The Role of Forecasting in Meeting Inflation Targets: The Case of New Zealand

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The Reserve Bank of New Zealand Act of 1989 was a landmark piece of legislation which has attracted attention from monetary policymakers worldwide. The act states that the sole macroeconomic objective of the central bank is to achieve and maintain "stability in the general level of prices." Price-level stability is defined in a Policy Targets Agreement (PTA) signed by the minister of finance and the governor of the Reserve Bank. Given the long and variable lags between changes in monetary policy and changes in the rate of inflation, the Reserve Bank's economic forecasts play a crucial role in its decisionmaking and in determining whether stability in the general level of prices can be achieved.

This paper begins by discussing the rationale for elevating price-level stability to an exalted place in the making of monetary policy. It then examines the major criticisms directed at a New Zealand-type system and the responses of New Zealand policymakers to those criticisms. Next, the paper describes the Reserve Bank's forecasting methods and evaluates the bank's forecasting performance. While acknowledging that forecasting is an imprecise science, the paper concludes that the Reserve Bank's record has been good enough to inspire confidence in its ability to achieve, or at least approximate, price-level stability. The paper also offers some comments on the future of inflation targets in the formulation of monetary policy.

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Price-Level Stability as a Central Bank's Sole Macroeconomic Objective

The Reserve Bank of New Zealand Act of 1989 followed in the wake of the literature on the Phillips Curve that was published in the late 1960s and 1970s. The dominant theme of that literature was that no long-run tradeoff exists between the rate of inflation and the rate of unemployment.[1] If there is no long-run tradeoff, the most important issues for monetary policy are (1) the optimal rate of inflation, from the standpoint of welfare economics, and (2) the rate of inflation most consistent with a rise in long-term living standards.

With regard to the first issue, Milton Friedman (1969) has argued that the optimal long-run inflation rate is negative—that is, a mild deflation would be required to make the real return on cash balances equal to the real rate of return on other assets. With regard to the second issue, Martin Feldstein (1996) has argued that, since the tax system is not fully indexed, an inflation rate of zero (i.e., perfect price-level stability) is desirable to minimize distortions in saving and investment decisions. He calculated that even small departures from price-level stability have significant consequences for long-run living standards.

A policy that seeks to achieve and maintain price-level stability has some possible drawbacks as well. There is the possibility that the long-run rate of unemployment is inversely related to the inflation rate. In an important paper based on New Zealand data, Simon Chapple (1996) reiterated the view of Akerlof, Dickens, and Perry (1996) that nominal wages are downwardly rigid; a positive inflation rate is then seen as desirable to reduce real wages in some sectors and bring wages closer to equilibrium levels. It is argued that the average unemployment rate can thereby be lowered.

Chapple concluded that, if anything, labor costs in New Zealand are more rigid than those in the United States. On the other hand, Donald Brash, the governor of the Reserve Bank, argues that, although standard-time nominal wage rates may indeed be downwardly rigid, there are other means by which labor costs can be reduced. For example, premium rates of pay for overtime work can be cut or eliminated. Labor costs can also be cut as workers change jobs, because jobs can be redefined, and departing workers can be replaced by new hires who are often less expensive (Brash 1994).

[1]In 1958, A.W. Phillips, a New Zealander, observed an inverse relation between the unemployment rate and the rate of nominal wage inflation (not price inflation).

Even if labor markets would eventually equilibrate in the absence of inflation, it is arguable that a stimulative—and perhaps even inflationary—monetary policy is sometimes desirable to speed the adjustment to higher levels of employment. However, it has been the view of New Zealand policymakers that if there is a severe negative shock to the total spending on goods and services, such as an abrupt fall in the foreign demand for New Zealand products, the aggregate demand for goods and services should be maintained via fiscal policy rather than monetary policy. Apart from any likelihood that fiscal policy acts more quickly than monetary policy, a countercyclical use of fiscal policy would tend to stabilize interest rates whereas the use of monetary policy would amplify the interest-rate impact of the initial shock.

Another concern about a policy that stresses price-level stability involves shocks to the aggregate supply of goods and services. Such shocks tend at least temporarily to increase the general level of prices and to depress production. If aggregate demand were then restrained via either monetary or fiscal policy in an attempt to stabilize the price level, the initial decline in production would be aggravated. The Policy Targets Agreement, to which the Reserve Bank's governor has committed himself, therefore contains "caveats" whereby the adverse impact of severe supply shocks on the "headline" rate of inflation may be disregarded unless it threatens to have long-lasting effects on the rate at which prices rise. The bank thus targets the "underlying" rate of inflation rather than the "headline" rate. (A copy of the most recent PTA has been included as an Appendix to this paper.)

In the absence of supply shocks, the official Consumer Price Index is still widely thought to overstate the true inflation rate by at least 1 percentage point, so the Reserve Bank has aimed at an annual inflation rate that is slightly positive as officially measured. It is understood that this target is unlikely to be hit very precisely. Early on, the PTA required the bank to keep the underlying inflation rate in a 0–2 percent band, as measured by the increase in the price level during the 12 months to the end of each quarter. After a change in government in 1996, a new agreement was reached whereby the bank is required to maintain a 0–3 percent band. The governor of the bank may be removed if the underlying inflation rate moves outside the band.

A final criticism of this kind of system—the criticism to which the heart of this paper is addressed—is that the Reserve Bank, however well-intentioned its staff may be, will simply be unable to accomplish its mission. As Friedman (1960: 87–89) noted,

> There is much evidence that monetary changes have their effect only after a considerable lag and over a long period and that the lag is rather variable. . . . In the present state of our knowledge, it

> is hard enough to conceive of an effective trial-and-error procedure for adapting to price level movements. . . . A satisfactory policy guide or rule should be connected more directly with the means available to the monetary authority than is the price level. . . . The stock of money therefore seems to me the relevant magnitude in terms of which to formulate monetary rules and the behavior of which should be a criterion of policy performance.

Thus, Friedman thought that a policy rule expressed in terms of the quantity of money would have practical advantages over a rule expressed in terms of the price level or the inflation rate. However, instability in the demand for New Zealand dollars has resulted in a situation where the connection between the New Zealand money supply, however measured, and the price level has been quite loose (Wong and Grimes 1990).

The Reserve Bank of New Zealand's Forecasting Methods

The Reserve Bank estimates that the lag between a change in monetary policy and the consequent change in the rate of inflation is 6–18 months or even longer. Policy, therefore, cannot simply respond to the current rate of inflation. A firming of monetary conditions, in response to an observed increase in the inflation rate, would occur too late to prevent a continued acceleration in the price level for at least the following half year. Hence, the Reserve Bank must try to anticipate price-level changes and, ideally, be able to forecast the situation at least 18 months ahead.

The bank undertakes an official forecast of the rate of inflation and related variables once per quarter. Forecasts are made of the 12-month inflation rate to be expected at the end of the current quarter and at the end of each subsequent quarter for the following three years. The process begins with an evaluation of previous forecasts. Forecast errors are tabulated and possible explanations for the errors are assessed. A large error may call into question previous forecasting methods. Once previous forecasts have been evaluated, a new forecast can be undertaken. The new forecast, in turn, depends on policy assumptions and assumptions about other variables assumed to be exogenous (e.g., foreign GDP growth and the growth rate of potential domestic output).

Assumptions regarding interest rates are dominated by the degree of monetary tightness that the Reserve Bank wishes to uphold during the forecast period. The trade-weighted exchange rate is, on the other hand, simply assumed to remain constant during the forecast period. Assumptions regarding fiscal policy are based on the projections of

the New Zealand Treasury and adjusted to reflect differences between the bank's outlook for the macroeconomy and the Treasury's.

Inflation forecasts up to two quarters ahead are made largely on a "components" basis. The Consumer Price Index is disaggregated into about 40 parts. Forecasts are prepared for each part and then weighted to forecast the quarterly percentage change in the aggregate. Statistics New Zealand, a government agency, provides monthly data on items such as retail sales, food prices, merchandise trade, wages and salaries, and employment. The Reserve Bank itself conducts surveys and sends staff to a few dozen major firms in metropolitan areas to determine the extent of economic activity and inflationary pressures. The surveys and on-site visits are thought to be especially helpful in identifying turning points in business behavior.

Because many markets may be in disequilibrium during a 0–2 quarter period, the bank has not relied on a structural equation for the core inflation rate in making its short-term forecasts. On a medium- to long-term basis, however, markets are assumed to approach equilibrium, and the Reserve Bank estimates the parameters of a structural equation. That equation views the underlying rate of inflation as being influenced by wage movements, productivity, the foreign prices of tradeable goods, the exchange rate, and excess demand pressures.

The bank has not relied on a full-blown macroeconomic model in making its forecasts. Rather, the bank's forecasts rely on a variety of sources, including prior staff beliefs, single-equation estimates, and the properties of other models. The bank's economics department has recently been building a more elaborate model to assist it in making forecasts, but a good deal of judgment is still exercised. For example, the model might be able to estimate the average impact of a change in real economic activity on the underlying inflation rate, but surveys might suggest that the actual impact is likely to be either above or below the average.

The Inflation Forecasting Record of the Reserve Bank of New Zealand[2]

The original Policy Targets Agreement that followed the passage of the Reserve Bank Act gave the bank until the end of 1992 to achieve an inflation rate of 0–2 percent. After the National Party unseated the Labour Party in the 1990 elections, the PTA was changed

[2]The Reserve Bank of New Zealand's projections and basic macroeconomic statistics can be found in two semiannual publications: *Economic Projections* and *Monetary Policy Statement*. The former is published in March and September of each year. (It used to be called *Economic Forecasts*.) The latter is published in June and December.

to give the bank until the end of 1993 to hit the inflation target. An inflation rate of less than two percent was, in fact, achieved during 1992. However, the disinflation involved caused a significant recession. The bank subsequently eased monetary policy, but no breach of the inflation target was initially forecast. Indeed, if the bank expects inflationary pressures to accumulate, it is obligated to adopt a more restrictive policy.

The underlying inflation rate did ultimately rise above 2 percent, but the bank did not forecast that result until June 1995, near the end of the quarter when the 12-month underlying inflation rate actually breached the target range. The target range was also breached in the 12 months to June 1996 and also in the 12 months to September and December, respectively, in 1996.

The most difficult time for the formulation of monetary policy was the 1994–95 period. As the economy recovered from the deep recession, and in the wake of numerous economic reforms undertaken in addition to the Reserve Bank Act of 1989, no one could be sure at what rate the economy could grow in the absence of inflation. Of particular note was the 1991 Employment Contracts Act (ECA), which eliminated legal privileges that had been enjoyed by trade unions. As the growth of nominal wages was subdued after 1991, the Reserve Bank had to judge the extent to which that moderation reflected an adjustment to the ECA as opposed to an absence of inflationary pressures.

In the four quarters to March 1994 real gross domestic product increased 6.2 percent, but nominal wage growth continued to moderate. Many people were still not sure if a significant rise in the inflation rate was occurring. What finally prompted the Reserve Bank again to tighten monetary conditions was an upsurge in real estate prices, particularly in the Auckland area. To its credit, the Reserve Bank did tighten conditions before the underlying inflation rate showed an increase. The interest rate on 90-day commercial bank bills rose to more than 10 percent. From the first quarter of 1994 to the first quarter of 1996, the New Zealand dollar appreciated by 15 percent on a trade-weighted basis.

In its March 1994 *Economic Forecasts*, the Reserve Bank projected that the underlying inflation rate in the 12 months to March 1995 would be only 0.6 percent. However, the actual underlying rate was 1.9 percent. For the 12 months to June 1995 the same document forecast that the underlying rate would be 0.9 percent, but the actual underlying rate for the period was 2.2 percent—a breach of the 0–2 percent target range.

Each of the above forecast errors was thus 1.3 percentage points. Those errors have been the largest ones experienced since the Reserve Bank began to target the underlying inflation rate. The bank itself has been quite humble about its ability to forecast inflation. However, if one considers all of the forecasts for the 1992–96 period, the average absolute error was only 0.4 percentage points. That average includes all forecasts of the underlying rate from 0–12 quarters ahead.

If one's attention is restricted to forecasts of the underlying inflation rate six quarters ahead, the average absolute error was 0.5 percentage points. Since a six-quarter lag is probably long enough for monetary policy to have had most of its impact on inflation, this result seems quite encouraging. Table 1 compares Reserve Bank of New Zealand inflation forecasts six quarters ahead with the ensuing reality.

To be sure, the bank's forecasting ability has not been sufficient to prevent a few breaches of the inflation target, but the largest breach has been only 0.3 percentage points. This occurred when the underlying inflation rate reached 2.3 percent at a time when the Policy Targets

TABLE 1

RESERVE BANK OF NEW ZEALAND INFLATION FORECASTS VERSUS ACTUAL INFLATION, 1992–1996[a]

Date of Forecast	Forecast of Underlying Inflation Six Quarters Ahead (%)	Actual Underlying Inflation Rate Six Quarters Later (%)	Forecast Error (% pts.)
Feb. 1992	2.1	1.5	0.6
June 1992	1.0	1.3	0.3
Sept. 1992	0.9	1.1	0.2
Dec. 1992	0.5	1.1	0.6
Mar. 1993	1.1	1.2	0.1
June 1993	1.3	1.5	0.2
Sept. 1993	1.2	1.9	0.7
Dec. 1993	1.3	1.5	0.2
Mar. 1994	1.2	2.0	0.8
June 1994	1.7	2.0	0.3
Sept. 1994	1.4	2.1	0.7
Dec. 1994	1.8	2.3	0.5
Mar. 1995	1.3	2.3	1.0

[a]Inflation rates were calculated on the basis of a 12-month moving average.

SOURCE: Reserve Bank of New Zealand.

Agreement permitted a maximum rate of 2 percent. When one considers that the inflation rate approached 20 percent during the 1980s, the record since 1989 is quite good. New Zealand now has a monetary policy framework that gives investors and labor market participants a high degree of confidence that the country will maintain a reasonably stable price level.

Since macroeconomic disruptions, such as the massive disinflation of the early 1990s, are now much less likely, the errors in future forecasts may be of an even lesser magnitude. The refinement of the bank's formal forecasting model may also help.

Finally, it should be noted that the New Zealand Treasury began to issue inflation-indexed bonds in 1995. By looking at the spread between the yields on traditional, unindexed bonds and on the new securities, the bank might gain additional insights into the inflation expectations of financial market participants. If the spread exceeded 2 percent, the bank would have an additional indicator that monetary conditions were not sufficiently tight. If the spread were very small or negative, it would indicate that monetary conditions were overly restrictive. To date, trading in the new bonds has been rather thin, and it may be awhile before they provide a reliable indicator of inflationary pressures.

Conclusion

The tightening of monetary conditions which began in 1994 eventually brought about a decrease in inflationary pressures in New Zealand. Production initially slowed, but there was no recession. During 1997 the underlying inflation rate again fell below 2 percent. However, the appreciation of the exchange rate that occurred until 1996 did do considerable damage to exporters, and political reverberations were felt inside the Reserve Bank itself. A new political party, New Zealand First, campaigned on a platform that included a promise to protect the interests of exporters better than the ruling National Party had been able to do. The results of the 1996 elections were thus that the National Party could not secure a clear majority in the Parliament and had to join New Zealand First in a coalition government in order to stay in power.

As part of the coalition agreement, the inflation target for the Reserve Bank was widened to the current 0–3 percent band. New Zealand First argues that the bank now has more leeway for easing monetary policy, and that such easing could bring short-term relief to exporters.

The new Policy Targets Agreement (see Appendix) also includes "sustainable economic growth" as a Reserve Bank objective. For its part, the Reserve Bank views price-level stability as a precondition for sustainable economic growth, and the consensus opinion in New Zealand seems to be that the changes in the most recent PTA are largely cosmetic.

Politics will never be far from the power to create money. Debate continues as to whether price-level stability should be the sole or even the primary macroeconomic objective of monetary policy. However, the forecasting record of the Reserve Bank of New Zealand provides some assurance that "long and variable lags" need not be an insurmountable obstacle to the achievement of such an objective.

Appendix: The 1996 Policy Targets Agreement

The following PTA was signed by Donald T. Brash, governor of the Reserve Bank of New Zealand, on December 10, 1996. It is a performance contract to which the governor commits himself.

POLICY TARGETS AGREEMENT

This agreement is signed under section 9(4) of the Reserve Bank of New Zealand Act 1989 (the Act) by the Minister of Finance (the Minister) and the Governor of the Reserve Bank of New Zealand (the Governor). It replaces that signed on 16 December 1992.

In terms of section 9 of the Act, the Minister and the Governor agree as follows:

1. Price Stability Target

Consistent with section 8 of the Act and with the provisions of this agreement, the Reserve Bank shall formulate and implement monetary policy with the intention of maintaining a stable general level of prices, so that monetary policy can make its maximum contribution to sustainable economic growth, employment and development opportunities within the New Zealand economy.

2. Measurement of Price Stability

a) In pursing the objective of a stable general level of prices, the Bank will monitor prices as measured by a range of price indices. The formal price stability target will be defined in terms of the All Groups Consumers Price Index (CPI), being the measure that is monitored most closely by the public.

b) For the purposes of this agreement, 12-monthly increases in the CPI of between 0 and 3 percent will be considered consistent with price stability.

3. Deviations from the Targets

a) There is a range of possible price shocks arising from external sources, certain government policy changes, or a natural crisis which are quite outside the direct influence of monetary policy. The Bank shall generally react to such shifts in relative prices in a manner which prevents general inflationary pressures emerging.

b) This approach means that the CPI inflation rate can be expected to move outside the 0 to 3 percent range in response to particular shocks. The principal shocks are considered to be:

- significant changes in the terms of trade arising from an increase or decrease in either import or export prices;
- an increase or decrease in the rate of GST, or a significant change in other indirect tax rates;
- a crisis such as a natural disaster or a major disease-induced fall in livestock numbers which is expected to have a significant impact on the price level;
- a significant price level impact arising from changes to government or local authority levies; and
- a movement in interest rates that causes a significant divergence between the change in the CPI and the change in the CPI excluding the interest costs component.

c) In the event of such shocks, the Reserve Bank shall be fully accountable for its handling of the price effects, and, in particular, for any movements outside the 0 to 3 percent band. In each Policy Statement made under section 15 of the Act, the Bank shall detail fully its estimate of the direct price impact of any such shock and the impact on the Bank's achievement of the price stability target. The Bank shall also detail what measures it has taken, or proposes to take, to ensure that the effects of such shocks on the inflation rate are transitory.

4. Renegotiation of the Targets

The policy targets are established on the understanding that the monetary policy instruments available to the Bank are adequate to achieve the objective. The Governor shall inform the Minister if he considers that any changes in the availability or effectiveness of these policy instruments impair the conduct of monetary policy. The Minister and the Governor may then set new policy targets.

5. Implementation

a) The Bank shall implement monetary policy in a sustainable, consistent and transparent manner.

b) Each Policy Statement released by the Bank under section 15 of the Act shall contain a statement of how the Bank proposes to formulate and implement *monetary policy to ensure that price stability is maintained over the succeeding* five years.

Governor

Minister of Finance

Signed in Wellington this 10th day of December 1996.

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