures targeted by the Bank at different periods of time. These are the underlying inflation rate, the CPI ex credit services and the current CPI measure.

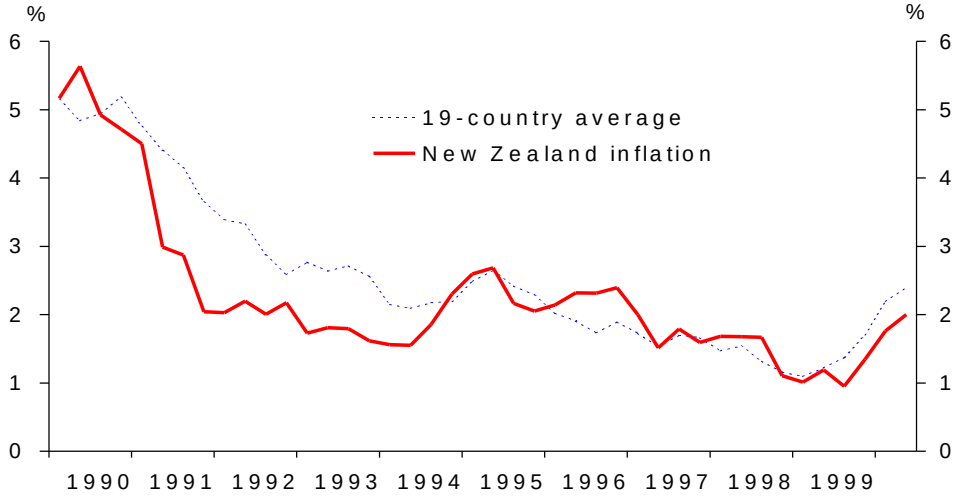
2.1 Inflation

The 1990s were both the first complete decade of inflation targeting in New Zealand, and the first decade for a long time in which inflation remained low and stable. Since achieving the 0 to 2 per cent inflation target in 1991, monetary policy can be credited with having successfully anchored the inflation rate over the remainder of the decade.

From 1991 on, most standard measures of the inflation rate remained below 3 per cent, and typically between 1 per cent and 2.5 per cent. As indicated in figure 1, there were two breaches of the top of the (then 0 to 2 per cent) inflation target band: in the June quarter of 1995 and throughout 1996. However, the Bank's measure of underlying inflation never came close to breaching the lower edge of the target, and indeed never fell into the bottom half of the then 0 to 2 per cent target band. Subsequent to a number of adverse shocks in 1998, CPIX inflation fell to a trough of about 1 per cent by late 1998.

To put New Zealand's inflation record in an international context, figure 2 compares New Zealand's average rate of CPIX inflation since 1991 with the OECD average. The average inflation rate has been very similar to the OECD average since 1995, and before that time it was slightly lower reflecting the earlier steps taken in New Zealand to get inflation down.

Figure 2 CPIX inflation in New Zealand and 19-country OECD average *(annual percentage change)*



Source: Statistics New Zealand and *International Financial Statistics*.

Note: The 19 countries included in the OECD average are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom and the United States.

2.2 Output

Figure 1 illustrates the cycle in GDP growth over the 1990s. There was a significant recession in the early part of the decade, followed by a strong boom in the mid-1990s. After that, there was a gradual slowing in growth, culminating in a small contraction in GDP in the first two quarters of 1998. GDP then accelerated quite quickly out of the 1998 trough before returning to more moderate growth rates.

Average GDP growth rates in the 1990s were higher than those in previous decades; real GDP growth averaged 2.5 per cent during the 1990s, compared with 1.8 per cent and 1.7 per cent in the 1970s and 1980s respectively. New Zealand's average GDP growth in the 1990s was also quite respectable compared with that in other industrialised countries. Table 1 shows that, of 18 industrialised economies, New Zealand's average GDP growth in the 1990s was 6th highest, although the strong average growth relative to the growth in many European economies was in part due to a faster growth in the workforce in New Zealand. In addition, the variability of output growth in New Zealand was also lower during the 1990s compared to the 1970s and 1980s.[5]

Table 1 Real GDP growth over the 1990s

Country	Average Growth Rate
Ireland	6.8
Australia	3.5
Norway	3.3
USA	3.2
Netherlands	2.9
New Zealand	**2.5**
Spain	2.5
Canada	2.4
Denmark	2.2
Belgium	2.1
Germany	2.0
United Kingdom	2.0
France	1.7
Finland	1.7
Italy	1.4
Sweden	1.3
Japan	1.3
Switzerland	0.9

Source: Datastream, Statistics New Zealand

[5] See the paper entitled "Output Volatility in New Zealand" at http://www.rbnz.govt.nz/monpol/review/index.html for a detailed analysis of New Zealand's output variability and how this compares to other industrialised countries.

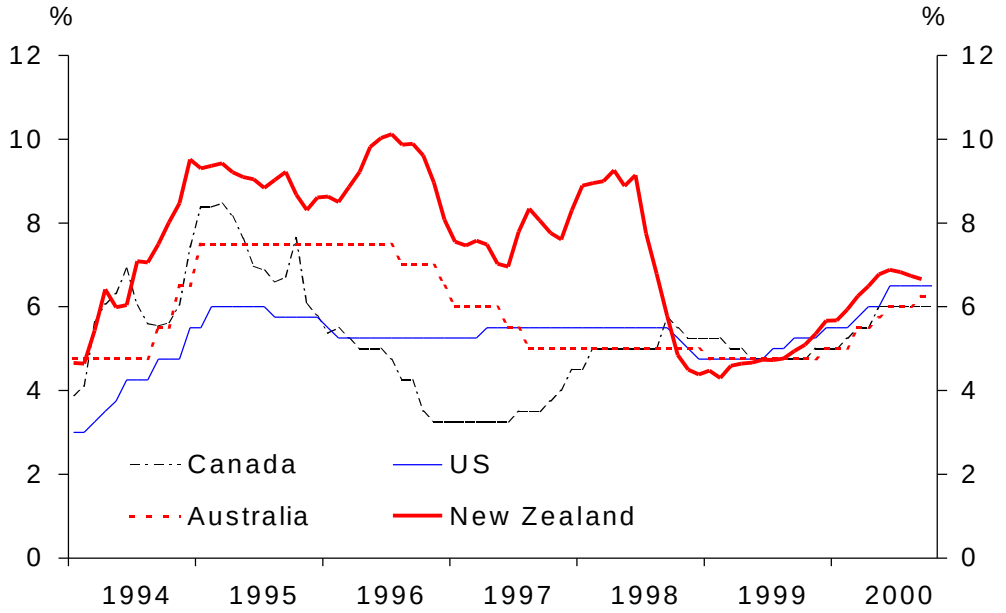
2.3 Interest rates

The path of interest rates through the 1990s featured three humps: 1994/95, 1996 and 1997/98 (see figure 1). Over the late-1994 to early-1997 period, 90-day rates in New Zealand averaged about 9 per cent. This was in response to strong inflation pressures, as discussed in following sections.

Following the 1996 peak, interest rates fell markedly to around 7 per cent in early 1997, before rising again sharply between mid-1997 and mid-1998 to a level of nearly 10 per cent. This increase in interest rates coincided with the Bank's use of the Monetary Conditions Index (MCI) to signal the stance of policy, to be discussed detail in Section 4. Following the third peak, interest rates fell from about 9 per cent to 4 per cent in the latter half of 1998. Since then they have risen gradually to just over 6.5 per cent.

Figure 3 provides a cross-country comparison of short-term interest rates over this period. However, it should be noted that different inflation rates, different risk premia, different cyclical demand pressures, and other factors mean that a simple comparison of nominal interest rates does not always provide a good indication of the relative tightness of monetary policy in different countries.

Figure 3 Short-term (official) interest rates of dollar bloc countries



Source: Reserve Bank of New Zealand, Reserve Bank of Australia and Datastream.

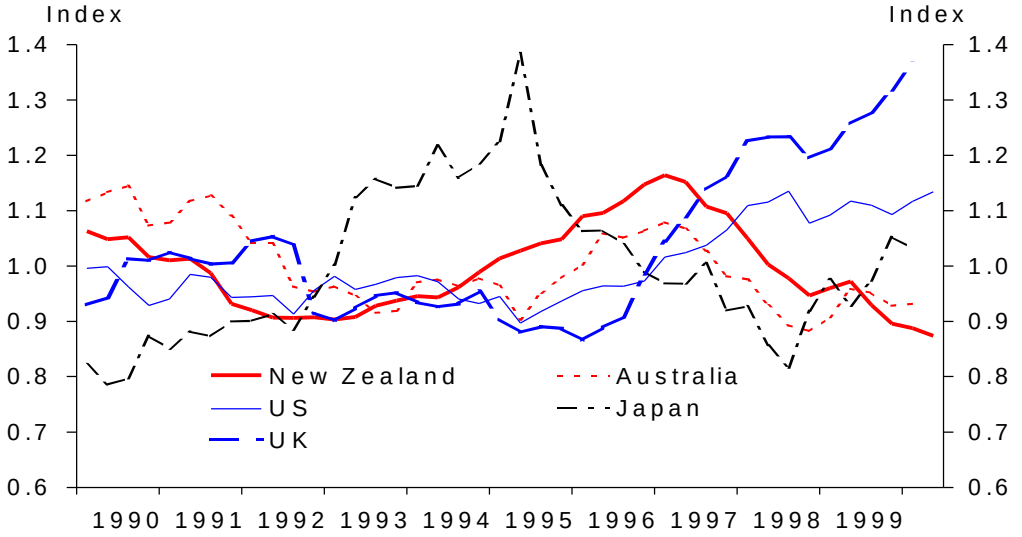
Note: The short-term rates charted are: the US federal funds target rate; the Bank of Canada bank rate; the Australian cash rate; and the New Zealand 90-day bank bill rate. Australia's 3-month bank bill rate tracks the RBA's official cash rate closely during this period.

2.4 The exchange rate

The bottom panel of figure 1 depicts a significant cycle in the New Zealand trade-weighted exchange rate (TWI). After an appreciation of around 30 per cent between the first quarter of 1993 and the first quarter of 1997, the TWI subsequently depreciated by around 30 per cent. With respect to the US dollar, the New Zealand dollar fell from a post-float high of nearly 72 cents in November 1996, to an all-time low of less than 40 cents in October 2000.

It is worth making the point that New Zealand has not been alone in experiencing large exchange rate fluctuations. Figure 4 plots New Zealand's real effective exchange rate alongside similar measures of the exchange rate for some other countries. Although the amplitude of the cycle in the Australian exchange rate has been lower than that for the New Zealand exchange rate, the swings in the yen, and in some other major currencies, have been larger than those of the New Zealand TWI.

Figure 4 Real effective exchange rates for various countries

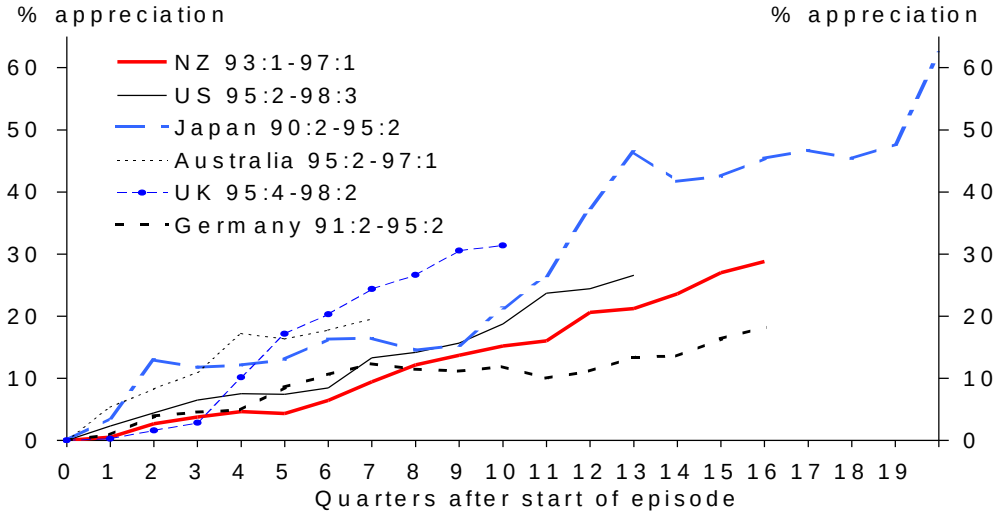


Source: *International Financial Statistics* and Reserve Bank of New Zealand.

Notes:
(1) The exchange rates shown are the real effective exchange rates as calculated by the International Monetary Fund, except for New Zealand where a CPI-based real trade-weighted exchange rate has been used.
(2) All the exchange rates have been re-based so that the respective indices average 1.0 over the period shown.

This point is also illustrated in figure 5, which compares 'episodes' of currency appreciation in various OECD countries in the 1990s. Each episode has been lined up at a common starting point. Thus, for example, New Zealand's episode of appreciation is taken as starting in the first quarter of 1993. An episode for Japan is taken as starting in the second quarter of 1990 and proceeding until the second quarter of 1995, and so forth.

Figure 5 Trough to peak comparison of various real exchange rates



Source: *International Financial Statistics*, Reserve Bank of New Zealand.

Note: The exchange rates shown are the real effective exchange rates as calculated by the International Monetary Fund, except for New Zealand where a CPI-based real trade-weighted exchange rate has been used.

3. The business cycle experienced in New Zealand over the 1990's

The expansion in output from 1991 to 1997 that New Zealand experienced was strong relative to New Zealand's recent history and contemporaneous OECD country experiences.[6] This expansion was driven both by the flow on effects of structural reform undertaken in the late 1980s, and more traditional business cycle drivers. These drivers included robust world demand conditions, high commodity prices for New Zealand's exports, strong net inward migration flows, high levels of business and consumer confidence boosting consumption and investment expenditures, and later, expansionary fiscal policy.[7]

Given the rapid and prolonged expansion in demand over the mid-1990s, inflation pressures were strong and monetary conditions were held firm for a prolonged period to counter them. Nominal short-term interest rates were increased over 1994 from under 5 percent to almost 10 percent, as seen in figure 1. Real short-term interest rates also rose substantially above the

[6] Using the NBER levels-based definition of the business cycle, Brook et al. (1998) show that the expansion in the 1990s lasted two years longer than the previous two expansions experienced in New Zealand. They also show that output growth in New Zealand was above an 18-country average of selected OECD countries from 1993 to 1996.

[7] For an account of the nature and scope of the New Zealand reform program see Evans et al. (1996). See Brook et al. (1998) for an in depth discussion on how the reforms and cyclical pressures shaped the 1991-1997 business cycle.

OECD average in 1994, and remained above until late 1997. This monetary tightening, and the general attractiveness of New Zealand as a destination of international capital, led to the substantial appreciation of the real exchange rate seen in figure 1.[8]

The tight monetary conditions were successful in keeping overall CPI inflation ex-interest costs within a tight band of 1.5 to 3 percent over the period. This is in marked contrast to New Zealand's longer inflation record, which has generally been poor.

In late 1996 policy started to ease as inflation pressures began to wane. Three large negative shocks, however, turned the desired 'soft-landing' into an unexpectedly harsh 'hard-landing'. First, the East Asian crisis of 1997 significantly affected both the volume and value of New Zealand's exports.[9] Second, on the supply side agricultural production contracted following over a year of severe drought. Finally, a change in national immigration policy caused net migration to swing very quickly from positive to negative. These factors, and the previously tight monetary conditions, resulted in GDP contracting nearly two percent over the first half of calendar 1998. Since that point, the economy has been growing moderately, assisted by a very competitive real exchange. However, the growth is yet to be 'balanced', as the most significant contributions to growth have occurred in the externally exposed sectors of the economy.

4. Key policy issues

In Debelle et al. (1998) and Mishkin et al. (1999), the general conclusion reached is that the experience New Zealand has had with inflation targeting, like other formal inflation-targeters, has been positive. The relatively strong growth performance of the 1990s occurred in an environment where, unlike New Zealand's longer historical record, inflation remained low and stable. Perhaps not surprisingly, this conclusion is also endorsed by the Reserve Bank of New Zealand.[10] However, this is not to say that it has all been 'plain sailing'. To quote from the Bank's main submission to the *Independent Review of the Operation of Monetary Policy*:

[8] See White (1988) for an account of the pressures on the exchange rate in addition to the monetary tightening.

[9] East Asia accounts for over 40 percent of New Zealand's exports, and exports amount to around 30 percent of GDP.

[10] See Sherwin (1999).

With the benefit of hindsight, there are occasions in the 1990s when our assessments missed the mark. Two are worth noting. We were slow to recognise the pace of acceleration of the economy in 1992/93, and slow to recognise the joint impact of the Asian crisis and the beginning of an extended drought through 1997 and early 1998. But we would argue that we responded quickly when we recognised the emerging problem – quickly enough to prevent these large inflationary and deflationary impulses to the economy from causing substantial price instability and even larger and more costly swings in the real economy.

The Bank's approach to inflation targeting itself has evolved as structural relationships in the economy have altered, as it has learned from past errors and experiences of other inflation targeters, and as the academic research on inflation-targeting has advanced. In this section, the following two questions are addressed in relation to these issues:

1. What lessons can be drawn from the specific shocks that occurred in New Zealand in the 1990s and the way monetary policy responded?

2. How forcefully should monetary policy respond to more generalised disturbances, and in relation, how wide does the inflation target band need to be to reasonably accommodate most shocks?

To address these questions, deterministic and stochastic simulations of the Bank's macroeconomic model, FPS[11] are performed. It must be stressed that these simulations are illustrative experiments only. They do not tell us with *precision* how monetary policy should have been run in the past at the Bank, or should be run in the future.

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[11]FPS is a large calibrated DGE model with the same generic structure as the Bank of Canada's QPM (see Colleti et al. 1996). These models have a two-tiered structure. The first is an underlying steady state structure, characterised by a neo-classical balanced growth path, and based upon optimising principles. The second tier models dynamic adjustment to the steady state path. The adjustment processes (both expectational and intrinsic) are calibrated to reflect the 'business cycle' dynamics of the economies concerned. Although there are many sources of inflation in FPS, fundamentally it arises from the deviation of output from potential output. The monetary authority enforces a nominal anchor via a policy reaction function that sets the short-term interest rate in response to forecasted inflation deviations from the target. See Black *et al* (1997) for a complete description of the properties of the FPS core model, and Drew and Hunt (1998b) for a discussion on how the FPS is used to prepare economic projections at the Bank.

4.1 Deterministic simulations

Four sets of experiments are undertaken to investigate:

1. What if the Bank had better anticipated the increase in demand pressures that occurred over the mid-1990's?

2. How much of an impact might an appreciation of the exchange rate, independent of interest rate effects, have had on the mix of monetary conditions and the external imbalance during this time?

3. In formulating policy responses to the specific disturbances, how much difference does it make whether the policy horizon is short or longer?

4. What are the implications of using an MCI to guide policy in the context of a fall in the currency that is initially seen as a 'portfolio' shock, rather than as a necessary adjustment to evolving real conditions abroad?

Each of these questions is addressed in turn.

4.1.1 Household expenditure and debt

A feature of the expansion that occurred in the mid-1990s was that consumption growth outstripped income flows, leading to substantial increases in household debt. This was also observed at a national level - New Zealand's Net Foreign Asset (NFA) to GDP ratio deteriorated considerably following a sequence of substantial current account deficits.[12]

The deterioration observed in NFA is consistent with households borrowing against their increased wealth, and/or saving less out of current income, to finance current consumption. Such behaviour can be explained by standard economic theory. An increase in household

[12] In 1992, New Zealand's nominal NFA to GDP ratio was around –0.72, by 1997 this had deteriorated to around –0.84. A large part of the deterioration was due to foreign investment inflows - in a sense representing a vote of confidence in the New Zealand economy by foreign investors. The other side of the coin, however, is that New Zealander's reluctance and/or inability to finance the capital expansion that occurred effectively increased our indebtedness to the rest of the world, as represented by the deterioration in the NFA position. See Collins et al. 1998 for a more developed exposition on this issue.

wealth that is *perceived* by households to be permanent will have important so called 'wealth effects' on consumption. The difficulty, of course, is to quantify the extent of these effects ex-ante. As discussed in Drew and Orr (1999), the Bank's inflation projections over the early 1990s did not adequately incorporate the impact on demand of households anticipating *future* wealth and income growth.

As FPS explicitly accounts for asset stocks, it can be used to examine the implications of misperceiving the willingness of households to incur debt to support consumption. To implement such a misperception, two alternative specifications of the model's behavioural equation for consumption of 'forward-looking' agents are considered. In one specification consumption is curtailed relatively strongly as the NFA to output ratio deteriorates from equilibrium, in the other the deviation is tolerated to a greater extent. To see this, the following three equations are a stylised representation of the dynamic structure for consumption in the model:

$$c_t = crt_t + cfl_t \quad (1)$$

$$crt_t = ydrt_t \quad (2)$$

$$cfl_t = cfl\_eq_t + \alpha(ydfl_{t-2} / ydfl\_eq_{t-2} -1) - \beta(rn_{t-2} - rn\_eq_{t-2}) + \delta(nfa_t - nfa\_eq_t) - cfladj_t \quad (3)$$

where c_t is aggregate consumption, crt_t is consumption by 'rule-of-thumb' agents and cfl_t is consumption by forward-looking agents.[13] Rule-of-thumb consumers can thought of as being liquidity constrained as they consume 100 per-cent of their after-tax real disposable income, $ydrt_t$. Forward-looking consumers earn income and hold financial assets, comprising of government bonds, the capital stock, and NFA (which is negative to reflect the New Zealand data). A utility maximisation problem is solved for to determine their 'desired' or equilibrium path for consumption, cfl_eq_t.[14] Actual consumption of forward-looking agents deviates from equilibrium when real disposable income, $ydfl_t$, deviates from its equilibrium path, $ydfl\_eq_t$; when monetary policy moves away from neutral, $rn_{t-2} - rn\_eq_{t-2}$; and when NFA, nfa_t, deviates from its equilibrium path, nfa_eq_t. The term $cfladj_t$ refers to a polynomial adjustment cost equation along the lines of Tinsley (1993). The coefficients α, β, and δ determine the strength that any dis-equilbrium has on the dynamic path for *cfl*. Finally, all stocks and flows are expressed relative to output.

[13] The portion of agents that are rule of thumb in the model is 30 per cent.

[14] See Frenkel and Razin (1992) for a complete specification of the problem.

The coefficient δ represents the extent to which forward-looking consumers tolerate their wealth deviating from equilibrium. Following any temporary disturbance that moves NFA from equilibrium, the smaller δ is, the less forward-looking agents adjust their consumption behaviour to ensure that their overall financial asset position is maintained. Given that NFA is negative, any shock that moves NFA below equilibrium effectively increases the indebtedness of forward-looking agents to the rest of the world.

In the standard version of FPS used for Bank projections, the coefficient $\delta = 0.12$. In an alternative specification of the model, this is increased to 0.3[15]. Each model is then hit with a sequence of exogenous positive demand shocks of one percentage point per-quarter for six quarters, applied to reflect the cyclical demand pressures faced in the mid 1990's.[16] In the first quarter of the experiment, the monetary authority observes the current demand shock only, and sets policy based on its projection of inflation. In the second quarter another demand shock arrives and policy is reset, and so on and so forth, for the remaining four quarters.

Three alternative scenarios are explored (see figure 6):

I. Households have a relatively *large* appetite for debt, in which case the shock is significantly accommodated by allowing NFA to deteriorate ($\delta = 0.12$).

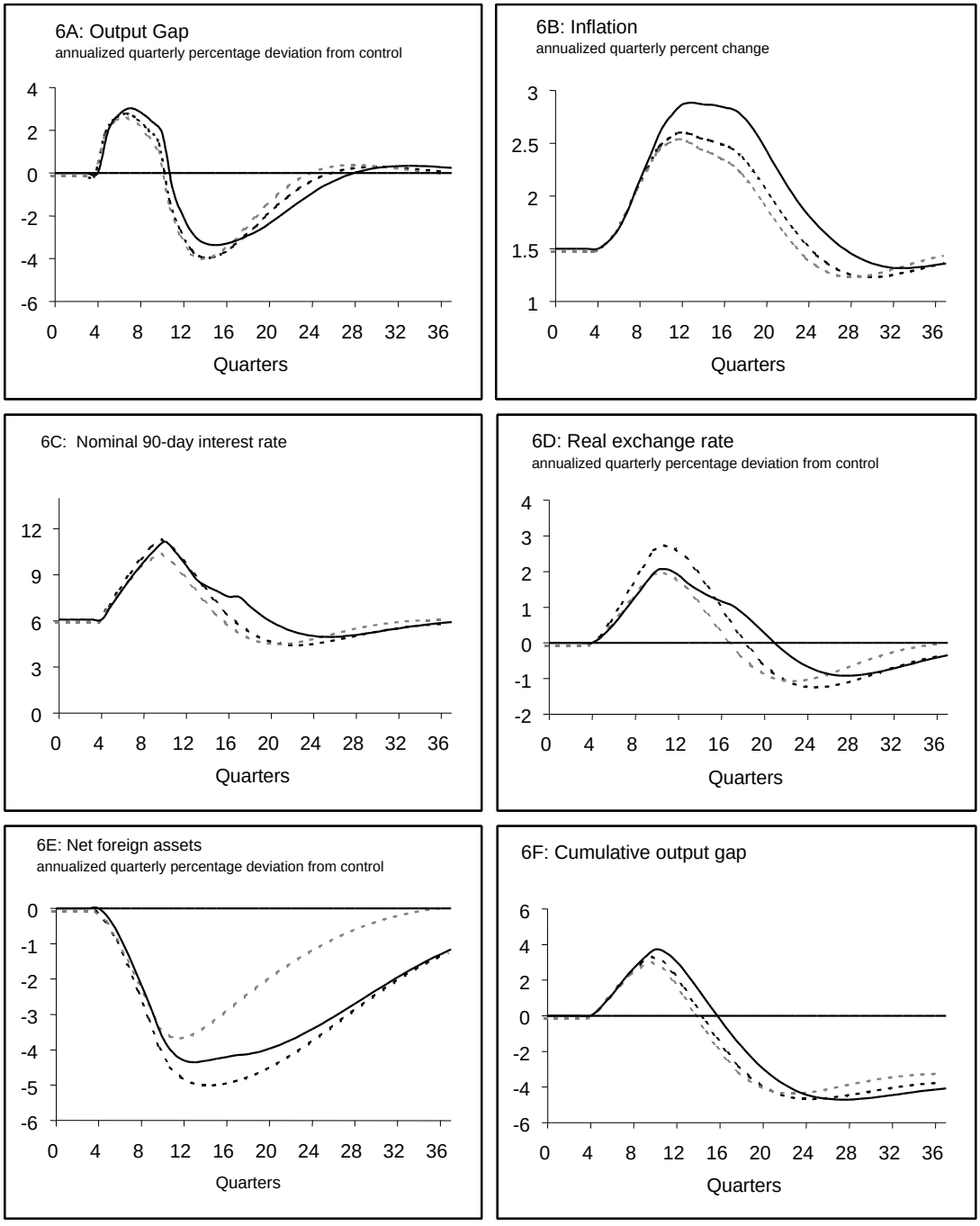
II. Households have a relatively *small* appetite for debt ($\delta = 0.3$).

III. Households have a relatively large appetite for debt, but the Bank sets policy assuming households have a small appetite. In other words, the Bank under-estimates the extent to which the shock can be accommodated by an additional deterioration in the NFA position and thus underestimates the medium-term spending pressures in the economy.[17]

[15] To quantify the impact of changing this coefficient, the rate of savings out of current income were compared under the two coefficient sizes following a one-quarter, one percentage point shock to demand. In both cases the household savings rate fell as households increased consumption relative to current income. When the coefficient was 0.3, however, the savings rate fell by approximately 2 percent *less* than under the coefficient of 0.12, reflecting agents' greater reluctance to tolerate the deterioration in the NFA position.

[16] Approximately two-thirds of the demand shocks is applied to the model's behavioural equation for consumption, and one-third to the behavioural equation for investment.

Figure 6 The implications of underestimating demand



Key to figures 6A – 6F

- – – – – – Households have a large appetite for debt (scenario 1)
- – – – – – Households have a small appetite for debt (scenario 2)
- ——— Bank underestimates debt appetite (scenario 3)

[17] This experiment examines what is essentially one aspect of model uncertainty. For a technical description of the technique employed to examine model uncertainty using models of the same generic form as FPS see Laxton et al. (1994).

In all three scenarios the unexpected increase in demand leads to an increase in inflation pressures (see figure 6B). The central bank responds to the inflation pressures by raising short-term interest rates, which also leads the exchange rate to appreciate via a UIP condition (see figures 6C and 6D). The eventual slowdown in demand occurs via four main paths. First, domestic consumption falls as forward-looking agents increase savings in response to the elevated interest rates. Second, the cost of capital increases and hence investment falls. Thirdly, the exchange rate appreciation causes exports to fall and imports to rise. Finally, the decline in net exports arising from arising from the exchange rate appreciation, and an increase in the servicing cost of NFA arising from the policy tightening, leads to a further decline in the NFA position (see figure 6E). Households respond to the deteriorating NFA position by curtailing current consumption, most noticeably so in scenario 2 (the scenario in which households have a low tolerance for allowing NFA to deteriorate from equilibrium).

The most interesting case, however, is where the Bank assumes households have a relatively small appetite for debt, when in fact the opposite is true (scenario 3). This broadly corresponds to the unexpected increase in household and national debt that was observed over the period from 1991-98. In this situation, the Bank underestimates the inflation pressures (leading inflation to peak at around 0.5 percentage points higher, as seen in figure 6B) and does not respond as aggressively initially. The net result is that the Bank must eventually tighten policy for longer, prolonging the need for elevated real interest rates and an elevated real exchange rate (see solid lines in figures 6C and 6D).

The results are consistent with the way in which, through the cycle, interest rates in New Zealand held up above the OECD average for an extended period, and consequently account for some of the appreciation seen in the New Zealand dollar. The results suggest that if the initial policy response to rising demand had been earlier and/or more aggressive, and 'wealth effects' better understood, the duration of the upward pressures on interest and exchange rates might have been noticeably shorter.

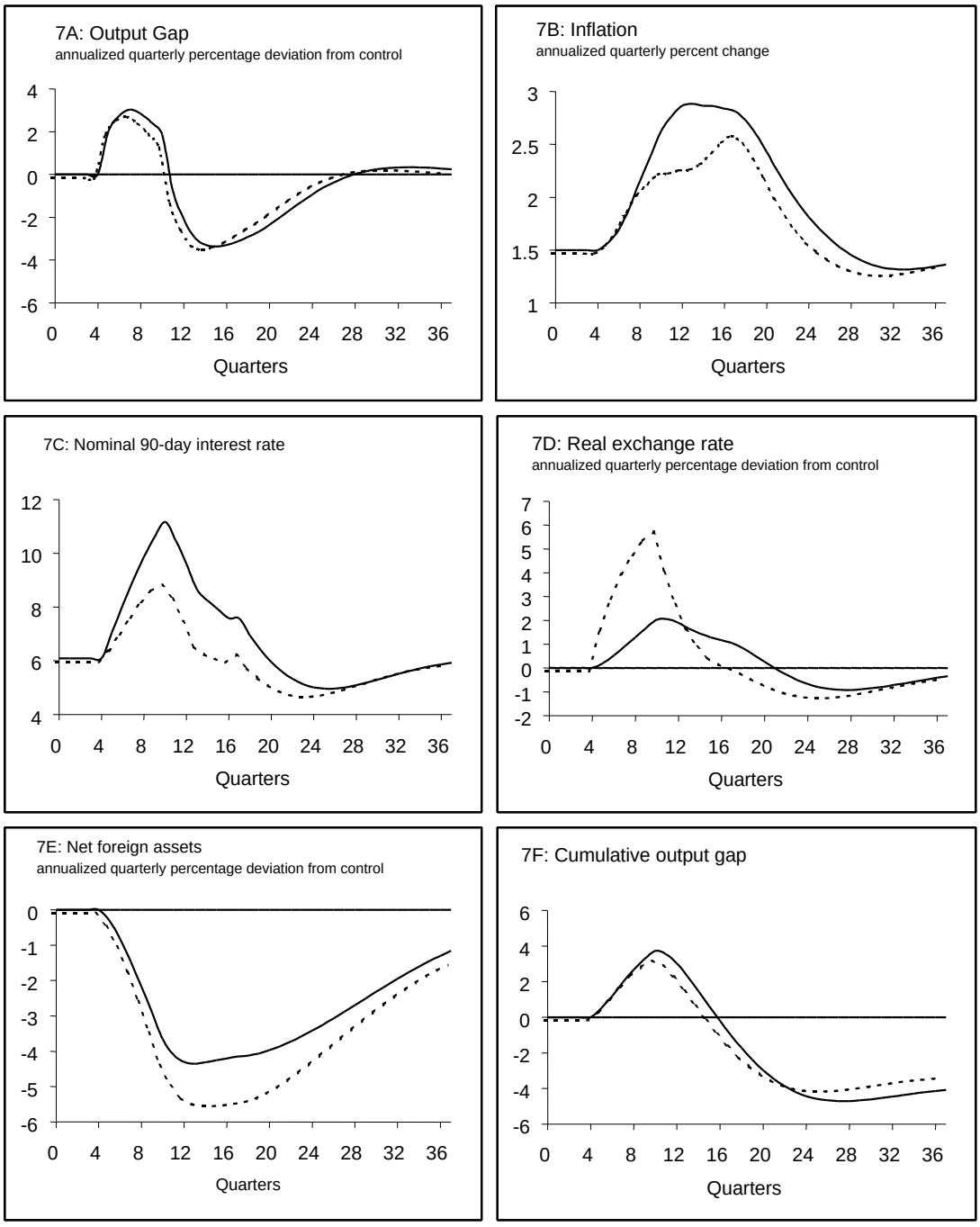
4.1.2 Exchange rate shock

Over the recovery phase of the recent business cycle, the real exchange rate appreciated strongly. Some of this appreciation can be attributed to the rise in real interest rates needed to contain inflation. However, it is also possible that additional factors were temporarily supporting the exchange rate. As discussed in White (1998), exceptionally low interest rates in Japan (and to a lesser extent Europe) and the favourable marketing of New Zealand as an investment destination may also have added to a strong demand for New Zealand dollar assets.

The impact of such a positive real exchange rate shock on top of the demand pressures just examined are seen in figure 7. The base case in figure 7 below is scenario 3 in figure 6, where the economy receives a demand shock which the Bank underestimates. That is, the demand shock scenario that may corresponds most closely with what actually happened. Added to this scenario is a positive real exchange rate shock to give the alternative scenario in figure 7 (scenario 4). That is, the real exchange rate is made to rise unexpectedly by one percent per quarter for six quarters (see figure 7D).[18] As with the shocks to demand, the monetary authority sets policy each quarter only observing the contemporaneous disturbances.

It can be seen in figure 7 that, as a consequence of the real exchange rate shock, short-term interest rates initially rise by around two percentage points *less* than in the case of the demand shock alone (see figure 7C). The more muted interest rate response reflects the work that the real exchange rate appreciation is doing in containing demand. However, the overall NFA position deteriorates even further (see figure 7E). This occurs as the external sector of the economy bears more of the brunt of the policy tightening. The overall deterioration in the NFA position is around 6 percent of GDP, similar to the size of the observed deterioration in this asset stock.

Figure 7 The implications of underestimating demand with shocks to the real exchange rate



Key to figures 7A – 7F

——— Bank underestimates debt appetite (scenario 3)
– – – – – – Addition of real exchange rate shocks (scenario 4)

[18] This is similar in magnitude to the real exchange rate appreciation experienced in New Zealand from late 1993 to early 1995.

4.1.3 The Policy Horizon

The generic monetary policy reaction function used in Bank projections is an inflation-forecast-based (IFB) policy rule of the form:

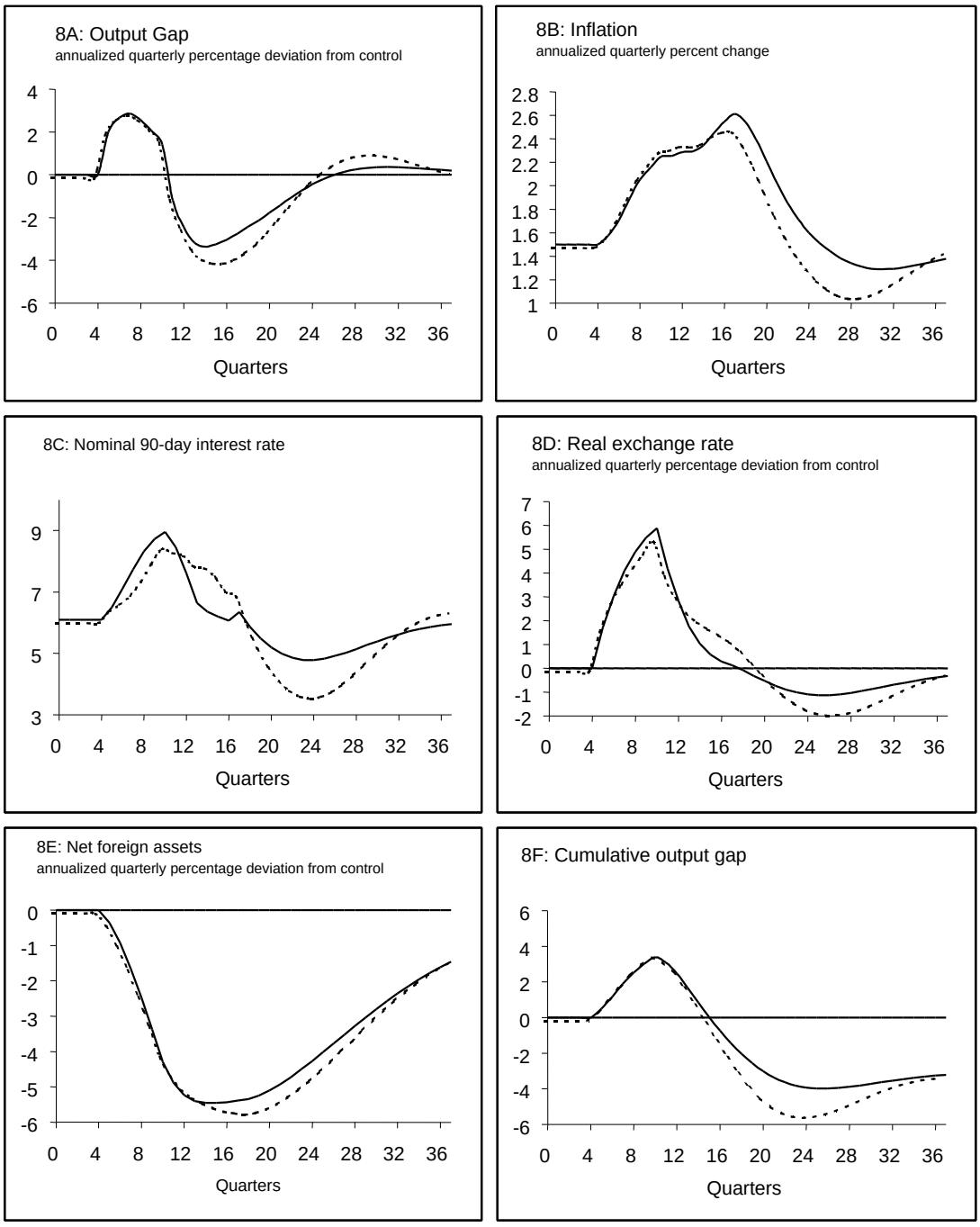
$$rs_t - rs_{t-1} = a\left[rs_t^* + \sum_{i=1}^{j} q_i\left(p_{t+i}^{e} - p^{T}\right)\right] - a rs_{t-1} \qquad (1)$$

where rs_t is the nominal 90-day rate at time t, rs^*_t is the neutral 90-day nominal interest rate, π_{t+i}^{e} is the model's forecast of inflation at time t+i and π^{T} is the mid-point of the Bank's inflation-target band (ie 1.5 per cent). The parameter a is an interest rate 'smoothing' constraint, and the parameter q specifies how strongly interest rates respond to projected deviations of inflation from the target.

In the demand and exchange rate shocks above the 'standard' FPS policy reaction function is used; that is, short-term interest rates are shifted in response to projected inflation deviating from the mid-point of the inflation target band 6 to 8 quarters ahead. Figure 8, by contrast, highlights the impact of shortening this policy reaction horizon to 3 to 5 quarters ahead. Under this model and the shocks applied, the inflation, output, and interest rate cycles are further accentuated when the horizon is shortened. This result is discussed more generally in the next section.

In shortening the policy horizon, the central bank effectively takes more account of the so called 'direct channel' of the exchange rate, that is, the impact on CPI inflation caused by the effect of the appreciation of the exchange rate on the price level of imported items. Accordingly, monetary policy initially is easier, since the rise in the exchange rate leads to initially lower inflation (see figure 8B). The corollary is that the central bank takes less account of inflation pressures arising from the slower-acting positive demand shock. Thus, when the central bank does see the implications of the demand shock, monetary policy has to be tighter for longer relative to what would have been required if policy had been more forward looking.

Figure 8 The implications of underestimating demand with shocks to the real exchange rate and a relatively short policy horizon



Key to figures 8A – 8F

——— Bank underestimates debt appetite and exchange rate shocks (scenario 4)
– – – – – – Outcome with shorter policy horizon (scenario 5)

The stylised result above also sheds some light on what occurred over the mid-1990s. The phase of the 1990s business cycle when monetary policy was probably at the greatest risk of operating over an excessively short-term horizon will have been when inflation was very close to the edge of, or outside, the then 0 to 2 percent target range. This was approximately over 1995 and 1996. During this period, the Bank was very much under the spotlight, and there was, at least for a period, an almost inevitable focus on getting inflation back within the target range as soon as reasonably possible. Despite this focus, the Bank was repeatedly surprised by how long it took for the goal to be achieved. In successive quarters, it was projected that within two or three quarters ahead inflation would fall below 2 percent, but in the event that outcome was not achieved until mid-1997.[19]

In hindsight, in addition to the demand shocks a possible explanation for the unexpected resilience of inflation during the period mid-1995 to mid-1997 was that the Bank was putting too much weight on the expected direct price benefits of the appreciating exchange rate. At the time, the Bank relied primarily on the 'mark-up' approach to projecting inflation pressures, in which the inflation outlook was based on cost pressures and margins.[20] The exchange rate, through its influence on import prices, was an important driver. With the exchange rate appreciating throughout this period, near-term aggregate inflation pressures were being constrained, despite the more persistent inflation pressures still in the domestic economy. In hindsight, it could be argued that insufficient attention was initially given to these persistent domestic inflation pressures, which are most influenced by the longer-term impact of the exchange rate and interest rates on, first, demand, and then inflation.

4.1.4 The Use of the MCI over 1997-1998

Output growth was negative over the first half of 1998 as the New Zealand economy was negatively impacted on by three coincident influences: a large swing in net migration, the Asian crisis and successive droughts throughout large parts of the country.[21] Even though these shocks were unavoidable, the question remains whether monetary policy responded

[19] See the Bank's Monetary Policy Statements over this period for a detailed account.

[20] See Beaumont et al. (1994) for an in depth discussion on this approach to modelling prices.

[21] See the paper entitled "Business cycle developments and the role of monetary policy over the 1990s" at http://www.rbnz.govt.nz/monpol/review/index.html for a detailed description of the size and impacts of these shocks on output.

appropriately, and in doing so buffered the shocks, or whether it was unhelpful. To answer this question, first the Bank's view of the shocks at the time are outlined, as is the interaction of this with the MCI implementation regime. Then, given what is known *ex-post*, the broad lessons from the period are illustrated via stylised model simulations.

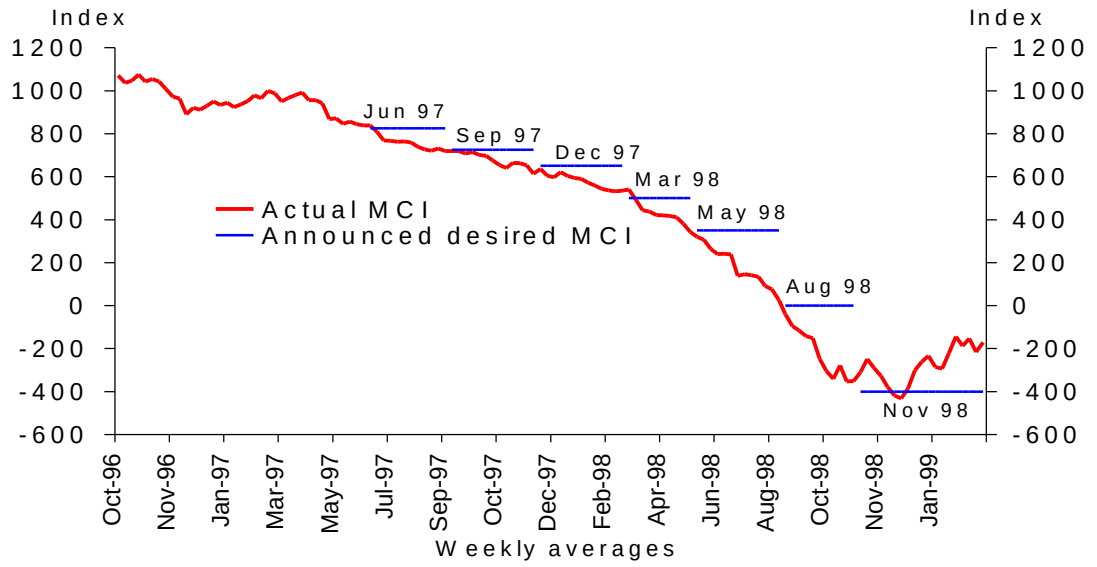
From mid-1997 and over 1998, a monetary conditions index (MCI) was used to signal the stance of monetary policy with the release of the Bank's *Monetary Policy Statement* each quarter.[22] In order to maintain the policy stance *intra-quarter*, any falls (rises) in the exchange rate that occurred were required to be offset by increases (falls) in interest rates.[23] Over late 1997/8 this in fact did lead to interest rates rising, between quarterly resets, as the exchange rate began to trend sharply downwards.

As the exchange rate fell through much of 1997 and into 1998, the Bank initially resisted the extent of the easing in monetary conditions by indicating at successive quarterly resets desired levels of monetary conditions that were consistent with interest rates rising. This reflected that the Bank thought growth conditions would be rather stronger than subsequently turned out to be the case. It initially did not anticipate the full magnitude of the Asian crisis or the severity of the first drought. However, as the extent of the fall in economic activity became more obvious through the first half of 1998, the Bank began to encourage a more rapid easing in 'desired' monetary conditions. This is illustrated in figure 9 below which shows the profile of the MCI from late 1996 to early 1999 together with indications of the 'desired MCI' at successive quarterly policy resets. The easings that occurred between mid-1997 and the end of that year were quite small, but they became larger after December 1997.

The Bank's policy stance was also influenced at the time by its understanding of what was behind the fall in the exchange rate. That is, if it had recognised the depreciation as well-founded by changing fundamentals it would have targeted a lower desired level of the MCI, and allowed actual conditions to ease more quickly. In addition, at least in late 1997, the Bank lacked a full appreciation of the required cyclical amplitude of monetary conditions in the context of large exchange rate shocks. This meant that the effective magnitude of easing at each quarterly policy reset, in terms of its impact on the real economy, was perhaps rather less than it had expected and intended it to be at the time.

[22] See Ball (2000) for a discussion on the use of an MCI as a policy instrument, and Hunt (1999) for the macroeconomic implications of using an MCI in FPS under general stochastic disturbances.

Figure 9 The Monetary Conditions Index and successive quarterly policy resets



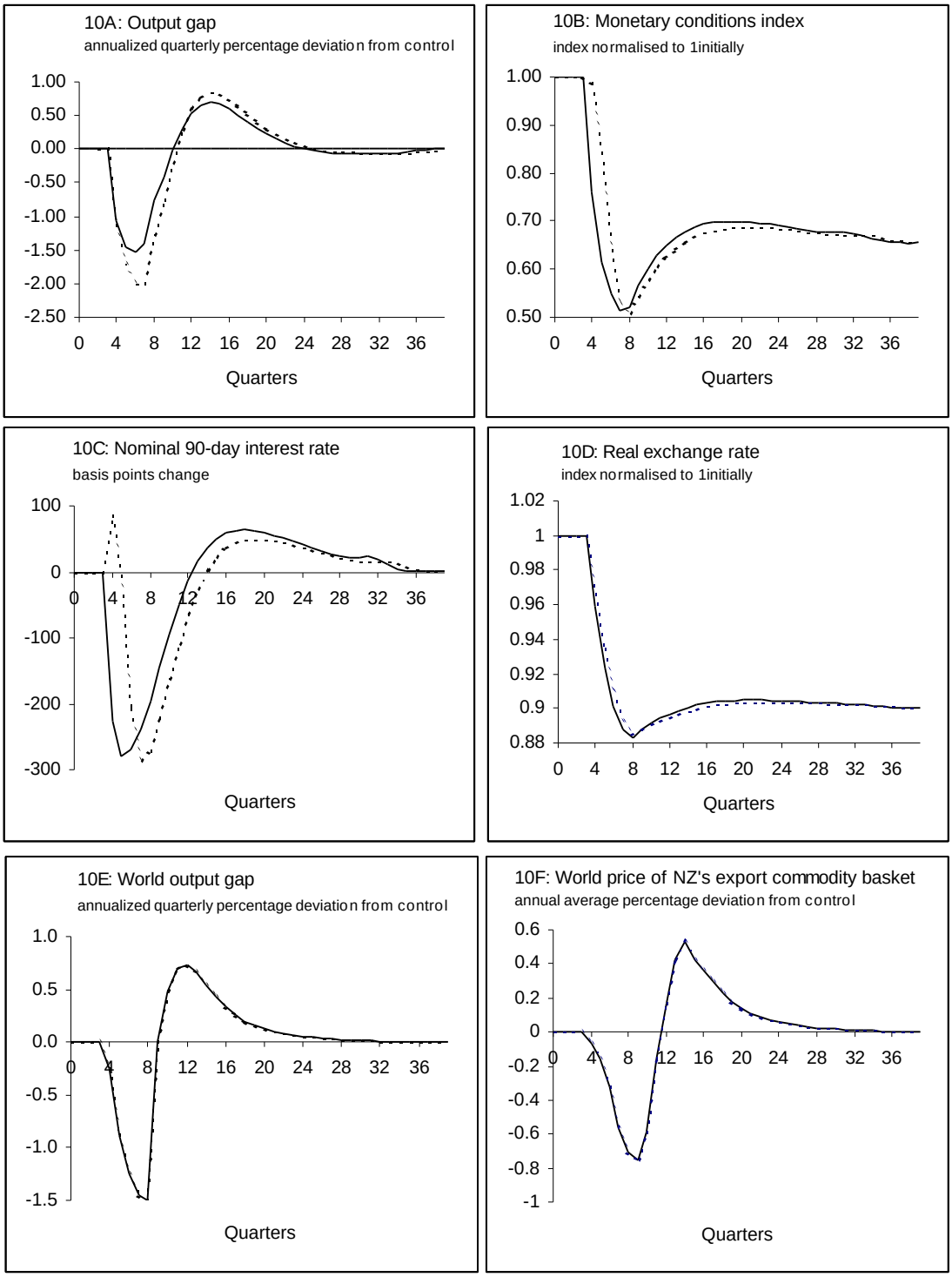
Source: Reserve Bank of New Zealand, *Monetary Policy Statements* and *Economic Projections*.

The overall effect of the initial interest rate rises over early 1998 on the economy are uncertain. Although the rises coincided with falls in consumer confidence, residential investment, and private consumption, normally such rapid transmission of policy would be ruled out as being implausibly fast. However, transmission times are not always and everywhere the same. Given the environment of considerable uncertainly resulting from the Asian crisis, it is possible that the interest rate rises could have contributed to observed falls in consumer confidence. In turn, lower confidence may have fed through to lower consumption and investment quite quickly.

To illustrate the discussion further, figure 10 below shows two alternative model scenarios. In both scenarios the starting-point level of the real exchange rate is over-valued, and the model is hit with a sequence of negative shocks emanating from both the domestic and external sectors of a size that roughly corresponds to the falls witnessed over 1997/8.

[23] See the paper entitled "The evolutions of monetary policy implementation" at http://www.rbnz.govt.nz/monpol/review/index.html for a detailed description of why the Bank moved to use an MCI and then later moved on to its current cash-rate system.

Figure 10 The implications of using an MCI to base policy when an exchange rate change is not seen as reflecting necessary adjustment



Key to figures 10A – 10D

——— Bank sees shocks to demand and reads exchange rate move correctly (scenario 1)
– – – – – – Bank slower to see demand shocks and initially resists exchange rate fall (scenario 2)

In the first scenario policy is set cognisant of both the shocks and the fact that the exchange rate is over valued. Consequently, interest rates immediately decline, as seen in figure 10a. In the second scenario, the central bank initially regards the fall in the exchange rate as a 'portfolio' disturbance, and does not foresee the fall in world and domestic demand. Hence the central bank does not seek to ease conditions as measured by an MCI to any material degree, and interest rates rise to maintain an overall level of monetary conditions. As time moves on, however, the central bank updates its view of the world and allows monetary conditions to rapidly fall.[24]

Compared to scenario 1, interest rates eventually have to fall further as the fall in demand is larger given the initial policy mistake. The difference in the output paths, however, is small relative to the underlying cycle that is set-up following the disturbances applied.

In summary, the negative impact of the sharp downturn in migration, the Asian crisis and the drought were always going to produce a reduction in growth and potentially a recession. Although it is difficult to separate the precise impact on the economy of this from monetary conditions, it does seem likely that the use of the MCI implementation framework shaped the evolution of monetary policy during that period in a manner that was on balance unhelpful.

4.1.5 Summary

The deterministic simulations above were designed to highlight some of the ways in which the Bank's monetary policy framework interacted with the economic shocks experienced over the 1990s. Given a relatively short policy horizon and a misperception of wealth effects, it became more difficult for monetary policy to maintain price stability over the mid-1990s than might, ideally, have been possible. With hindsight, reacting sooner to the demand shocks and focussing on the persistent, domestic-based inflation pressures may have helped moderate the business cycle. Furthermore, had policy eased more quickly in response to the Asian crisis and domestic conditions, and had an MCI not been used to implement policy, the downturn in growth may have been moderated to a more significant degree.

Of course, the most important feature of the simulations presented is that the differences between the scenarios are relatively minor in comparison to the cycle set up by the impact of the underlying shocks. This is not to say that monetary policy is not important. What is not

[24] The central bank sees the full implications of the shocks after one year.

shown in the simulations outlined is what the cycle would have looked like if monetary policy had considerably delayed its reaction to the shocks that occurred, or in the limit, completely ignored them. The Bank's *contention* (as shown by the quote at the start of this section) is that the cycle would have been of considerably greater magnitude than what actually occurred in this situation.[25] The alternative scenarios presented should therefore be considered more in the nature of refinements to inflation targeting, and not as different approaches that would have reshaped the events over the 1990s in any fundamental sense. These refinements are considered in the context of generalised macroeconomic disturbances next.

4.2 Approaches to inflation targeting

The scenarios just described illustrate how maintaining low and stable inflation is not incompatible with having a concern for maintaining stability in the economy more generally, for example, in real output and in interest and exchange rates. While the central bank certainly cannot 'buy' any permanent increase in output growth, it does have some influence over volatility in the economy.

In part, the volatility issues concern the choice between 'strict' or 'flexible' inflation targeting.[26] Before discussing this choice, the *key presumption* that must be kept in mind is that the central bank is credible and that inflation expectations are relatively well anchored. This certainly was not the situation the Reserve Bank of New Zealand faced when it, like other central banks, embarked upon the road to price stability in the mid 1980s. Given the historical circumstances, in the early period of the Bank's inflation-targeting history it took concerted effort to reduce inflation. The outcome of this action was that, over the 1990s, both inflation and output variability in absolute terms were lower than that seen in the 1970s and 1980s. This experience suggests that the variability 'trade-offs' that are depicted in the following sections might be quite misleading during the transition to a low inflation environment. By reducing the level of inflation, variability in output, inflation, the exchange

[25] Given the structure of the FPS model this is a *fait accompli*. Inflation expectations are a linear combination of past outcomes and the model consistent forward-path solution. As such both actual inflation and inflation expectations move away from the target following any disturbance. Monetary policy is required to re-anchor inflation expectations to the inflation target. The longer the policy response is delayed, the larger is both the initial cycle, and the secondary cycle required to re-anchor inflation expectations to the target.

[26] See Svensson(1999b)

rate, and real interest rates may all be reduced, as was the case in New Zealand in the 1990s.[27] These may well be the main gains of New Zealand's inflation-targeting regime, and the refinements to the Bank's approach discussed below may be considered to be more in the nature of marginal improvements.

4.2.1 Strict versus flexible inflation targeting

A strict central bank can be categorised as being concerned only with deviations of inflation from some target level. As such, the strict central bank will aim to have inflation return to its target in the shortest possible time. It is thus likely to be most reactive in its interest rate response to inflation pressures projected as close as, say, 2 to 4 quarters ahead. In an open economy like New Zealand's, a strict central bank would rely more heavily on the direct impact of the exchange rate on consumer prices, given its more immediate and transparent impact.

In contrast, a flexible central bank attaches some importance to minimising the volatility of output as well as returning inflation to its target. It is thus likely to adjust interest rates so as to return inflation to its target more slowly, thereby avoiding large fluctuations in the policy instruments and output. In an open economy, this implies that the central bank places more weight on the indirect impact of the exchange rate (and interest rates) on prices.[28]

From the outset of inflation targeting in New Zealand, the Reserve Bank has recognised these sorts of trade-off. This recognition has been implicit in, for example, the 'caveats' in the successive Policy Targets Agreements and the phased approach the Bank took in achieving low inflation.[29] More explicitly, the original target date for achieving price stability was extended, following the 1990 election, from end 1992 to end 1993 on account of the short-run output trade-off.

Against this background, the decline in and anchoring of inflation expectations achieved in more recent years, in combination with the wider inflation target range since late 1996, has

[27]The macroeconomic outcomes seen in New Zealand in this regard are not unique. In many countries over the 1990s, inflation and output variability was considerably lower than that experienced over the 1970s and 1980s. Although there are certainly other factors behind the more benign economic environment of the 1990s, it is very likely that in part this occurred because of the concerted efforts that central banks took to get inflation down over the mid-to-late 1980s.

[28] See Svensson (1997b).

[29]See Archer and Nicholl (1992).

afforded the Bank more flexibility in its policy approach. The advantages of this ongoing flexibility can be examined more formally using FPS, by asking the question: is it possible to reduce the volatility in interest rates, the exchange rate and output without unduly increasing the volatility in inflation?

In order to address the volatility questions stochastic simulations of the model are undertaken. The randomly drawn shocks in this exercise impact on five key macroeconomic variables: the exchange rate, inflation, domestic demand, foreign demand, and New Zealand's terms of trade. The stochastic simulation technique also accounts for auto and cross-correlations in the data between these variables. For example, shocks to foreign demand or the terms of trade will affect the exchange rate as well. A combination of shocks, taken from New Zealand's historical experience, is selected randomly to produce 100 simulations each quarter, running 100 quarters into the future (generating 10,000 observations for each variable of interest). [30]

For each alternative monetary policy rule considered, the variability of each of inflation, output, the exchange rate and interest rates is calculated over the full 25-year period and compared. The monetary policy rule that results in the least variability in these macroeconomic variables over the entire period is considered to be preferable.[31]

4.2.2 Alternative policy horizons

The policy horizon currently used in the FPS monetary policy reaction function - that is, how far ahead the model is looking in formulating its response to inflation pressures - has been chosen to reflect views within the Bank, and from wider research. This research suggests that the lag between monetary policy actions and inflation outcomes is between one and a half and two years time (references). The standard monetary policy reaction function is thus set so that policy responds to projected inflation pressures some 6 to 8 quarters ahead.

Results from simulating FPS with the same battery of shocks, but alternative policy reaction horizons, are shown in figure 11. The left-hand panel plots outcomes in terms of output and inflation volatility under different reaction horizons, while the right-hand panel shows the policy instrument (interest rate) and inflation volatility. The point labelled A relates to the most short-term, or myopic, policy reaction. This short horizon is clearly not 'efficient',

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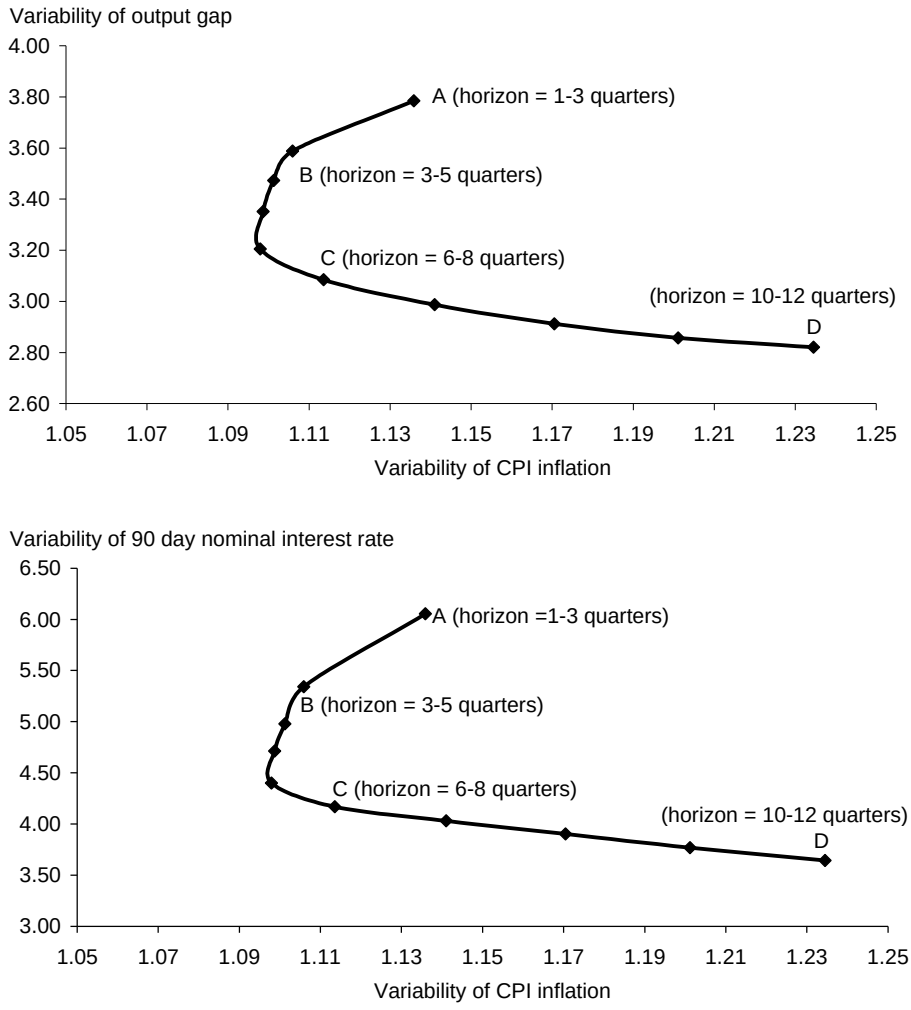
[30] See Drew, A and B Hunt (1998a) for technical details.

[31] See Drew, A and B Hunt (2000) for a discussion on alternative monetary policy rules using FPS.

given that a more forward-looking rule can reduce instrument, output, *and* inflation variability.[32] Point C is the standard FPS policy rule, and point D is the most forward-looking policy rule considered. It is clear that moving from point C to point D reduces output (and instrument) variability, but at the expense of greater inflation variability.

Figure 11 The Implications of varying the policy horizon



The results of these simulations suggest that reduced output and instrument variability can be achieved by being forward-looking. However, it is also evident that as the policy horizon is extended much beyond 6-8 quarters (point C), not much is to be gained in terms of reduced output and instrument volatility, while inflation volatility increases quite markedly. This suggests an optimal policy horizon in the vicinity of point C.

[32]The policy rule represented by the point labelled 'A' fares poorly because the monetary authority tries to return inflation to the target over a horizon where inflation outcomes are essentially pre-determined - given the short-run rigidities that exist in the economy. As such, the monetary authority induces instability into the model economy.

It is recognised that these results are not fully independent of the FPS model, which has been constructed on the prior view that policy generally works with a lag of about 6 to 8 quarters. However, the results are not predetermined. The outcomes are generated from the interaction of the monetary policy reaction with the rest of the model - which is constructed to reflect the workings of the New Zealand economy – and thousands of randomly selected shocks. In this sense, the results provide some independent support for a reasonably forward-looking policy reaction function.[33]

4.2.3 A wider or narrower inflation target band

Another question we consider is the degree of flexibility the current 0 to 3 percent inflation target range has brought to policy, compared to the previous target range of 0 to 2 percent. It could be argued that a wider target range allows the Bank to be less active in its policy, with the Bank able to allow more time for projected inflation to return to its mid-point. This type of flexibility is afforded since a wider band means it is less likely that the target will be breached.

Figure 12 presents the results from further FPS stochastic simulations, this time altering the degree of policy activism. Monetary policy is made more active by increasing the size of the interest rate response in the model's reaction function to any deviations from the inflation target. Conversely, policy is made less active by decreasing this interest rate response coefficient.[34]

In the first panel of figure 12, it is seen that the more active the policy response, the lower is inflation variability and the higher is output variability. This illustrates the well-known trade-off between inflation and output variability.[35] The second panel illustrates that, as the variability of inflation is reduced, instrument variability increases.

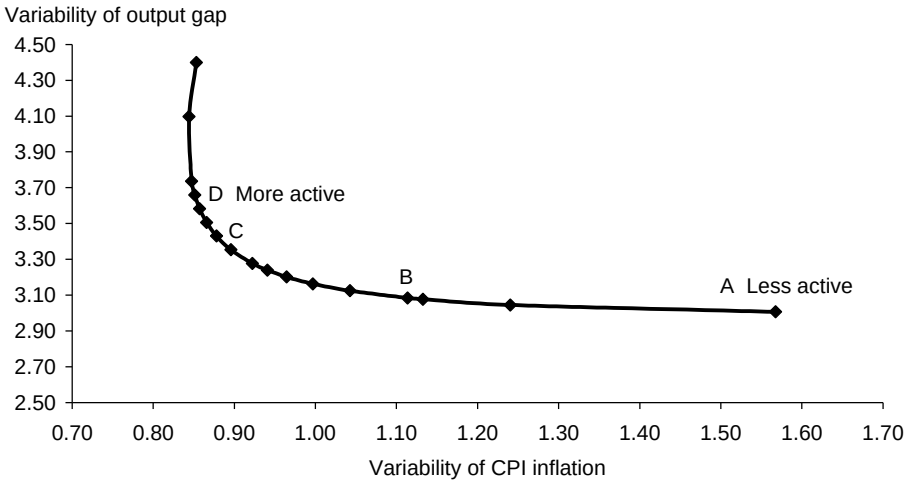
[33] For a theoretical discussion on the benefits of using forward-looking inflation forecast based policy rules see Haldane and Batini (1999).

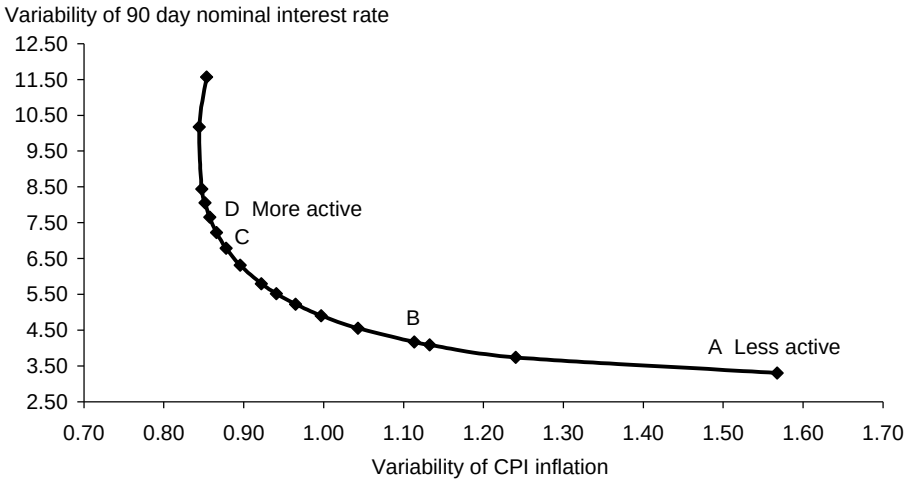
[34]By way of example, in the standard FPS rule (represented by point B) the size of the interest rate response is such that if inflation is projected to be one percentage point above target over the policy horizon, short-term interest rates will be increased by around 140 basis points. Point A is a less active policy rule, whilst points C and D are rules that respond more vigorously to inflation deviations.

[35]See Taylor (1994).

In figure 12, point B represents the standard FPS policy rule. It can be seen that the cost of reducing inflation variability through increased policy activism is a rise in output and instrument variability.

Figure 12 The Implications of varying policy activism





The probability that inflation will fall within a certain range about the target can also be calculated using these results. The probabilities are shown in table 2. It can be seen that under the standard policy rule, inflation is expected to remain within our current target, of +/- 1.5 percentage points around the mid-point, about 80 percent of the time. In contrast, the less active policy rule keeps inflation within the range 66 per cent of the time, while the more vigorous policy rules ensure inflation remains within the band over 90 per cent of the time.

Table 2 Alternative band widths for CPI inflation targeting rules

	A: Less Active Rule	B: Standard policy rule	C: Active policy Rule	D: Very active policy rule
RMSD CPI inflation	1.56	1.13	0.94	0.86
RMSD output gap	3.06	3.07	3.24	3.58
RMSD nominal 90 day interest rate	3.31	4.08	5.51	7.65

Band Width	Probability that inflation lies within the given band width			
+/- 1%	50%	64%	70%	75%
+/- 1.5%	66%	82%	90%	92%
+/- 2%	80%	93%	97%	98%
+/- 3%	95%	99%	99.8%	99.994%

The policy dilemma is thus clear. If the Bank is to be judged purely on its achievement of keeping inflation within the target range, then it is likely to favour a more active policy approach. Or, if the Bank is trying to establish credibility by achieving its inflation target at all points in time, then it is wise to favour a more active approach and a shorter policy horizon.

However, a more active policy with short horizons implies more variability in both output and the instruments. This is why the Bank – and those who monitor its performance - recognised that, although the Bank should be constantly aiming to meet the target, it is neither sensible nor realistic to expect that inflation will always be in the range. Indeed, as inflation expectations have become more anchored on the official target over recent years, there has been some shift further in this direction. The Bank has preferred to move towards a longer-term horizon when targeting inflation. This approach may come at the cost of slightly more variable inflation outcomes, although the wider 0 to 3 percent inflation target reduces the probability of the Bank actually breaching its target.

The simulations in this section, of course, should be interpreted as stylised results, rather than as strict quantitative assessments of, for example, the 'optimal' inflation target range or the 'optimal' policy horizon. Qualitatively, however, the results are intuitively appealing:

1. the narrower the target range the more active monetary policy must be;
2. more activism implies more variability in interest rates, the exchange rate, and output; and (up to a point) less variability in inflation;
3. lower inflation expectations and a wider target range allow for a longer policy horizon, and less active monetary policy.

5. Conclusions

This paper has discussed some monetary policy issues that emerged from the Bank's reviews of the conduct of monetary policy over the 1990s. Possibly the most significant conclusion relates to the importance of using a flexible, medium-term, approach to inflation targeting. A key reason why the Bank has felt able to move in this direction has been the rise in public confidence that low inflation is now the norm, not the exception.

One important change in policy focus relates to the role of the exchange rate. Broadly, the policy changes have comprised a shift in focus from the direct impact of the exchange rate on the price of imported goods, to the indirect effect on prices via the real economy and inflation expectations. This shift in emphasis is evinced by, amongst other things, the longer horizon over which inflation is targeted, and the focus on what the key demand pressures are in inflation forecasting. Another important shift is the wider target range for inflation of 0 to 3 percent, which provides additional scope for flexible policy.

The benefit of anchoring inflation expectations near the mid-point of the target range is that the Bank can afford larger, temporary, deviations in actual inflation from the mid-point. This reflects the fact that the Bank recognises that while monetary policy can not be used to engineer sustainably faster growth in the long term, there can be a trade-off between the variability of the policy instrument and output, and the variability of inflation.

However, the most significant lesson for the Bank is the importance of pre-empting shifts in inflation pressures. If monetary policy is able to adjust in a timely manner, then a significant

degree of interest rate, exchange rate and output volatility may be avoided. At the end of the day, this requires that the right decisions are made when required. Due to the uncertainty surrounding policy-making, this is not an easy task. To finish from a quote from the Bank's submission to the *Independent Review of Monetary Policy*[36]:

The Bank has to continually balance the risks of doing "too little too late", and possibly unnecessarily accentuating the business cycle, against the possibility of over-reacting to inflation pressures, thereby also causing unnecessary volatility in the economy. This is often difficult, as signals from the data can be unclear or conflicting. The art of policy-making is to get a good feel for the pulse of the economy. This involves making judgements about the relative value of information in various data sets. It also involves continuously updating one's view or "model" of how the economy works. Such judgements are made on the basis of historical experience, research, intuition, and by keeping in touch with people in New Zealand engaged in a wide variety of economic activity, as well as in various institutions at home and abroad.

References

Allen, W.A., 1999. Inflation Targeting: The British Experience. Bank of England Handbooks in Central Banking Lecture Series, No. 1.

Archer, D., Nicholl, P., 1992. An announced downward path for inflation. Reserve Bank of New Zealand Bulletin, December 1992.

Ball, L., 2000. Policy Rules and External Shocks. Paper presented at the Third Annual Conference of the Central Bank of Chile, September 1999.

Brook, A-M., Collins, S., Smith, C., 1998. The 1991-1997 business cycle in review. Reserve Bank of New Zealand Bulletin, December 1998.

Beaumont, C., Cassino, V., Mayes, D., 1994. Approaches to modelling prices at the Reserve Bank of New Zealand, Reserve Bank of New Zealand Discussion Paper G 94/3.

[36] See the paper entitled "Inflation targeting in principle and practice".

Bernanke, B.S., Laubach, T., Mishkin, F.S., Posen, A.S., 1999. Inflation targeting: Lessons from the International Experience, Princeton University Press, Princeton, New Jersey.

Batini, N and A G Haldane (1999), "Forward-looking rules for monetary policy", Bank of England Working Paper No 91.

Black, R., Cassino, V., Drew, A., Hansen, E., Hunt, B., Rose, D., Scott, A., 1997. The Forecasting and Policy System: the core model. Reserve Bank of New Zealand Research Paper No. 43.

Brash, D.T., 1996. New Zealand's Remarkable Reforms. The Fifth IEA Annual Hayek Memorial Lecture. Institute of Economic Affairs, occasional paper no. 100.

Coletti, D., Hunt, B., Rose D., Tetlow, R., 1996, The Dynamic Model: QPM. Part 3 of The Bank of Canada's New Quarterly Projection Model. Technical Report No.75, Ottawa: Bank of Canada.

Collins, S., Nadal de Simone, F., Hargreaves, D., 1998. The current account balance: an analysis of the issues. Reserve Bank of New Zealand Bulletin, Vol. 61, No 1.

Conway, P., Hunt, B., 1997. Estimating potential output: a semi structural approach. Reserve Bank of New Zealand Discussion Paper G97/9.

Debelle, G., Masson, P., Savastano, M., Sharma, S., 1998. Inflation targeting as a framework for monetary policy. International Monetary Fund Economic Issues Series, No. 15.

Drew, A., Hunt B., 1998a. The forecasting and policy system: stochastic simulations of the core model. Reserve Bank of New Zealand Discussion Paper G98/6.

Drew, A., Hunt, B., 1998b. The forecasting and policy system: preparing economic projections. Reserve Bank of New Zealand Discussion Paper G98/6.

Drew, A., Hunt, B., 2000. Efficient simple policy rules and the implications of uncertainty about potential output. Journal of Economics and Business Vol. 52, No. 1

Evans, L., Grimes, A., Wilkinson, B., Teece, D., 1996. Economic reform in New Zealand 1984-95: The pursuit of efficiency. Journal of Economic Literature, Vol. 52, No. 1.

Frenkel, J.A., Razin A., 1992, Fiscal Policies and the World Economy. Cambridge: MIT Press.

Hunt, B., 1999, Inter-forecast Monetary Policy Implementation: fixed-instrument versus MCI based strategies. Reserve Bank of New Zealand Discussion Paper G99/1.

Heikensten, L., Vredin, A., 1998. Inflation targeting and Swedish monetary policy – experience and problems. Svergies Risksbank Quarterly Review, 1998:4, 5-33.

Laxton, D., Rose, D., Tetlow, R., 1994. Monetary policy, uncertainty and the presumption of linearity. Bank of Canada Technical Report No.63.

Orr, A., Scott, A., White, B., 1998. The exchange rate and inflation targeting. Reserve Bank of New Zealand Bulletin, September 1998.

Sherwin, M.A, 1999. Inflation Targeting: 10 years on. Address to the New Zealand Association of Economists Conference, July 1 1999.

Stevens, G., 1999. Six years of inflation targeting. Address to the Economic Society of Australia, Sydney, 20 April 20 1999.

Svensson, L. E. O., 1997a. Inflation forecast targeting: implementing and monitoring inflation targets. European Economic Review 41.

Svensson, L. E. O., 1997b. Inflation targeting in an open economy: strict or flexible inflation targeting? Reserve Bank of New Zealand Discussion Paper G97/8.

Tinsley, P.A., 1993. Fitting both data and theories: Polynomial adjustment costs and error-correction decision rules. Unpublished paper. Division of Statistics and Research, Board of Governors of the Federal Reserve System, Washington.

Taylor, J., 1994. The inflation-output variability trade-off revisited. in J. Fuhrer (ed.), Goals, Guidelines, and Constraints Facing Monetary Policy Makers, Conference Series No 38. Boston: Federal Reserve Bank of Boston.

Thiessen, G.G., 1998. The Canadian Experience with Targets for inflation Control. Gibson Lecture at the Queen's University, Kingston, Ontario, 15 October 1998.

White, B., 1998. Monetary policy and the structure of the capital account: the New Zealand experience. Reserve Bank of New Zealand Bulletin, December 1998.