

# Monetary policy in an uncertain world

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*“It’s not so much the things you don’t know that cause the trouble, as the things you do that ain’t so.”*

*Will Rogers*

Policy makers and policy economists have long recognised that uncertainty has important implications for monetary policymaking. Milton Friedman’s famous prescription of a constant money growth rule was in large part a response to the existence of pervasive uncertainty. William Brainard is well known for his analysis of (one form of) uncertainty that policy makers face, and the resulting prescription to adjust policy gradually. However, because of its nature, incorporating uncertainty into the policymaking process is by no means straightforward. In this article, we outline the nature and implications of the different types of uncertainty that the Reserve Bank of New Zealand must contend with.

## 1 Introduction

It is now reasonably common practice for central banks to conduct monetary policy with the explicit aim of controlling inflation. Inflation-targeting central banks have been granted the freedom to choose how the instruments of monetary policy should be adjusted to achieve their low inflation objectives. While the objectives of monetary policy and the operational frameworks for central banks have become more certain in recent years, the economic environment in which monetary policy is implemented probably has not. In this environment, policy makers must contend with a wide range of uncertainties that can have important implications for the design and conduct of monetary policy. In fact, virtually every aspect of the policymaking process is influenced by uncertainty in some way.

To manage monetary policy successfully in an uncertain world policy makers need to understand the nature and implications of the uncertainties they face. Uncertainty can arise for a number of reasons. First, policy makers’ understanding of how the economy works is far from precise. As a result, there is always a degree of uncertainty about the nature of economic relationships and the appropriateness of different models of the economy used to describe those relationships. Second, uncertainty is also inherent in the data that policy makers use to assess the state of the economy. This type of uncertainty is particularly pronounced for economic indicators that cannot be measured directly – for example, the output gap and inflation expectations.<sup>1</sup> In addition,

policy makers, much like everyone else, are completely uncertain about the shocks that will impact on the economy in the future.

To assess the policy implications of these different types of uncertainty, researchers use models of the economy as ‘economic laboratories’ in which the theoretical assumption of “all else being equal” can be relaxed in one way or another. For example, researchers might investigate the behaviour of model economies when policy actions are based on measures of the output gap that turn out to be inaccurate. Alternatively, researchers may be interested in the implications of policy makers mis-estimating the strength of key economic relationships. In any case, the basic objective of this literature is to find ways for policy makers to act so that undesirable macroeconomic outcomes – such as unnecessary volatility – are avoided, irrespective of the uncertainty under investigation.

The policy prescriptions suggested by this literature tend to be specific to the type of uncertainty being assessed. Consequently, there is no generic prescription as to how policy makers should alter their behaviour in the face of uncertainty. Because of its very nature, uncertainty cannot be incorporated into the policymaking process in a mechanical or rigid fashion. Indeed, such an approach may prove to be detrimental. Instead, within the context of the monetary policy framework in place – in New Zealand’s case, inflation targeting – policy makers must set policy bearing in mind on a case by case basis the key uncertainties that predominate at the time.

<sup>1</sup> For a detailed discussion of potential output and the output gap, see Claus, Conway and Scott (2000).

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In this article we discuss uncertainty in the context of monetary policymaking in New Zealand. In section two we outline in more detail the different types of uncertainty that policymakers must contend with. The implications of these uncertainties for conducting monetary policy are discussed in section three. In section four, some of the broader lessons that policymakers can take from the uncertainty literature are outlined. Finally, concluding comments are offered in section five.

## 2 Uncertainty comes in many forms

Because monetary policy settings affect inflation with a lag, policymakers set instruments today to achieve their inflation objective at some point in the future. To do this effectively, policymakers must account for a number of factors. To begin with, they need a good understanding of how the economy works, in particular the dynamic links between the instruments of monetary policy – usually the short-term interest rate – and inflation. Another important prerequisite for effective monetary policy is an accurate understanding of the current state of the economy. In the absence of such an understanding, it is very difficult for policymakers to envisage where the economy will be in the future when current policy settings take effect. Finally, any future events that may influence inflation in the interim are also an important consideration, although, of course, it is rare for future events to be known today.

If policymakers could perfectly account for each of these factors it might be possible to run monetary policy in such a way that price stability would prevail at all points in time. Unfortunately, this is not the case. Because each of the factors mentioned above can only ever be partially accounted for, virtually every aspect of monetary policy is influenced by uncertainty in some way. Even the objective of monetary policy is specified as a target range for inflation, given that a point target would be unrealistic in light of the uncertainties that policymakers face. In this section we outline why policymakers can always expect to be uncertain about the structure of the economy, the state of the economy, and the likely nature of future events.

## Uncertainty about the structure of the economy

The way economies behave is ultimately the result of individual actions by a great many people. Although people display some relatively methodical traits, we are also prone to powerful whims and flights of fancy. These aspects of human nature, which make the world such an interesting place, generate a significant degree of uncertainty as to individual and collective actions. Not surprisingly, economies tend to reflect the characteristics of their constituents. Hence, while they display a number of relatively orderly features that can be captured in economic models and used as a basis for prediction, because these characteristics are the product of human behaviour, they are subject to significant and pervasive uncertainties.

By way of an example, over recent quarters Reserve Bank forecasts for aggregate consumption have been based partially on the *assumption* that household spending will become constrained by increased levels of debt. However, the way households respond to increased debt burdens in this economic cycle, and the way in which this feeds into consumption and asset prices, is not known with certainty. This type of uncertainty is referred to as ‘model uncertainty’ because it arises when policymakers are uncertain about the structure of the economic relationships that comprise their (formal or informal) models.

Even where policymakers do have a broad understanding of economic structure, the strength of individual economic relationships within that structure is still likely to be estimated imprecisely. For example, policymakers may be confident that policy actions influence aggregate demand and inflation, but uncertain about the speed and potency of these effects. Alternatively, the magnitude of ‘pass through’ from exchange rate movements to inflation will, in all likelihood, never be known with certainty. This type of uncertainty relates to the coefficients in the equations that make up an economic model and is referred to as ‘parameter uncertainty’.

To complicate matters even further, it is unreasonable to assume that the structure of the economy and the strength of the relationships involved will remain constant through time. Just as human behaviour evolves and changes through

time, so too do macroeconomic relationships. Consequently, models based on the past behaviour of the economy will not necessarily provide accurate descriptions of future behaviour.

The extent of economic reform and structural adjustment that has occurred in New Zealand during the last fifteen years or so is testament to how important change of this nature can be. These changes left policymakers grappling throughout the 1990s with a number of structural issues, including re-assessing the potential growth rate of the economy and the extent to which demand pressures would arise following a period of financial repression. By way of a less stark example, over recent years movements in the exchange rate appear to have had a smaller influence on inflation than they did at the start of the 1990s. Whether this is the result of structural change in the relationship between exchange rate movements and inflation or simply an increase in the time lags involved is still unclear. Looking to the future, it is currently uncertain what effect the Employment Relations Act, ACC reform, or 'New Economy' factors will have on New Zealand's economic structure. These are just some of a number of structural issues that the Reserve Bank is constantly having to assess and factor into policy decisions.

For all of these reasons, policymakers' understanding of how the economy works is imprecise. Economic models – such as the Reserve Bank's *Forecasting and Policy System* (FPS) and the less formal 'models' that policymakers carry in their heads – are, at best, rough approximations of reality. Even although experience and advancements in economic theory have enhanced our understanding of the macro-economy, there are, and will continue to be, many areas open for debate.

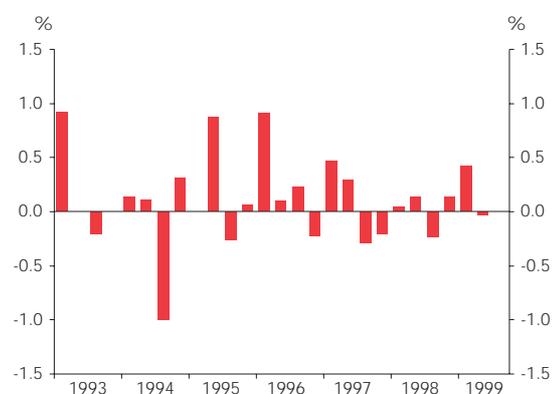
### Uncertainty about the state of the economy

Meteorologists have a distinct advantage over economists in that they have more accurate, up-to-the-minute information on the current state of the weather. Economists, in contrast, have to cope with a wider range of issues that compromise data quality and introduce significant uncertainty into assessments of the current economic 'climate'. At a fundamental level, a great deal of macroeconomic data are

estimated on the basis of sample surveys. As such, these data *approximate* the underlying macroeconomic concepts that economists are interested in and are subject to statistical uncertainty, which may be considerable in some cases. For example, New Zealand's rate of consumer price inflation is estimated on the basis of price changes in a subset of consumer products and is an imperfect measure of what one would regard as true inflation in the economy.<sup>2</sup> In addition, macroeconomic data can suffer from aggregation problems. For example, there are non-trivial difficulties associated with aggregating the range of goods and services produced in New Zealand into a single measure of output.

Macroeconomic data are also often revised in light of additional source information, changes in measurement or sampling method, or shifts in seasonal adjustment factors. Figure 1 graphs the difference between initial estimates of the quarterly growth in New Zealand's gross domestic product (GDP) and 'final' estimates. As is apparent from the graph, these differences can be substantial, with a number of revisions in the vicinity of plus or minus one percentage point. In addition to revisions, macroeconomic data may even be statistically redefined from time to time. Although this is clearly designed to improve the mapping between the data and economic reality, it can also contribute to uncertainty about the state of the economy in the interim.

**Figure 1**  
**Revisions to initial GDP quarterly growth estimates**



<sup>2</sup> It is important to note that, although this example and those that follow are made in reference to New Zealand, the difficulties of quantifying economic activity are universal across countries.

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As well as problems associated with statistical inference, assessments of the current state of the economy are prone to additional uncertainty because a lot of important macroeconomic data are only available with a lag. For example, June quarter GDP is not available until the end of September. As a result, the most recent data releases do not reflect the current state of the economy, but instead pertain to a slightly earlier time period. In addition, macroeconomic data are often not continuous but relate to a given interval of time such as a month, quarter, or a year. Consequently, policymakers cannot watch the economy evolve through time but must instead make do with discrete (and slightly dated) snapshots.<sup>3</sup>

Finally, assessments of the economy are also prone to uncertainty because some important indicators – notably potential output and the output gap – are intrinsically unobservable and cannot be measured using conventional data-collection techniques. Measures of these economic variables are typically inferred from other macroeconomic data. The inference process invariably generates additional uncertainty about the accuracy with which these measures reflect underlying economic conditions.

For all of these reasons, it is far more difficult for economists to assess the state of the economy than it is for meteorologists to assess the state of the weather.

### Uncertainty about future events

Uncertainty for monetary policymakers can also arise from unforeseen future events that influence inflation. Because policy actions affect the economy with ‘long and variable lags’, monetary policy should be set on the basis of the expected future state of the economy. However, monetary policymakers do not, unfortunately, have anything like perfect foresight. Because the economy is continually subject to ‘shocks’ of unknown nature and duration, economic reality will turn out to be different from forecasts, even when the starting point is well understood and the economic model is accurate.

New Zealand’s economic history is full of examples of this type of ‘shock uncertainty’. The recent droughts, fallout

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<sup>3</sup> Not all economic data are prone to these types of difficulties. Exchange rates and interest rates, for example, are accurate, timely and continuous.

from the financial crisis in Southeast Asia, and the current oil shock are all good examples of unanticipated events that have had a significant impact on the New Zealand economy. This type of uncertainty can also arise from unexpected changes in other areas of economic policy. For example, unanticipated changes in fiscal policy, tariffs, and other areas of microeconomic reform may influence future inflation in ways that are difficult to quantify *ex ante* (although many policy changes are announced somewhat in advance of taking effect).

## 3 The implications of uncertainty for setting monetary policy

The policy implications of the different types of uncertainty are usually assessed in the context of economic models. Researchers use models of the economy as ‘economic laboratories’ in which the policymaker is exposed to some well-specified form of uncertainty. In this environment researchers search for ‘rules’ for conducting monetary policy that minimise the extent of macroeconomic volatility in the model economy, in spite of the uncertainty under consideration.<sup>4</sup>

In an economic model, a policy rule is a mathematical description of how the policymaker should move the instrument of monetary policy – usually the short-term interest rate – in response to economic developments. For example, under a ‘Taylor rule’<sup>5</sup> the policymaker adjusts the short-term interest rate in response to movements in the current output gap and the annual rate of inflation. By way of another example, the policy rule embedded in the Reserve Bank’s FPS model adjusts the instrument of monetary policy in response to deviations of forecast inflation from the mid point of the inflation target band (1.5 percent).<sup>6</sup> In practice,

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<sup>4</sup> It is now generally accepted that monetary policy cannot influence the *levels* of real macroeconomic variables, such as output, in the long run. Accordingly, different policy rules are assessed by comparing the *volatility* of model variables, in particular output, inflation, and interest rates.

<sup>5</sup> See Taylor (1993).

<sup>6</sup> These are two of a large number of potential policy rules. Under each of the various rules, monetary policy settings are changed in response to a different set of macroeconomic data. The aggressiveness with which policy reacts to the data may also vary across rules.

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policy rules may be used to provide guidance in setting policy but are never followed in a mechanical or rigid fashion.

In this section we briefly outline some of the results of research into the policy implications of uncertainty. The focus in this section is on the implications of the different types of uncertainty discussed in section 2 for the way in which policymakers should adjust monetary policy settings. In section 4 we outline some of the broader implications of uncertainty for monetary policy.

### Uncertainty about the structure of the economy

Given that policymakers can never be certain about the true structure of the economy, a desirable property of rules for conducting monetary policy is that they be robust to different characterisations of how the economy works. If a particular policy rule works well across a range of different assumptions about economic structure then it is relatively robust to this type of uncertainty. However, if a policy rule performs well under one characterisation of economic structure, but not under another, then it is sensitive to uncertainty about the structure of the economy and may be a risky tool for guiding policy decisions in the real world.

The most general form of this robustness test involves 'transplanting' various policy rules into different models of the economy. Recent US research<sup>7</sup>, for example, assesses different policy rules in four separate models of the US economy. An important result to emerge from this work is that 'simple' policy rules are more robust across different models – in the sense that they result in lower average variability in output and inflation – than are more 'complex' rules.<sup>8</sup> In essence, this result arises because complicated rules for conducting monetary policy can be 'fine tuned' to perform well in a particular model economy. However, because they are finely tuned these rules may be incompatible with the

idiosyncrasies of the other models, giving rise to poor performance in those models. Simple policy rules, however, are less sensitive to the nuances of a particular model and, therefore, are more robust across models.<sup>9</sup>

Consistent with the quote at the beginning of this article, this result suggests that policymakers run the risk of 'causing trouble' if they fine tune policy actions on the basis of complicated assumptions that are specific to one particular view of how the economy works. Undesirable macroeconomic outcomes – such as unnecessary volatility in output, inflation, and interest rates – may arise if economic reality turns out to be different from that view. In the presence of uncertainty about economic structure, policy making that is more pragmatic and less dependant on complicated structural assumptions would seem to be more appropriate.

Other research in this genre investigates the policy implications of more specific forms of uncertainty about the structure of the economy. In a seminal article, William Brainard<sup>10</sup> assessed the consequences for monetary policy of uncertainty about the strength of economic relationships – that is, parameter uncertainty. He argued that if policymakers are uncertain about the potency with which policy actions affect aggregate demand and inflation, it is optimal to move the interest rate by a smaller amount in response to shocks than in the case of no uncertainty. If the economic effect of policy actions is uncertain, then the larger the change in the interest rate, the greater is this uncertainty. Consequently, policymakers should reduce the magnitude of interest rate movements relative to the case of no uncertainty; hence the Brainard attenuation result of 'estimate your best policy response and then do less'.

In the New Zealand context, this attenuation result suggests that we should 'feel our way' with smaller changes to the cash rate relative to what we would do if we were totally certain about the effect of policy changes on economic activity. This strategy would avoid interest rate changes that could create, through their interaction with other factors,

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<sup>7</sup> See Levin, Wieland and Williams (1998).

<sup>8</sup> In this work, a 'simple' policy rule is a type of Taylor rule in which the short-term interest rate is adjusted in response to movement in the output gap, inflation, and the lagged interest rate. Under a 'complex' rule the short-term interest rate is responsive to a larger number of the model's variables and/or additional lags of the output gap and inflation.

<sup>9</sup> Of course, within each model, a finely tuned complex rule outperforms a simple policy rule. However, the authors find that the difference in performance is relatively small and that simple rules still do well in stabilising output and inflation.

<sup>10</sup> Brainard (1967).

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disproportionately larger effects on economic activity than anticipated and destabilise the economy, rather than reduce variability.

Recent research suggests that the implications of parameter uncertainty for monetary policy may not be so clear cut. Gabriel Srouf<sup>11</sup> points out that, for some economic relationships, it would be incorrect to presume that being uncertain implies policymakers should 'feel their way'. For example, if the extent to which unexpected changes in inflation feed into generalised inflation is uncertain, then it may be optimal for policymakers to respond *more* forcefully to inflation surprises, thereby minimising the potential for inflation to deviate persistently from the target. Whether optimal monetary policy should be more or less aggressive in the presence of parameter uncertainty would seem to depend on which parameters in the policymakers' model are subject to the most (relative) uncertainty. If there is general uncertainty about all or most of the parameters in the policymakers' model then the attenuation result may not hold.

The policy implications of specific aspects of model uncertainty have also been studied extensively.<sup>12</sup> Not surprisingly, as the specificity of the uncertainty under investigation increases, so too does the specificity of the policy prescription. In the Economics Department at the Reserve Bank we have designed a number of exercises that simulate various misperceptions and mistakes by the policymaker. In one exercise, for example, we consider the case of uncertainty about the length of time it takes for policy actions to influence inflation.<sup>13</sup> Under this type of model uncertainty, policy rules that respond more gradually to bring inflation back to the target are least affected (relative to more aggressive rules) by uncertainty about the length of the monetary policy transmission lag.

In other work at the Reserve Bank, we examine uncertainty about the impact of exchange rate movements on people's

expectations of future inflation.<sup>14</sup> This research suggests that, irrespective of the way in which exchange rate movements influence inflation expectations, macroeconomic stability can be enhanced if policymakers ignore ('look through') the inflationary impact of temporary exchange rate shocks. Of course, determining the persistence or otherwise of exchange rate shocks presents an additional conundrum for policymakers.

## Uncertainty about the state of the economy

Until relatively recently, research into the policy implications of uncertainty about the state of the economy suggested that policymakers should simply ignore this type of uncertainty and set policy on the basis of their best estimates of the uncertain variables.<sup>15</sup> This result, known as 'certainty equivalence', is based on the assumption that policymakers know exactly how the economy works and set policy on the basis of 'optimal rules' that are complicated functions of all the variables in the model economy.<sup>16</sup>

Under more realistic assumptions about the information available to policymakers, certainty equivalence does not hold. Frank Smets, for example, assesses the implications of uncertainty about estimates of the output gap when policymakers base their actions on more realistic rules such as the Taylor rule.<sup>17</sup> In this model, because policymakers have restricted knowledge of the state of the economy, they must discern the true level of the output gap from an imprecise estimate. As the accuracy of the output gap estimates deteriorates, it becomes optimal for policy makers to put less weight on these estimates when making policy decisions. That is, in the spirit of Brainard, it becomes optimal for policymakers to attenuate their response to the output gap if they are uncertain of its true value.

A number of other studies also refute certainty equivalence and find that policymakers should alter the way in which they respond to movements in the output gap in light of associated uncertainties. For example, US researchers suggest

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<sup>11</sup> Srouf (1999).

<sup>12</sup> For example, Laxton, Rose and Tetlow (1993) examine the implications of uncertainty about whether inflation responds symmetrically or asymmetrically to excess demand and excess supply in the economy. Frankel and Rockett (1986) and Ghosh and Masson (1988, 1991) investigate the implications of model uncertainty for policy co-ordination between two countries.

<sup>13</sup> Ha (2000).

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<sup>14</sup> Conway, Drew, Hunt and Scott (1998).

<sup>15</sup> Chow (1977).

<sup>16</sup> See, for example, Woodford (1999) and Svensson (1997).

<sup>17</sup> Smets (1999).

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that in the presence of measurement error, efficient monetary policy should put less emphasis on the output gap relative to the case of certainty.<sup>18</sup> Work at the Reserve Bank, however, finds that the policy implications of output gap uncertainty depend on the specific nature of the measurement errors.<sup>19</sup> If techniques for estimating the output gap systematically underestimate the extent of excess demand or supply in the economy (as some tend to do), then a more cautious response in the face of such uncertainty may not always be optimal.

A broad interpretation of this literature is that uncertainty about data that describes the state of the economy can have important implications for the way in which policymakers factor this data into the policy process. Of course, this is not news to policymakers, who are generally well aware of the pitfalls inherent in inferring the state of the economy from a narrow range of (uncertain) data.

In the New Zealand context, macroeconomic volatility appears to be more pronounced than in other OECD countries, reinforcing the notion that an excessive reliance on any one piece of data could be detrimental for monetary policy.<sup>20</sup> Accordingly, we consider a broad array of data when assessing the state of the economy. We also have frequent contact with Statistics New Zealand and other data providers to determine how different economic indicators are constructed and what exactly they are measuring. In addition, each year the Reserve Bank conducts around two hundred interviews with different businesses and commercial banks to hear their views on the current state of the economy.

Because current economic conditions provide a 'starting point' for economic forecasts, uncertainty about the current state of the economy can have potentially important implications for monetary policy making. If policymakers do not have a good feel for where the economy is at present, it is very difficult to forecast where the economy will be when current policy actions influence aggregate demand and inflation. Consequently, the 'burden of proof' that is required

to justify changes in monetary policy is more than can be provided by one or two data releases in isolation.

### Uncertainty about future events

The optimal way in which policymakers should respond to uncertainty about future events is, in theory, relatively straightforward. With this type of uncertainty, policymakers should simply base their actions on the *expected* nature of future events. For example, if it is uncertain how long a given shock will persist into the future, it is optimal for policymakers to base their response on the expected degree of persistence of the shock. To the extent that policymakers' expectations are in some sense 'optimal', the associated policy actions will be as well. In effect, certainty equivalence holds in that the optimal strategy for conducting monetary policy does not change in light of uncertainty about future shocks.

Under this strategy, monetary policy follows a 'middle of the road course' in which the risks associated with uncertain future events are evenly balanced. As such, policymakers' forecasts of how the economy will evolve, including the future path for monetary conditions, represents a central or most likely scenario.

In practice, however, it might, from time to time, be sensible to depart from this middle of the road approach. Some events that are unlikely to occur could be quite damaging to the economy if they were to happen. A very sharp collapse in US asset prices is a case in point. Given the potential damage to New Zealand's economic performance that would follow such an event – especially if the situation were already fragile – it might be sensible to take more account of such a potential shock than the middle of the road approach would suggest. In any case, as is frequently pointed out in the Reserve Bank's *Monetary Policy Statements*, the published projection is highly conditional on future events turning out as predicted. If the nature, size, or persistence of economic shocks turn out to be different from our expectations, then the actual path of the economy, and monetary conditions, will deviate from the forecast. As policymakers learn more about the nature of shocks affecting the economy, they will revise their forecast and reset monetary policy accordingly. The evolution of monetary conditions in New Zealand in response to the Asian financial crisis provides an example of

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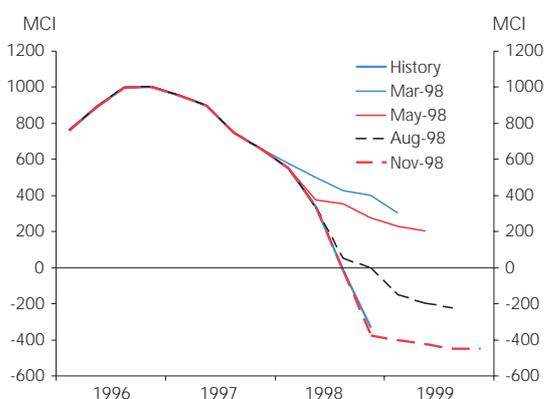
<sup>18</sup> Orphanides (1998) and Swanson (2000).

<sup>19</sup> Drew and Hunt (2000).

<sup>20</sup> Macroeconomic volatility in New Zealand appears to have declined over the 1990s (Buckle 2000). However, *relative to other OECD countries, the level of volatility does not seem to have improved. This may be because New Zealand is a relatively small, predominantly agricultural economy that is open to the foreign sector.*

these types of resets. Figure 2 graphs the path of the actual Monetary Conditions Index and the projected paths from Reserve Bank forecasts, as published in *Monetary Policy Statements* from March to November 1998. Over this period, both the level and forward path of monetary conditions were steadily revised downwards in light of new information that suggested the effect of the Asian financial crisis on the New Zealand economy was more severe than originally anticipated.

**Figure 2**  
**Response of monetary conditions**  
**(forecast and actual) to the Asian crisis**



With the benefit of hindsight, the fallout from the Asian crisis is a relatively obvious example of an economic shock. However, identifying economic shocks *ex ante* is often not so straightforward. For example, an appreciation in the New Zealand dollar may reflect some kind of shock to investors' preferences – such as a 'flavour of the month' effect – or it may stem from a more fundamental source such as an increase in international demand for New Zealand exports. While the optimal policy response to uncertainty about future shocks is straightforward in theory, in practice identifying what underlies a shock and determining the appropriate policy response can often be a challenge.

In conclusion, it is apparent from the material discussed in this section that uncertainty can have a substantial impact on the stabilisation properties of strategies for conducting monetary policy. Further, there does not seem to be a generic or simple answer for guiding the design of policy strategies in the face of uncertainty. The theoretical literature suggests that some types of uncertainty should induce the policymaker to 'do less' while other types call for no moderation in policy setting. Because the predominant uncertainties faced by policymakers are likely to change through time, it would

appear that because of its very nature, uncertainty cannot be incorporated into the policymaking process in a mechanical or rigid fashion.

An analogy that can be used to describe this situation is that of driving an unfamiliar motor vehicle with dim headlights on a foggy night. In such a situation the motorist is unsure exactly how the car will respond to adjustments of the steering wheel, accelerator and brakes. They are also unsure of where the next bend in the road is and what direction it will take. In much the same way as the Brainard attenuation result suggests monetary policymakers should "feel their way", it would seem appropriate in these potentially hazardous circumstances for the driver to slow down, remain as close to the centre of the road as possible, and alter their path only gradually. However, in some situations the appropriate response may not be so simple. Persisting with the car analogy, if the driver becomes more familiar with the vehicle it may be optimal to move faster towards the ultimate destination. Alternatively, if the driver is confronted with rapidly changing conditions, or suddenly realises that they are close to the edge of the road, then rapid corrective action might be called for.

In a similar fashion, although a clear policy framework might be used to direct the medium-term orientation of monetary policy, to a great extent tactical policy responses may need to be decided on a case by case basis, bearing in mind the key uncertainties that prevail at the time. This approach is aptly termed 'constrained discretion'. Policymakers are 'constrained' in that monetary policy must be conducted consistent with the overall policy framework (notably, to keep inflation within the target band). However, within the inflation-targeting framework, policymakers have 'discretion' to factor such uncertainties that might prevail at the time into their policy decisions.

To do this successfully, policymakers require a good understanding of the uncertainties that they face, and sound judgement. By way of a working example, in the August 2000 *Monetary Policy Statement*, the Bank put further interest rate rises on hold in response to a sharp deterioration in business confidence, among other things. In effect, the Bank factored uncertainty about the ultimate implications of the fall in confidence into the policy decision and decided to adopt something of a 'wait and see approach'. More

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generally, empirical evidence tentatively suggests that central banks do alter their policy strategies in light of the uncertainties that they face. Research indicates that central banks tend to move interest rates in a series of small steps in the same direction, rather than taking the larger and more volatile changes that economic models suggest would be optimal if there were no uncertainty. Policy attenuation in light of uncertainty is one potential explanation for this observation.<sup>21</sup>

Policymakers also need to understand the potential trade-offs involved in factoring uncertainty into the policymaking process. For example, consider the case in which a relatively easy policy stance is adopted to reduce the probability of a deflation provoked by a recession caused by a forecast sharp reduction in foreign demand for exports. If this reduction in export demand does not eventuate and policy settings are too loose in hindsight, then any resultant inflation could feed into expectations of future inflation and become persistent. In turn, this would necessitate a more severe policy action in the future. To the extent that monetary policy is about managing uncertainty, it clearly is a balancing act.

These types of policy subtleties are not captured by economic models, but are instead part of the 'art' of monetary policy. In this context, an important part of this 'art' is discerning the nature of the current uncertainties and altering policy accordingly. The science of monetary policy, in the form of rigid, judgement-less policy rules, can only take the policymaker so far.

## 4 Some broader implications of uncertainty for monetary policy

Given the potentially important implications of uncertainty for monetary policy, considerable benefit can be expected to accrue from removing as much uncertainty as possible from the policymaking process. Reducing the uncertainty

that policymakers must contend with can occur in a number of different ways. Most obviously, we can try to enhance our knowledge of how the economy works, understand exactly where the economy is when policymaking decisions are made, and formulate the best possible forecasts of what the future might hold.

As well as these relatively obvious antidotes, a high degree of transparency in the policy making process may also help mitigate uncertainty. If it is clear what the central bank's objective is and how it plans to achieve that objective, then market participants will be more likely to react to incoming data in a way that is consistent with the objectives of monetary policy. As a result, lags in the policy process might be shortened by anticipatory actions on the part of private sector agents. This is an important reason why the Reserve Bank publishes economic forecasts. In addition, the Bank has also published the macroeconomic model (FPS) that sits at the heart of the forecasting process, and publishes other research that has a bearing on policy decisions.

The awkwardness of publishing detailed economic projections in an uncertain world is that some facet of the forecast will invariably turn out to be markedly different from economic reality, especially during turning points in the economic cycle or in the wake of significant shocks to the economy. Hence, the Bank treads a fine line between providing useful information that can help condition expectations, and generating false benchmarks for assessing the Bank's capability. In essence, it was a subtle reassessment of this balance that prompted the Bank to move away from publishing forecasts in terms of quarterly growth rates in favour of growth rates at six monthly and annual frequencies.<sup>22</sup>

In any event, uncertainty can never be completely resolved and will continue to be an important aspect of the policy-making process. An important implication of the literature on monetary policy under uncertainty is that policymakers should continually assess the implications of key uncertainties as they arise. At the Reserve Bank, 'alternative scenarios' in

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<sup>21</sup> Alternatively, central banks may have an interest rate-smoothing objective. This might stem from a desire to provide clear guidance to financial markets so as to enhance the degree by which movements in the short-term interest rate – which the central bank can influence – feed through into longer-term interest rates, which influence economic behaviour (Woodford, 1999).

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<sup>22</sup> Prior to March 1999, the Bank published short-term forecasts for a range of economic variables as quarterly growth rates. Currently, forecasts for most variables are published as six-monthly or annual growth rates. Only GDP and CPI forecasts are still published as quarterly growth rates.

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which some aspect of the central forecast is changed to reflect the uncertainties that predominate at the time, are regularly prepared as part of a projection round. For example, FPS might be used to prepare an alternative forecast in which household consumption is stronger than anticipated in the central projection, or in which the equilibrium exchange rate turns out to be lower than expected. By asking these types of “what if” questions, the Monetary Policy Committee (MPC) develops an appreciation for the range of possible outcomes that might arise if economic reality turns out to be different from the assumptions on which the central forecast is based.

From time to time alternative forecasts for key macroeconomic variables, such as monetary conditions and inflation, are published in the *Monetary Policy Statement*. For example, during the Asian crisis the Bank published alternative scenarios in which the world economy grew at a slower rate than was assumed in the central projection. By publishing aspects of alternative scenarios, the Bank communicates some of the uncertainties that policymakers face – in this example, uncertainty about the size of the Asian shock. In addition, the predominant risks that surround the central projection are discussed extensively in every *Monetary Policy Statement*. Both of these practices reinforce the important point that the central forecast is only one of a large number of potential outcomes for the economy, albeit the outcome that the Bank considers to be the most likely.

Other central banks also use a variety of different techniques to communicate the extent of the uncertainties that they face. For example, the Bank of England publishes confidence intervals about their inflation and GDP forecasts. These confidence intervals indicate the values that these variables can be expected to take 95 percent of the time.<sup>23</sup> By eschewing point forecasts, the Bank of England communicates the degree of uncertainty that is intrinsic in the policy-making process. In addition, the Bank of England also publishes the minutes from meetings of the MPC, which indicate the diversity of opinions among committee members.

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<sup>23</sup> Ninety five percent confidence intervals around RBNZ projections are illustrated and discussed in Drew and Frith (1998).

## 5 Concluding remarks

One of the most important messages to be reinforced by the recent literature on monetary policy under uncertainty is ‘ignore uncertainty at your peril’. It is now increasingly understood that different types of uncertainty have different implications for the conduct of monetary policy. Because of its diverse nature, there does not appear to be a generic or simple guide that policymakers can use to account for uncertainty. Instead, within the context of the inflation-targeting framework, good understanding and sound judgement are required to factor current uncertainties into the policymaking process.

In any case, given the uncertainties that the Reserve Bank must contend with, it is unlikely that inflation will always stay within the zero to three percent target band. Recent work at the Reserve Bank suggests that as a result of uncertainty about future events, there is a possibility that consumer price inflation may fall outside the target band for approximately one in every five years.<sup>24</sup> However, with frequent policy resets and ongoing research aimed at understanding the complexities of the economic environment, New Zealanders will continue to enjoy low and stable inflation.

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<sup>24</sup> This work is reported in Drew and Orr (1999).

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