Volume 69 No. 1, March 2006
Contents

This document is also available at www.rbnz.govt.nz

ISSN 1174-7943

Editor's Note

Maintaining financial system stability is a key responsibility of modern central banks and is an issue that has received considerable attention from policymakers and academics in recent years. Many countries have experienced episodes of financial instability in one form or another, and the damaging effects of that instability – and the need to avoid it in future – are well recognised. But what constitutes financial stability and how do we measure whether or not a financial system is essentially stable?

In the first article of this issue, Leni Hunter, Adrian Orr and Bruce White of the Bank's Financial Stability Department set out a conceptual framework describing the preconditions for financial stability. Needless to say, the article is not intended to be the last word on the subject, but should be seen as an important step in setting out the guiding principles behind the Bank's financial stability role. The Bank regularly reports on its assessment of the financial system in its twice yearly *Financial Stability Report* and we will continue to publish *Bulletin* articles on topics related to financial stability in the future.

The second article, written by me, considers how the inflation process in New Zealand has changed over the past two decades or so. The article is a revised version of a paper originally written for a Bank of International Settlements seminar. It identifies a range of factors, including the move to inflation targeting, low global inflation and structural changes in the domestic economy, that appear to have contributed to a more muted inflation process than was once the case.

The third article by Cath Sleeman of the Economics Department introduces a database that has been established to capture real time revisions to New Zealand's GDP statistics. The magnitude of these revisions determines the reliability of initial estimates of GDP, which in turn has implications for policymaking. It is hoped that the database will prove a useful resource for researchers interested in forecasting and policy issues. The database can be accessed free of charge at www.rbnz.govt.nz.

Finally, this issue includes an economic and financial chronology for 2005, which was prepared by Alex Deans, a summer student in the Economics Department. A full chronology running back to the early 1990s can be accessed on the Bank's website.

Bernard Hodgetts
Editor
Reserve Bank of New Zealand *Bulletin*
PO Box 2498
Wellington 6001
Telephone 64 4 471 3781
Facsimile 64 4 473 1209

Email hodgettsb@rbnz.govt.nz

ARTICLES

Towards a framework for promoting financial stability in New Zealand

Leni Hunter, Adrian Orr, and Bruce White

Central banks, like the Reserve Bank of New Zealand, make judgements and take actions to promote the stability of the financial system. This involves making decisions in inherently uncertain situations. For example, how is financial stability defined? How can we recognise an imminent financial crisis? And, how is a financial crisis best mitigated or recovered from?

This article presents a step towards a broad conceptual framework for promoting financial system stability and guiding the Bank's policy actions. We argue that the preconditions for financial stability are met when all financial system risks are being adequately identified, allocated, priced and managed. The financial system is made up of markets, institutions, and payments and settlement systems. Financial system risks broadly include credit, liquidity, market and operational risks.

All of the preconditions are important to best ensuring that the financial system is resilient to a wide range of economic and financial shocks, and able to absorb financial crisis losses with least disruption. The preconditions for financial stability also best ensure that the financial system is efficient in its delivery of financial services, and allocating resources throughout the economy.

In making assessments of financial stability, the Reserve Bank does not have a single, well-defined quantitative measure. Instead we draw on a variety of information, practices, and ongoing research. The Bank conducts regular surveillance of financial risks and reports on its assessments in the twice-yearly *Financial Stability Report*.

1 Introduction

The last two decades have been recognised internationally as amongst the most financially unstable in modern history.[1] Many regions during this period have experienced periods of financial instability. For example, New Zealand, Australia, and Scandinavia in the late 1980s and early 1990s; Japan throughout much of the 1990s; East Asia in 1997/98, and the United States, first in the early 1990s (the Savings and Loan crisis) and again early this decade (the 'tech wreck'). These experiences have resulted in financial stability issues coming to the fore of central banks' attention.

Many central banks, including the Reserve Bank of New Zealand, now publish regular financial stability reports alongside their regular monetary policy and inflation reports. However, the framework for undertaking this surveillance and for linking financial system surveillance to its policy powers and purposes is less developed than for central banks' monetary policy function. Unlike inflation targeting, financial stability is not an easily quantified concept, and is also not clearly separable from other factors such as political stability, international financial stability, and wider economic and social stability.

This article presents the beginnings of a framework for the promotion of financial stability. It is intended to aid assessment of the activities that the Bank undertakes, as well as assessment of the sufficiency of its legal and operational capacity, with regard to promoting financial stability.

2 Financial stability in the central banking context

The roles of central banks in maintaining monetary and financial system stability have evolved in different ways across countries. However, for many central banks, these roles emerged from similar origins: supplying notes and coins (monetary liabilities) to the public and being 'banker to the banks'. These origins have led central banks towards being an obvious potential 'lender of last resort', interested

[1] See Aliber (2005).

in bank and payments system prudential regulation, and maintaining various financial crisis management capacities.

In New Zealand today, the Reserve Bank of New Zealand Act (1989) sets two broad functions for the Reserve Bank. These are to:

- formulate and implement monetary policy to maintain price stability; and
- promote the soundness and efficiency of the financial system.[2]

Monetary policy concerns the policy followed by the Bank in issuing its monetary liabilities. The Bank currently implements its monetary policy by setting the interest rate at which it stands ready to transact in its liabilities overnight. In this way, the Reserve Bank sets the risk-free rate of interest for the economy and ensures that the purchasing power of its liabilities is broadly maintained over time (ie, that consumer price inflation is stable).

By contrast, the promotion of a sound and efficient financial system covers a range of activities. For example, in order to inject liquidity into the banking system and allow inter-bank transactions to occur, the Reserve Bank provides settlement accounts to domestic banks. The Bank is also the natural 'lender of last resort', which involves it potentially providing cash to a solvent bank that cannot obtain liquidity elsewhere.

In these roles, as 'banker to the banks' and 'lender of last resort', the Reserve Bank has an interest in ensuring that the risks are prudently managed in banks, and that financial crisis management capabilities exist. The Bank thus sets prudential regulatory policy as well as maintaining financial crisis management capacities. The Bank also has a natural interest in ensuring that all payments systems are operationally, financially, and legally robust, and is currently developing its oversight role in this area, as well as being the owner/operator of some critical payments system infrastructure itself. The Bank also holds a portfolio of liquid foreign exchange reserves for the purpose of both intervening in the foreign exchange market to influence the exchange rate for monetary policy purposes, and to provide foreign exchange liquidity necessary to support the functioning of the foreign exchange market in a financial crisis.

Hence, while implementing monetary policy to maintain price stability and promoting financial system soundness and efficiency are two different functions, they have similar origins. Taken together, they can encompass maintaining the stability of the monetary unit of account (the monetary policy function) and of the institutions, markets and systems through which economic exchange in a monetary economy occurs (the financial stability function).

3 The foundations for financial stability

The financial system enables the vast majority of economic exchange and plays a pivotal role in the efficient allocation of resources. It does this by providing the processes that mitigate the need for the simultaneous bilateral exchange of physical goods or services. Without a financial system, the scope for economic exchange would be confined to barter.

The financial system comprises three interconnected components:

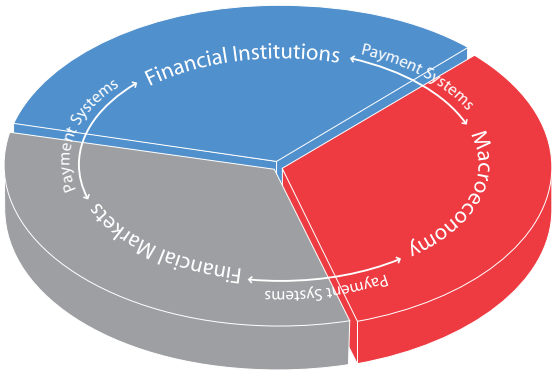
- *financial markets*, in which financial contracts are entered into or traded directly between buyers and sellers (or borrowers and lenders);
- *financial institutions*, which intermediate between borrowers and lenders (including the central bank); and provide financial services; and,
- *payments systems*, which allow financial transactions within markets and with institutions to be made.

The efficiency of the financial system relates to both its role in allocating risk and resources throughout the economy, as well as the economic costs of doing so. Achieving efficiency in allocating resources is mostly about ensuring that the conditions required for optimal economic exchange are satisfied, such as full information and clear property rights.

[2] The Bank is required to prudentially supervise registered banks and to oversee the payments system, in order to promote the soundness and efficiency of the financial system. The Reserve Bank Act additionally specifies that the Bank should use its prudential intervention powers to avoid significant damage to the financial system should a registered bank fail.

Figure 1

The financial system



The efficiency of the financial system itself is mostly about satisfying the conditions required for competition amongst competitive firms eg, low barriers to entry and an absence of monopoly powers.

At the core of the process of exchange through the financial system is a market pricing mechanism. A current market price signals the market's valuation to prospective buyers and sellers, who compare that price to their own valuations. If a price is too low, then more people will want to buy than sell. As buyers outweigh sellers, the price rises and the imbalance is reduced until the market 'clears' and exchange takes place. At this point the resource is valued equally by both buyers and sellers. It is those buyers who value the resource the most who bid the highest price and remain in the market. Hence, markets set prices so as to efficiently allocate resources to those for whom they have the most value, at least as measured by ability to pay.

This basic explanation applies to trade in all sorts of goods and services. For assets there is an additional element to the pricing mechanism, where time is involved. Assets are bought and sold on the basis of a benefit that is expected to be realised over a future period of time. However, because the future is always uncertain, there is always some uncertainty around whether the future benefit will be delivered and match up to today's expectations. It is this uncertainty that creates financial risk.

Asset markets implicitly price this financial risk. The price of risk is the additional yield (or premium) an investor would expect to receive for holding a risky asset over and above the 'risk-free' interest rate. Hence, in a market, investors who can best manage the risk associated with an asset will be prepared to receive a lower risk premium in compensation for the risk exposure (or conversely pay a higher asset price). Efficient pricing of risk therefore will tend to result in risk being allocated to those who best understand the nature of the risk, and are most willing and well-positioned to manage it.

However, the sound and efficient functioning of the financial system is conditional on assumptions about the economic environment which do not always hold. These assumptions include the existence of markets that can allocate all forms of financial risk, clear ownership rights of both financial risk and reward, and investors having adequate information with which they make their financial decisions. If these assumptions do not hold, then the financial system can become unstable and necessitate various forms of market intervention.[3]

Financial system risks

In general terms, a financial system is sound when it has the resilience to continue to efficiently provide financial services in a plausible range of adverse circumstances. However, if any one component of the financial system is impaired, then it can become unstable and will not operate to allocate resources efficiently. The financial system could be considered impaired when, for example, a material number of users incur significant losses from exposures to financial system risk that they could not have been expected to be aware of or manage. That is, all financial risks were not adequately identified, allocated, priced and/or managed.

The main types of financial system risk can be summarised as:

Credit risk – The risk that contracts represented as payable as a fixed sum of money in the future will not be paid in full on maturity.

Market risk – The potential for the market value of an asset to fluctuate because of, for example, changed credit risk

[3] From Draghi, Giavazzi, and Merton (2006): "To understand the breeding conditions for financial crises the prime source of concern is not risk per se, but the unintended, or unanticipated accumulation of risks..."

Box 1

Microfoundations for financial stability

The preconditions for financial stability are such that all relevant financial system risks are adequately identified, priced, allocated and managed. These preconditions are consistent with the 'first order' intertemporal optimising conditions of early models of consumption under uncertainty, once these have been restated for assets rather than consumption goods. This follows in part the example of Haldane (2004).

If someone consumes a little less today in order to save and invest, then they reduce the benefit or 'utility' that they would have had today. According to the Keynes-Ramsey rule (Ramsey, 1928), if they use their resource optimally then the utility lost from the marginal reduction in today's consumption is counterbalanced by the discounted utility gained from their ability to use the investment returns to buy and consume goods at a later date.

The work by Samuelson (1969) and Merton (1969) effectively extended the Keynes-Ramsey rule and introduced future investment uncertainty. The extended rule describes how investors will choose to consume over time when they are maximising their utility, given expected asset returns.

However, we can also use the rule to think about what asset returns should be, depending on how people consume over time (see Blanchard and Fisher, (1989)). In this way the rule tells us whether an asset price is too high or low. An asset price is said to be too low if its implied pay-off is so high that the added future utility that we obtain from having invested in the asset is greater than the utility we have had to forgo today in order to purchase the asset. Intuitively then, it would follow that if the price is too low, the investor should reduce today's consumption, and increase savings in order to buy more of the asset. As the investor demands more of the asset the price moves towards its equilibrium.

The restatement of the consumption rule to an asset pricing relation is done in the consumption capital asset pricing model (Breedon, 1979; Merton, 1973; Rubenstein 1976). In the consumption CAPM (capital asset pricing model) the price of an asset depends on the asset's risk; if an asset is risky, then people will only hold it if they are paid a risk premium in compensation.

The risk premium is determined by how the asset's return co-varies with the marginal utility of consumption. Assets that help to smooth consumption over time are relatively more valuable and command a higher price. An example of such an asset is insurance: it is generally designed to have a high pay-off at exactly the time when an event occurs which lowers income and hence consumption. On the other hand, suppose we have an asset that is likely to have a high pay-off when consumption is already high, but which might have a low or negative pay-off when consumption is low. This asset may well add to consumption volatility, and hence it is considered risky and less valuable.

Under certain conditions the asset price relation from the consumption CAPM model can in turn be recast in terms of the standard CAPM equation (Sharp, 1964; Lintner, 1965).[4] Standard CAPM brings portfolio theory into focus, as the risk premium now depends on how the individual asset return co-varies with the total market return.[5]

The underlying objective in these models is to maximise the 'utility' of a representative individual. The conditions under which this is done amount to statements of optimal resource allocation: they are efficiency conditions.

However, the further we are from the optimal path, the more incorrectly priced are assets and risk. This incorrect/inadequate asset pricing may be due to the lack of adequate identification, allocation and management of financial risks; and may present potential threats to financial stability. Hence, in addition to its interpretation as an efficiency condition, we view the first order condition for asset prices as providing a precondition for financial stability.

[4] The condition is the existence of an asset (or composite asset) that is perfectly negatively correlated with the marginal utility of tomorrow's (ie, the next period's) consumption.

[5] We note that there is ongoing debate about the empirical validity of the CAPM.

It should be noted that the first order conditions discussed in this box are not solutions of the dynamic path for asset prices; in the event of a perturbation to the financial system they cannot tell us exactly how the economy will correct. Whether instances of inadequate pricing are actual threats to financial stability requires further assessment of the materiality of the risks involved (see section 5 and figure 2). However, if financial risks are adequately identified, allocated, priced and managed then the financial system should be capable of dissipating imbalances.[6]

assessment, changed assessments of the future income flow from the asset, or a change in the rate of exchange between currencies.

Liquidity risk – A loss that might be incurred as the result of a forced sale.

Operational risk – Economic loss caused by a process breakdown eg, computer failure, human error, and fraud.

We consider that the preconditions for financial stability are met when all financial system risks are adequately identified, allocated, priced and managed.

These financial system risks relate to all components of the financial system, which include markets, institutions, and payments systems. The financial system risks include credit, market, liquidity and operational risks.

All four of the preconditions may not be strictly necessary or relevant in every instance. In some cases the preconditions could be adequately met through non-price approaches to risk management. Or one might argue that in a perfect market with full information, adequately 'priced' risk would also imply adequately identified, allocated and managed risk (in which case adequate pricing alone would be the only relevant precondition).

However, for generality, and because the market fails for various reasons, we see an adequate combination of identification, pricing, allocation and management of financial system risk as necessary for financial stability. Each precondition is important to best ensuring that the financial system is resilient to a wide range of economic and financial shocks, and able to absorb financial crisis losses with least disruption.

Of course, even if the preconditions for financial stability are in place, volatility and sharp adjustments in financial prices (and/or quantities) can still occur. These adjustments are often an important part of the adjustment process in a sound and stable system. For example, short-term volatility is often caused by the 'price discovery' or 'quantity adjustment' process that occurs as economic circumstances change. Such volatility is, however, less likely to lead to financial instability or necessitate some form of crisis intervention if the preconditions for financial stability are in place.

Furthermore, financial crises can and will still occur. Financial crises are caused by a combination of unlikely events where the correlations were not obvious ex ante. Hence financial crisis management capabilities must still be in place, including capital buffers and pre-positioned loss allocation, insurance and/or resolution mechanisms. This is why we include all components of identify, price, allocate, and manage in our preconditions.

The microeconomic foundations for our preconditions to financial stability are outlined in Box 1

4 Market failure and financial instability

Financial instability can be triggered by a variety of causes and shocks. These causes generally arise from combinations of structural and behavioural factors. Structural market failures are attributable to factors such as information asymmetries, negative externalities, and moral hazard. Behavioural market failures refer to issues such as herd behaviour in investment decisions, and investment fads and fashions, or myopia in decision making around various components of the financial system. There is substantial overlap between these structural/behavioural categories; for example, a structural problem such as information asymmetry will likely contribute to herd behaviour, by causing agents to rely more on observations of each other's trades for information regarding the appropriate market price.

[6] Using words borrowed from Schinasi (2004).

Structural failure

An important determinant of structural failures in the financial system is information asymmetry. Sellers (or borrowers) typically know more about the risks embodied in the exchange than do buyers (lenders). Faced with such an asymmetry, buyers will be cautious, and will tend to overestimate (price) risk. If risk is over-priced, this may drive out the less-risky activities, causing buyers (lenders) to become more cautious still. Such a process can result in less exchange than would otherwise be the case if the two sides to the exchange were more equally informed.

Hence, an important purpose of financial regulation is to address this information gap. The regulation may include insisting on a greater level of disclosure, or impose certain standards on sellers (borrowers). Financial regulation, like many other forms of regulation, thus generally entails a combination of disclosure requirements and standard setting.

The existence of externalities and 'free-rider' opportunities in some instances also means that risks may not be owned by the owner of the asset, and hence not priced or managed adequately. A result can be under investment in some risk management tasks, such as ensuring the ongoing operational capacity of critical payment systems.

Structural factors can mean that identifying, pricing, allocating, and managing financial risks can be very difficult at times, if not impossible, thus necessitating various forms of prudential regulation, financial crisis management capabilities, and/or the public provision of certain financial services. For example, it is difficult to be able to identify all threats to financial stability ex ante. Hence, some forms of risk are best managed by ensuring adequate capital buffers are in place to absorb losses without disruption to the system. The Basel II process of allocating capital buffers to various forms of financial risks in banks is an example of such an intervention.

Some forms of risk are also not adequately *priced* due to the lack of a market for the price discovery process to occur. Likewise, both free-rider and externality aspects of certain payment system networks may mean that risks are not allocated accordingly and may be mismanaged. This may necessitate the public provision of certain services (eg, utility networks) or prepositioned loss allocation mechanisms in the case of a bank failure.

Behavioural factors

The financial system can also be exposed to destabilising behaviours. These influences can be exacerbated by some of the structural weaknesses discussed already, especially for example, the phenomenon of contagious bank runs.[7]

Recent developments in the field of behavioural finance have extended our understanding of the potential sources of financial instability. Concepts such as myopic decision making, cognitive dissonance (repression of contradictory evidence), and fallacy of composition, some of which come from psychology, are receiving wider recognition in relation to the study of financial stability. It is becoming increasingly recognised that individually 'rational' people all making the same choices can lead to herd behaviour and momentum that can drive a market price far away from that consistent with underlying returns and risks. Kindleberger (1996) describes how 'euphoria' can turn into mania, as speculation "leads from normal rational behaviour to what has been described as 'mania' or a 'bubble'". In short, people can become overly optimistic about returns, and insufficiently focussed on their risks.

History gives us many examples of 'mania', bank runs, asset bubbles and other financial crises, from as early as the Dutch tulip bulb bubble in 1636 to the present day. Aliber (2005) has described the most recent 35 years as the "most tumultuous in international monetary history." He describes the effect of financial deregulation in enabling Japanese banks to rapidly increase their real estate loans – resulting in both property price increases, and real estate company valuation increases, boosting the Tokyo stock exchange. At the same time, Aliber notes that when Nordic controls on foreign borrowing were lifted, there was an inflow of foreign

[7] Contagious runs on (solvent) banks are attributed to depositors with little information on their own bank exercising their ability to withdraw on-demand funds when they see others doing so. Because the bank deposit contract provides for repayment in full on a "first come, first served" basis, depositors face no penalty if they are wrong, but stand to avoid loss if their bank actually does have a problem.

).

(notably Japanese) funds which led to real estate and stock price bubbles in Finland, Sweden and Norway. The Mexican crisis of the 1990s had its roots in over-optimism regarding the success of macroeconomic reform. Excessive lending driven by high expectations of growth helped to create both the Asian crisis and the US stock market bubble in the latter years of the 1990s and early this decade.

New Zealand had a similar experience in the second half of the 1980s, when economic reform and financial liberalisation resulted in a surge in credit expansion and correspondingly leveraged bubbles in commercial real estate and listed equity prices. When it became apparent that the market's assessment of risk had become substantially misaligned from the returns, a reassessment triggered by the sharemarket correction in the US in October 1987 caused the bubble to burst and widespread defaults occurred. This correction of previous misalignments caused material damage to the financial system, including the failure and hence closure of a number of financial institutions and a significant fall in equity market participation for several years following.

A common element in these financial crises has been the rapid expansion in the supply of bank credit which, at least with the benefit of hindsight, was priced too cheaply (ie, the risks were underpriced). Enthusiasm draws in a wider and wider class of investors and the financial intermediaries who provide them with credit.[8] Borio (2005) emphasises credit supply by highlighting the role of 'financial imbalances' in causing crises. That is, lenders over-extend themselves by financing highly leveraged assets that turn out to be incapable of generating the cash flows required to service the debt.

When credit is more readily available than usual, or when it is relatively inexpensive, financial systems can become prone to credit defaults and ensuing instability. For example, the Latin American debt crisis that broke out in the early 1980s had its origins in large scale bank lending to sovereigns in the 1970s that became unsustainable when US interest rates rose sharply at the end of the decade. By contrast, the equity bubble in the US in the late 1990s, which was relatively less leveraged with bank debt, was associated with less financial instability.

However, credit growth measures and asset market valuations alone are not *necessarily* good financial stability indicators. Rather, it is assessing why the indicators have moved that matters most, and hence the need for a framework to assess these developments.

Making assessments of the sustainability of credit expansions and large asset price movements is, of course, difficult. The extent to which central banks should attempt such assessments is also an area of considerable debate. Much of the debate concerns rather polar positions, that is, whether or not central banks should 'target' asset prices. The financial stability assessment framework proposed in this article does not approach this question as an 'either-or' issue, but instead aims to assist an assessment-based approach by providing a framework of questions (see section 5).

Regulatory response

Crafting the regulatory infrastructure to support the process of economic exchange is not straightforward. Regulation that excessively constrains sellers, whether directly or through imposition of compliance costs, can cause them to withdraw from the market and lead to economic inefficiencies. Significant 'moral hazard' problems can also arise, where over-regulation can remove the actual financial risk from the owner of the asset, institution, market, or payments system. The public provision of certain financial services may also crowd out competition and innovation. These factors can imply that the financial risk will then not be adequately identified, priced, and/or managed.

It is also very important to recognise that markets can and do generate their own solutions to what otherwise would be information asymmetry market failures. Financial intermediaries themselves are a market response to this underlying economic problem. The role of a bank is to monitor and manage the risks embedded in risky loans that depositors would be unable to monitor themselves. Banks in effect facilitate the economic exchange between depositors and borrowers by playing a role that balances up the information asymmetry.

[8] See Kindleberger's (1996) discussion of Hyman Minsky's model.

However, there is always the question: who monitors the monitors? In the financial system, a number of mechanisms perform this role: shareholders, and those appointed by them (boards of directors and auditors), creditors, rating agencies, and regulators.

Experience suggests that market-based solutions – sometimes with regulatory prompting and encouragement – can often result in a better performing financial system than over-relying on regulatory interventions. The Reserve Bank attempts to find a balance between self and market discipline operating in the banking system, and regulatory discipline as an additional pillar. The general principles we aspire to in all that we do with our prudential regulation role thus include:

- Keeping efficiency issues at the centre of our attention;
- utilising the synergies amongst our monetary policy, macro prudential, supervision and market operation roles;
- maintaining a system overview as well as knowing individual institutions well;
- seeking to utilise market forces as far as possible rather than oppose them;
- recognising that we have many common interests with supervised institutions;
- using incentive-based techniques as much as possible; and
- making sure that we maintain high analytical standards in our regulatory design.

In summary, we approach financial system regulation from the standpoint of its role in enabling economic activity - by supporting the processes by which people and firms can engage in welfare improving specialisation and trade.

5 Financial stability assessment and the role of the Reserve Bank

Assessment

We define the preconditions for financial stability as being that all financial risks are being adequately identified, allocated, priced and managed. If these preconditions are in place, then that should also imply that a plausible range of financial losses can be absorbed without financial system disruption.

This financial stability definition is around preconditions rather than outcomes, hence it is not like the definition of price stability in the Reserve Bank's Policy Targets Agreement. Our definition of financial stability is also an ex ante (rather than ex post) definition. Its value thus lies in prompting questions for policymakers and financial system users in relation to whether an apparent imbalance or misalignment may be a source of financial instability.

The financial market monitoring and research that the Reserve Bank and other market participants undertake helps form views on the likelihood that financial risks are not being adequately identified, priced, allocated, or managed. Such judgements are formed on the basis of indicator models, stress testing, past experiences, banking surveillance, and other forms of analysis. These judgements are augmented by the regular contact the Bank has with market participants and financial institutions, managing foreign exchange reserves, implementing liquidity management, and operating elements of the payment and settlement system.

At the macroeconomic level, imbalances such as inflation pressures and large surpluses or deficits on the current account of the balance of payments, can make the financial system more susceptible to shocks that test the resilience of the financial system. To assess how risky these imbalances are requires a good understanding of the causes of the imbalance, and of the underlying financial drivers. Again, understanding the 'why' matters more than knowing the 'what'. This assessment combines judgement, research, forecasting and economic models.

Table 1

Framework overview

Financial System	Risks	Identify	Allocate	Price and/or manage	Powers and purposes	Actions
Financial stability exists when risks are adequately identified, allocated, priced and managed.						
Markets Institutions Payment systems	Liquidity Credit Operational Market	Identify market failure/source of financial risk	Ensure risks are allocated to those who are willing, aware, and best able to manage them	Form view of how well risk is priced; and/or how well risks are being managed.	RB Act (1989) RB capital and balance sheet	Prevention Correction Crisis management

Objectives and powers

The Reserve Bank has a number of roles that relate to maintaining financial stability. The overall role of the Reserve Bank can be viewed in terms of promoting the stability of New Zealand's monetary and financial system – comprising the monetary unit of account, and the markets, institutions, and systems that make monetary exchange possible. These roles include:

- Maintaining low and stable inflation (ie, maintaining the purchasing power of our money liabilities);
- acting as banker to the banks (and the government);
- prudentially supervising registered banks and being prepared to manage a bank failure;
- overseeing the payments and settlement system; and
- maintaining a reserve of foreign currency for financial crisis management.

The Bank's activities thus fall into prevention, correction, and crisis management areas. Most of the Reserve Bank's efforts are aimed at preventing financial crises and promoting financial stability. This broad framework is outlined in table 1; for a more detailed list of the Bank's activities see table 2 at the end of this section.

Prevention

Most of the Reserve Bank's activities are aimed at preventing financial crises and thus promoting financial stability. In the prudential supervision of registered banks an important element is the bank registration process. This is directed to ensuring that banks are, for example, established with appropriate governance arrangements and capability, as well as having adequate capital for the business to be undertaken soundly and plausible losses are able to be absorbed without disruption. The disclosures that registered banks in New Zealand make also have an important preventative role, by bringing to bear the scrutiny of the marketplace on how banks are identifying, allocating, pricing and managing their financial risks.

The Reserve Bank also plays a direct role in the surveillance of the financial system, through its direct supervisory and banking relationships, participation in the financial markets (particularly in foreign exchange and government securities), and wider financial system and macroeconomic surveillance and analysis. Much of this work is reported on in the Bank's *Financial Stability Report* and *Monetary Policy Statement*. The Bank thus contributes generally to the provision of information and analysis to the marketplace.

However, no system of policies and procedures can ensure that the conditions for financial stability are met all of the time. From time to time there will be developments where the Bank will become less confident that risks are being adequately identified, priced, allocated, or managed, and where interventions to lessen the potential for emerging financial instability will be called for.

Correction and crisis management

The Reserve Bank's interventions aimed at *correcting* potential preconditions for financial instability may take a number of forms. Such interventions may range from Governors' speeches that draw attention to the issue, through to the Bank exercising powers (with the consent of

the Minister of Finance) by which it can give directions to a registered bank or banks.

The Bank may also use its own capital or balance sheet to intervene financially, for example, by intervening in the foreign exchange market, or through providing the markets with access to its bank's bond portfolio in order to bolster liquidity.

There is also overlap between the Bank's monetary policy and financial stability roles. For example, asset price bubbles have the potential to overwhelm monetary policy responses and threaten financial stability. The Reserve Bank Governor recently acknowledged that in rare situations an (asset class) price misalignment may be sufficiently obvious that a monetary policy response in excess of that required for the usual price stability objective could be required; in these cases in particular, a longer term view of the risks to price stability would be appropriate, (Bollard, 2004).

The Bank also has a *crisis management* role. Some categories of extreme and very low probability risk are also inherently difficult for the financial system to price and manage – the so-called 'uninsurable' risks. Most insurance policies, for example, excluded compensation for loss arising from the Y2K problem, a once in a millennium event. A current example of the Reserve Bank's contingency planning of a low probability but potentially very damaging event, is its preparation for any potential pandemic.[9]

While 'lender of last resort', foreign exchange intervention, and bank statutory management are the crisis management activities usually associated with a central bank, a recent additional example is the Reserve Bank's outsourcing policy.[10] A primary motivation for that policy is to better ensure that should a (large) bank become insolvent, or should an important provider of outsourced services no longer able to deliver, that bank could continue to be operated. While such an event may be in the low probability category, it would have significant consequences for the financial system as a whole.

[9] See http://www.rbnz.govt.nz/crisismgmt for details on the contingency planning that is being undertaken for this risk.

[10] See http://www.rbnz.govt.nz/finstab/banking/outsourcing/index.html.

Figure 2, opposite, steps through, in a stylised manner, the typical stages and questions involved in the Bank considering a policy intervention aimed at promoting financial stability. Following that two examples of recent issues are briefly discussed.

Example: Outsourcing

As referred to earlier, the Reserve Bank has recently released a policy regarding outsourcing of key functionality by banks. The market failure that prompted regulation is the risk (ie, negative externality) that third parties may be exposed to in a crisis event where a bank cannot maintain its services. Providers of banking services may not bear all of the risks of a failure in their systems and hence underinvest in core infrastructure. Conversely, users of banking services are in a weak position to assess and hence apply market discipline over this risk. This 'market failure' is material to financial stability because of the centrality of core banking functions to the functioning of the economy overall, and the systemic nature of large banks.

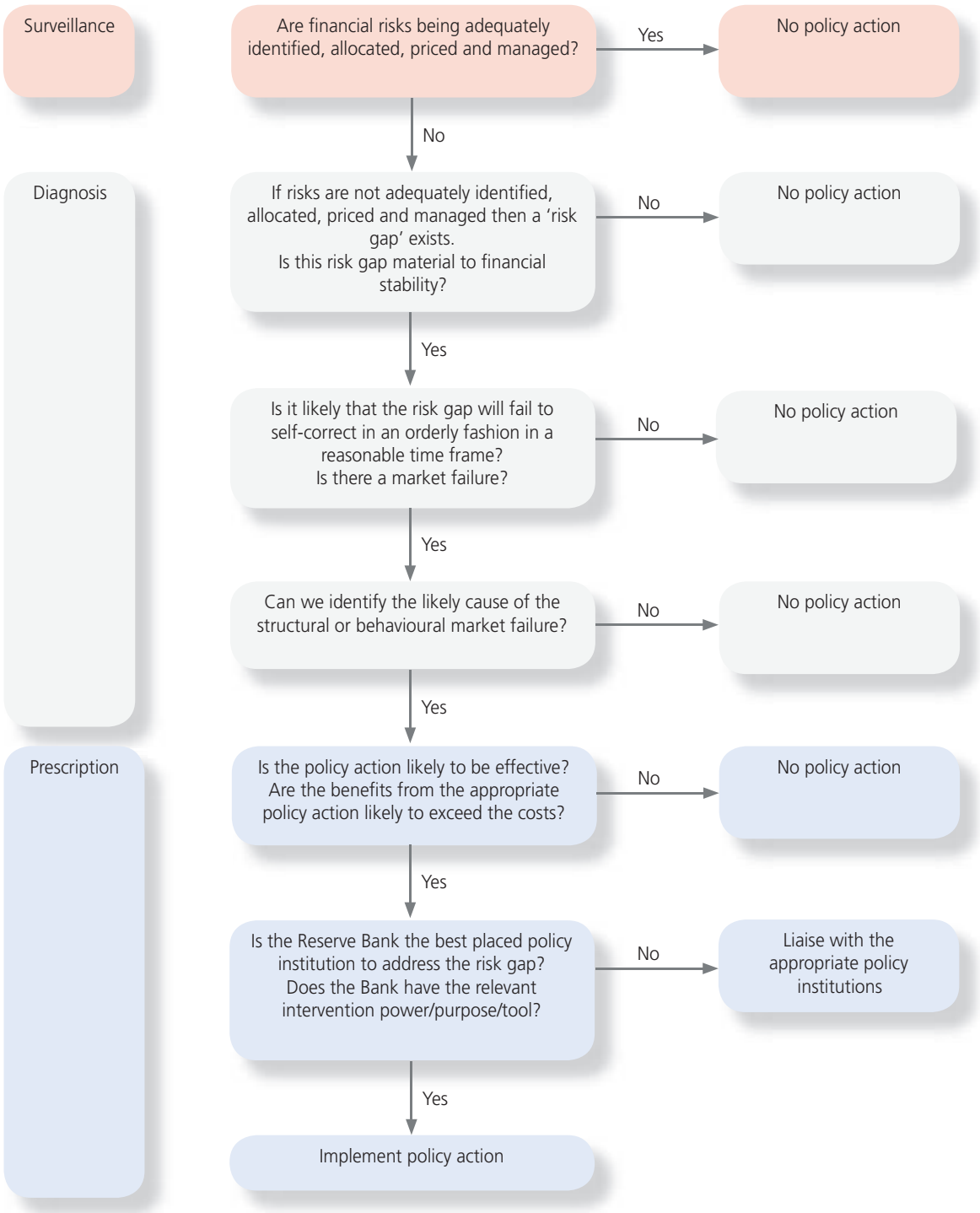
Example: Housing market

Over recent times the Bank has expressed the view that the housing market is inflated. While economic fundamentals have supported higher prices, it is likely that an element of speculative behaviour has been present in the cycle, with prices outstripping their fundamentals. There has also been some inelasticity of housing supply, and structural aspects of the financial system such as tax policy driving behaviour.

Given the high leverage in household balance sheets, a significant reduction in house prices could be material to wider financial stability. However, our current assessment is that the banking system's lending to households, overall, has accounted for these risks within a plausible range. Hence the Bank has not raised specific prudential concerns with banks. However, the Basel II capital requirements will sharpen the focus of banks and banking supervisors on making sure that banks' capital adequacy is sufficiently sensitive to risk, and that banks hold a sufficient capital buffer at all times to absorb unexpected loss.

Figure 2

Stylised overview of the Bank's policy decision process[11]



[11] This flow chart is intended as a broad overview – it is not a precise statement of how policy decisions will necessarily be made.

Table 2

Reserve Bank activities and the Reserve Bank Act

Prevention	Information and monitoring: Financial Stability Report; Monetary Policy Statement (s 15); Provide advice to the Minister of Finance (s 23, s 33); information and disclosure relating to payment systems (Part 5B) Banks: Prudential regulation (bank registration, capital requirements, connected lending limits, disclosure), outsourcing policy) (Part 5) Liquidity: Provide liquidity to the banking sector through the payment system, open market operations, Bond Lending Facility, issue of currency (s 8, s 25, s 39) Payment and settlement systems: provision of critical infrastructure eg NZ operator of ESAS/Austraclear (s 32, s 39); support for the CLS' adoption of NZD, designated payment systems (Part 5C) Holding portfolio of foreign reserves for intervention purposes (s 24)
Correction	Intervening in the foreign exchange market for monetary policy purposes (s 16, s 17, s 18) Primary function is maintaining price stability (s 8) Impose prudential requirements upon banks (Part 5); ability to impose and alter conditions of registration on banks (s 74); powers to give bank directions (s 113)
Crisis management	Acting as lender of last resort (s 31) Statutory management (s 117) powers to give bank directions (s 113) Foreign exchange intervention (s 16, s 17, s 18)

In addition, the Bank takes the housing market into account in setting monetary policy, through wealth effects and the transmission of existing house prices to the prices of goods and services included in the CPI. This has resulted in monetary policy, at the margin, leaning against large asset price cycles such as in housing.

6 Summary

This article provides the beginnings of a conceptual framework for promoting financial stability. The framework aims to contribute to an understanding of the Bank's actions in the financial stability area, and enhance the transparency of these actions as a basis for accountability and governance. The Reserve Bank's performance in promoting financial stability can be assessed by asking whether financial risks are being adequately identified, allocated, priced and managed.

References

Aliber, R. (2005), "The 35 most tumultuous years in monetary history: shocks, the transfer problem, and financial trauma" IMF *Staff Papers*, Vol 52. Special Issue

Blanchard, O; and Fisher. S., (1989), "Lectures on macroeconomics" MIT Press, Cambridge Massachusetts.

Bollard, A., (2004) "Asset prices and monetary policy", Speech to the Canterbury Employers' Chamber of Commerce, 30 January.

Borio, C and White, W (2004) "Whither monetary policy and financial stability? The implications of evolving policy regimes", BIS *Working Papers* No. 147.

Borio, C (2005) "Monetary and financial stability: so close and yet so far?", *National Institute Economic Review* No 192 (April).

Breedon, D., (1979), "An intertemporal asset pricing model with stochastic consumption and investment" *Journal of Financial Economics* 7 (Sept.), 265-296.

Draghi, M, Giavazzi, F and Merton, R, (2003), "Transparency, Risk Management and Internal Financial Fragility" *Geneva Reports on the World Economy* 4, International Centre for Monetary and Banking Studies.

Goodhart, C, (1988), "The Evolution of Central Banks" MIT Press, Cambridge Massachusetts.

Haldane, A, (2004), "Defining monetary and financial stability" Unpublished.

Kindleberger, C., (1996), "Manias, Panics and Crashes: A history of financial crises" John Wiley and Sons, Inc. Third Edition.

Lintner, J, (1965), "The valuation of risky assets and the selection of risky investments in stock portfolios and capital budgets" *Review of Economics and Statistics* 47 (February): 13-37.

Merton, R, (1969), "Lifetime portfolio selection under uncertainty: the continuous time case" *Review of Economics and Statistics* 51, 247-257.

Merton, R, (1973), "An intertemporal capital asset pricing model" *Econometrica* 41 (September): 867-887.

Ramsey, F, (1928), "A mathematical theory of saving" *Economic Journal* 38 No.152 (Dec.), 543-559.

Samuelson, P, (1969), "Lifetime portfolio selection by dynamic stochastic programming" *Review of Economics and Statistics* 51 (Aug.), 239-246.

Schinasi, G., (2004), "Defining financial stability" IMF Working Paper, WP/04/187.

Sharpe, W, (1964), "Capital Asset Prices: A theory of market equilibrium under conditions of risk" *Journal of Finance* 19 (September): 425-442.

Rubenstein, M, (1976), "The valuation of uncertain income streams and the pricing of options" *Bell Journal of Economics* 7 (Autumn): 407-425.

Changes in the inflation process in New Zealand

Bernard Hodgetts

This article is a revised version of a paper prepared for the Bank of International Settlements Central Bank Economists' meeting held in Basel in October 2005. The article describes changes in the inflation process in New Zealand over the past two decades. Over time, inflation seems to have become less responsive to its fundamental determinants, such as excess demand pressures in the economy or variations in the exchange rate than was previously the case. This is partly attributed to the reduction and 'anchoring' of inflation expectations that followed the adoption of an inflation targeting framework. Some of the determinants of inflation have also changed in profound ways. Low global inflation and downward pressure on prices from countries such as China has muted New Zealand's inflation rate in recent years. The article notes that wages no longer appear to be a direct driver of inflation in the manner seen in the 1970s and 1980s. Changes in the competitive environment in New Zealand – especially in areas such as retailing – are also considered to have dampened the economy's 'inflation response', although there has so far been relatively little empirical work in New Zealand on this topic.

1 Introduction

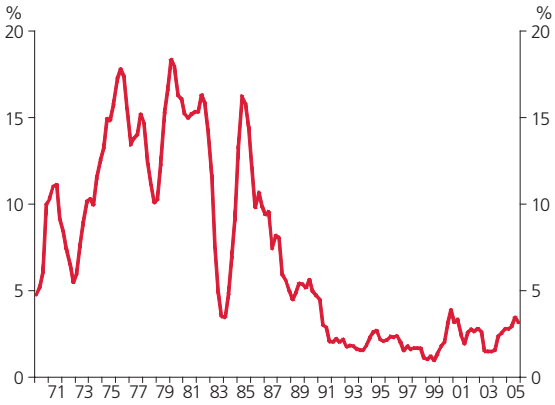
During the 1970s and the first half of the 1980s, New Zealand experienced high and variable inflation. In the second half of the 1980s, monetary policy embarked on a process of disinflation. The passage of the Reserve Bank Act (1989) saw the introduction of a formal inflation targeting regime, and by 1992 the underlying annual rate of CPI inflation was reduced to below 2 per cent. Despite some variability in the inflation rate since that time, and changes to the inflation target, inflation has been maintained at low single digit rates (see figure 1).[1]

When the Reserve Bank first began to target inflation, its understanding of the inflation process was based on a period in which inflation had been high and relatively variable.

Figure 1

Consumer price inflation[2]

(at annual rate)



Inflation has been maintained at low rates over the past 14 years, but it has also become considerably more stable.[3] At one level, this is hardly surprising – monetary policy has after all been actively pursuing low and stable inflation and

[1] Since 1992, there have been some changes to the Policy Targets Agreement (PTA), which is an agreement between the Reserve Bank and the Minister of Finance (required under the Reserve Bank Act (1989)). The PTA sets out the inflation target for monetary policy. Between 1992 and 1996, the Reserve Bank was required under the Policy Targets Agreement (PTA) to keep inflation within a 0 to 2 per cent range. The Bank did so over most of that period, although a build-up in inflation pressures due to a strong economy saw inflation rise briefly above 2 per cent in both 1995 and 1996. In 1996, the PTA was changed to 0 to 3 per cent annual increases in the CPI. Inflation was kept within the 0 to 3 per cent target until 2000, at which time pressures from a depreciating exchange rate and indirect tax changes led to a temporary spike in inflation. From September 2002, a new PTA has required the Reserve Bank to pursue 1 to 3 per cent inflation, "on average over the medium term".

[2] The measure of consumer price inflation shown here excludes mortgage interest rates, which were included in the headline CPI until 1999. It also excludes the effects of the introduction of a 10 per cent Goods and Services Tax (GST) in October 1986 and its subsequent increase to 12$^1/_2$ per cent in July 1989.

[3] In economic parlance, inflation is often said to have become less persistent, meaning that it has less tendency to continue moving up (or down) in response to a shock of some kind. There is a growing body of literature around the measurement of inflation persistence (see, for example, Cecchetti and Debelle (2004)). Note, however, that changes in the shocks that affect inflation may also play a role in muting the inflation process, even if the degree of persistence to a given shock has not changed.

inflation expectations have evolved to reflect this. However, the response of inflation to its immediate determinants also appears to have changed over this period. The sensitivity of inflation to excess demand conditions in the economy, fluctuations in the exchange rate, wages, or prices of key commodities such as oil seems to have reduced (see box 1).

Of course, this is not to suggest that inflation has been dormant in the New Zealand economy and unaffected by the various factors that we would expect to influence it. Over the past few years, monetary policy has had to respond to a significant increase in inflation pressures associated with very strong demand in the economy. However, at the margin, the economy's 'inflation response' appears to have been more muted than in the past.

Policymakers in many countries across the globe have also been favourably surprised at the subdued nature of the inflation process over the past decade (see, for example, Bean (2005)). Much effort is being directed towards understanding how the inflation process might have changed. Is it simply a consequence of successful inflation targeting acting to stabilise inflation expectations among households and firms, thereby making inflation less sensitive to shocks of various kinds? Are structural changes in economies contributing to this moderation? What role has productivity played? Are increased competitive forces playing a role? Are policies other than monetary policy playing a part? Is the availability of low-cost manufactured imports from countries such as China acting to mute the inflation process across the globe?

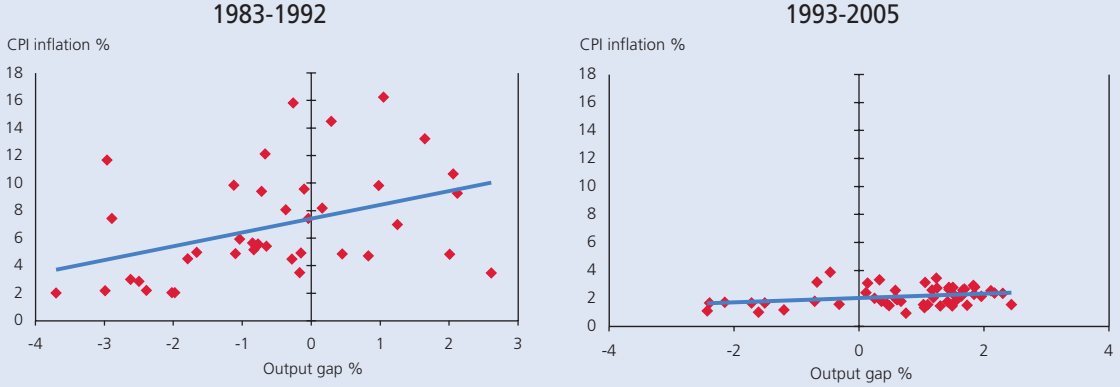
Box 1

The changing sensitivity of inflation to the economic cycle

A sense that inflation has become more muted to excess demand conditions in the economy over the past decade or so can be seen in figure 2. The two scatter plots relate annual CPI inflation to a measure of excess demand or supply in the economy (known as the output gap). The first plot is for the period preceding the achievement of low inflation and covers the years 1983 to 1992. The second plot covers the period since the achievement of low inflation.[5] A line of best fit is shown on each chart. This line, or 'Phillips Curve', has not only shifted down in the past 13 years (which would be expected given the reduction in inflation), it has also become more shallowly sloped. In other words, not only has inflation declined, it appears to have become less variable over the course of the economic cycle.

Figure 2

New Zealand's inflation-output relationship[4]



[4] The measure of CPI inflation shown here excludes mortgage interest rates and GST.

[5] Despite signs that the New Zealand economy's inflation response has become more muted, note that in recent years the Reserve Bank has tended to under-forecast inflation (see Ranchhod and McCaw, 2002). However, the main reasons for under-predicting inflation appear to be a misreading of the exchange rate cycle and strength of demand pressures, rather than an overly-optimistic reading of the inflation process.

These are among the questions that have been receiving attention.

The purpose of this article is to summarise some of the important ways in which the inflation process appears to have changed in New Zealand over the past 15 years. Some of these areas have been subject to empirical examination, whereas others remain the subject of conjecture and ongoing research within the Reserve Bank.

The five key areas examined in this article include:

- The changing behaviour of inflation expectations;
- the more muted response of prices to exchange rate fluctuations;
- globalisation, low trading partner inflation and greater flexibility in trade patterns, which have led to reductions in imported inflation;
- the apparent breakdown of the traditional wage and cost-dynamic in the inflation process; and
- heightened competition in the economy generally and in retailing in particular, which appears to have played a more persistent role in containing price increases than we might have expected.

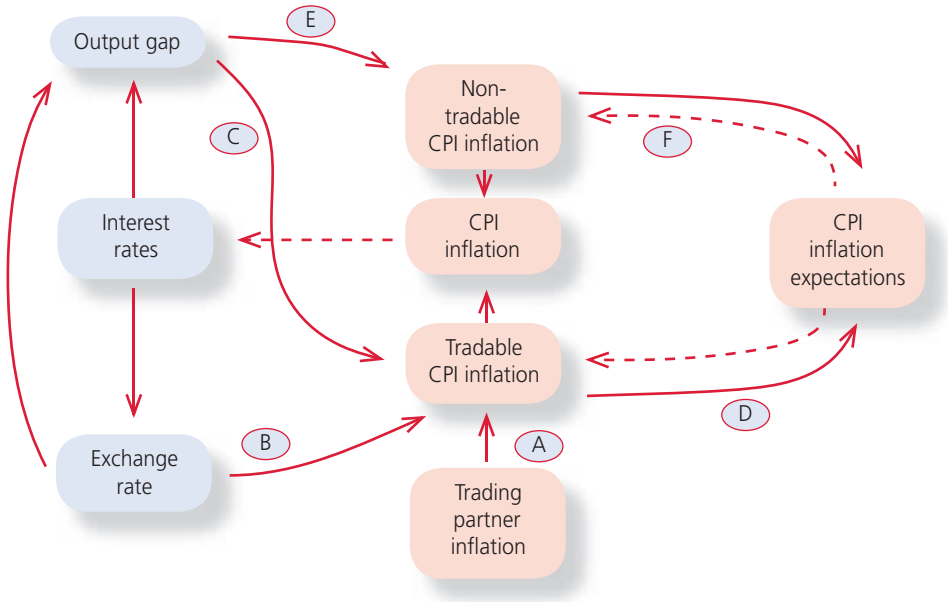
Section 2 of the article briefly provides a stylised model of inflation against which these changes can be discussed. Section 3 goes on to discuss the various changes to the inflation process, while section 4 concludes.

2 The inflation process

Before discussing ways in which the inflation process may have changed, it may be useful to set out, in broad terms, a stylised model of the inflation process in New Zealand. Changes in the inflation process can then be discussed in light of the various channels identified in the model. Of course, there is no one 'right' model of inflation, and observed inflation outcomes may be consistent with a range of different models. However, it is still useful to have a framework in mind when discussing the inflation process.

Figure 3 provides a stylised diagram that broadly represents the way the Bank currently models the inflation process in New Zealand. CPI inflation is explained in terms of its two key components – tradables and non-tradables. Tradables covers goods and services which are imported from overseas and/or for which there is significant international competition. The non-tradable component covers items subject to little international competition and is largely made up of construction- and housing-related costs, some utilities like electricity, and services.

Figure 3
A stylised representation of the inflation process in New Zealand



As shown by the diagram, the main proximate determinants of tradables inflation are thought to be the rate of trading partner inflation (A) and movements in the exchange rate (B). This captures the fact that tradables inflation may be largely 'imported' given that New Zealand is generally a price-taker in world markets. Excess demand or supply conditions in the domestic economy may also have a bearing on the level of tradables inflation (C), with excess demand conditions resulting in stronger rates of tradables inflation. There are potentially a number of channels through which excess demand conditions may operate, including via their effect on the local production and distribution costs of tradables, and on the level of margins able to be earned in product markets. Finally, the level of inflation expectations is also thought to influence the level of tradables inflation, with higher rates of tradables inflation, in turn, likely to have a feedback effect on the level of inflation expectations (D). This 'expectations effect' may likewise operate through a variety of channels, such as through wage claims or price-setting behaviour.

The main determinants of non-tradables inflation are thought to be excess demand or supply conditions in the domestic economy (E) and inflation expectations (F) (again through a mutually reinforcing relationship). Some work has recently been undertaken at the Bank to clarify this relationship further and this is reported in Box 2. The work has highlighted the dominant influence of housing-related prices in establishing the relationship between excess demand conditions and non-tradables inflation in New Zealand.

The left side of the diagram captures the role of interest rates in influencing the level of demand and the exchange rate, thereby exerting an influence on both tradables and non-tradables inflation and, indirectly, in the level of inflation expectations. These two channels reflect the ways in which changes in the Official Cash Rate (OCR) may ultimately affect inflation.

The stylised inflation model shown in figure 3 differs from models of the inflation process that characterised the Bank's understanding of the inflation process up until the mid 1990s (see, for example Schoefisch, 1993). These earlier models, which could loosely be characterised as 'cost-push' or 'mark-up' models, principally modelled inflation as a function of the costs of production, such as unit labour costs and import prices. Such models stressed the role of changes in production costs, such as wages, in directly influencing inflation and had little explicit role for inflation expectations. While the model in figure 3 is not necessarily inconsistent with 'cost-push' influences on inflation, it potentially allows for a rather broader range of influences.

The diagram in figure 3 is stylised and does not purport to capture every possible influence on inflation. There are a host of factors – such as indirect tax changes, changes in the intensity of competition, technological changes and so on – which may have an important bearing on inflation outcomes but are not represented on the diagram.

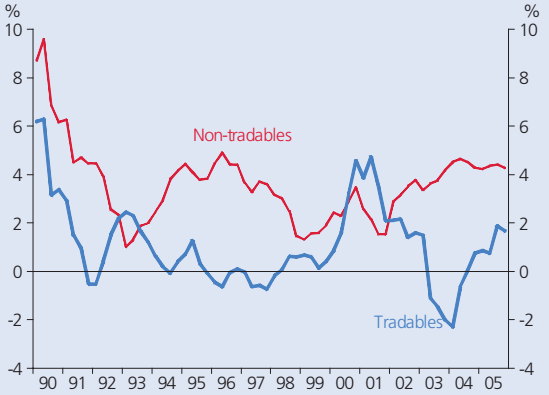
Box 2

Non-tradables inflation in New Zealand

Figure 4

Tradables and non-tradables inflation

(at annual rate)



As shown in figure 4, non-tradables inflation has significantly outpaced tradables inflation, on average, over the past 15 years, a divergence evident in most open economies. Fluctuations in tradables inflation are largely a reflection of exchange rate movements, whereas fluctuations in the non-tradables component are more likely to be due to 'domestic' influences. Work has recently been undertaken at the Reserve Bank to better understand the behaviour of non-tradables inflation.

(continued on p 22)

Figure 5

Non-tradables inflation and the output gap

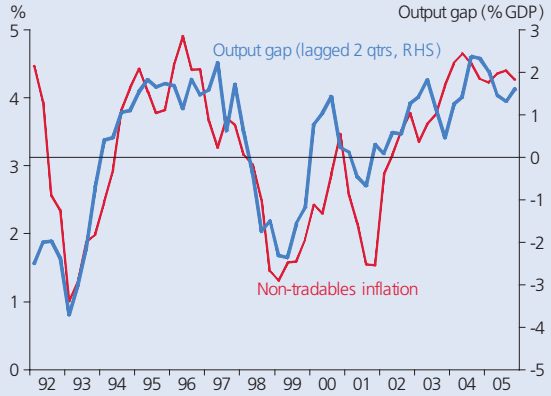
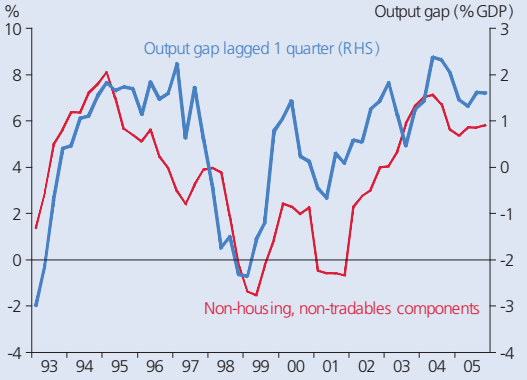


Figure 6

Housing-related inflation and the output gap



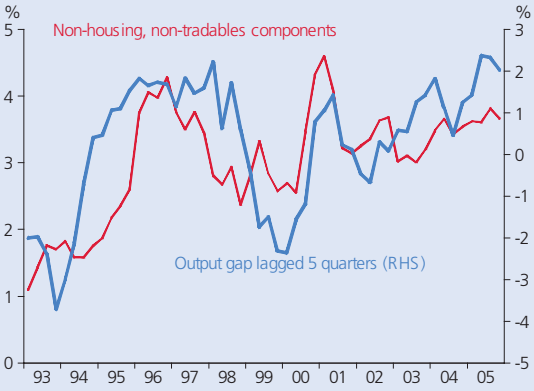
As shown by figure 5, there has been a relatively tight relationship in New Zealand between non-tradables inflation and cyclical indicators such as the output gap over the past 15 years, perhaps to a greater extent than in some other countries.[6]

Kite (2005a) found that the cyclical relationship with non-tradables largely arises due to the housing cycle, which has tended to be a dominant feature of economic cycles in New Zealand (figure 6). A number of housing -elated prices included in the non-tradables index appear to be particularly closely correlated with the economic cycle, including construction costs and rentals.

However, Kite's work has also revealed that the non-housing components of non-tradables inflation have also displayed an enduring relationship to the economic cycle over recent years, albeit with a rather longer lag (figure 7). While this secondary cycle in non-tradables inflation is more muted than for the housing components, there is also little compelling evidence that it has changed appreciably over the past 15 years.

Figure 7

The non-housing component of non-tradables inflation and the output gap



Of course, the fact that this aggregate relationship between non-tradables inflation and the cycle seems to have stabilised over the past 15 years does not necessarily preclude ongoing changes to the inflation process at a more disaggregated level (ie, in particular industries within the non-tradables sector). Work in this area is continuing.

[6] This relationship is perhaps all the more surprising given that non-tradables inflation includes a number of local and central government administered prices. When these items are excluded, the relationship further improves.

3 Ways in which the inflation process has changed

Inflation expectations

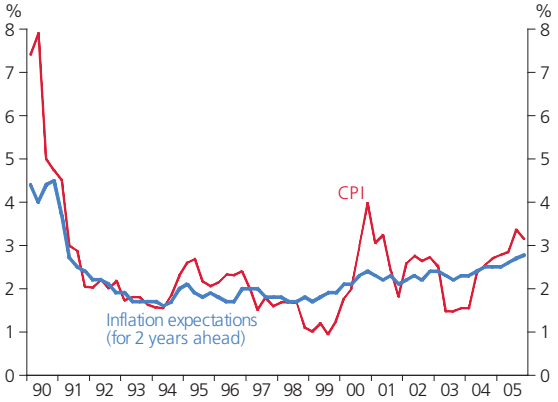
As figure 3 illustrates (see channels D and F), inflation expectations play a central role in determining inflation outcomes. The adoption of inflation targeting explicitly recognised this role and the reduction in the 'sacrifice ratio' that can be achieved by building credibility in a low inflation target.

Survey measures of inflation expectations gradually began to fall during the process of disinflation (figure 8), although much less quickly than inflation itself. By the early 1990s, some measures of expectations had settled at a little below 2 per cent, seemingly consistent with the inflation target of the time.[7] Surveyed expectations have edged up slightly over

the past 9 years. In part, this probably reflects the change to the inflation target in 1996 (from 0 to 2 per cent to 0 to 3 per cent) and again in 2002 (when a target of 1 to 3 per cent inflation on average over the medium term was adopted).

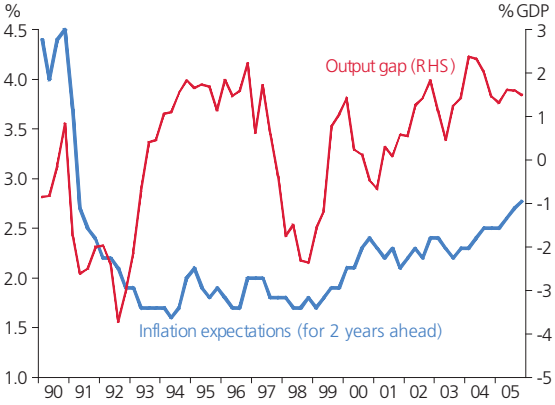
As time progresses, we have become more confident in New Zealand that inflation expectations have become more stable and target-consistent. As noted, New Zealand's Phillips curve appears to have flattened and become rather better 'anchored' over the past 15 years than was the case over the high inflation period of the 1980s. Surveyed expectations have remained relatively stable during the recent economic cycle (figure 9). Expectations appear to have been less prone to inflationary shocks (such as that generated by the sharp exchange rate depreciation in 2000) than we may have feared.[8] This seems to have made the task of countering a pick-up in inflation associated with the economic cycle a little easier than might have been the case if expectations had been more responsive to a lift in inflation. However, we have also been extremely wary of simply assuming that inflation expectations are 'anchored' and taking policy risks based on that assumption.

Figure 8
Inflation and surveyed inflation expectations
(at annual rate)



Alas, the empirical evidence around the inflation expectations process in New Zealand remains very blurred. One of the side effects of successfully achieving low and stable inflation is that the expectations data also tend to become low and stable and hence less empirically 'revealing'. There has been some empirical work, such as that provided by Basdevant (2003), suggesting that inflation expectations are becoming less responsive to lagged inflation and the output gap, and potentially more 'rational'. However, Basdevant cautioned that the available data series is short and the approach used may be too simple to capture all aspects of the inflation process.

Figure 9
Surveyed inflation expectations and the output gap



Hunter (2005) has also looked at the structure of the expectations formation process and concluded that empirical analysis is hard-pressed to gauge the extent to which inflation expectations are being formed adaptively (with reference to historical inflation), or with reference to the inflation target (which would reveal something about the credibility of monetary policy), or some other forward-looking process. The expectations data for New Zealand over the past 15 years can be equally well described by models with a large 'backward' component as they can by putting a large weight on a 'forward' looking component, or the inflation target.

[7] In New Zealand, there are several surveys of inflation expectations. Surveys of the household sector generally reveal expectations well in excess of actual inflation. Expectations derived from the Reserve Bank's Survey of Expectations (shown in figure 8) covers mainly business sector respondents and tracks closer to actual inflation. Ranchhod (2003) provides further discussion of the various expectations series in New Zealand and their pitfalls.

[8] Given New Zealand's open economy, with considerable participation by foreign firms, we are also conscious that low inflation abroad may have assisted in keeping expectations low in New Zealand over recent years.

From a policy perspective, we know that a reduction in inflation expectations has been very helpful in maintaining low inflation in New Zealand over the past decade. But what we really want to know is how that process could change endogenously over time (eg, in response to a significant inflationary shock or policy error). Despite our confidence that expectations have probably become more stable, and less prone to being disturbed by temporary perturbations to inflation, we are still some way from showing that empirically. Nor are we in a position to reliably gauge how inflation expectations might be affected by a future inflation shock.

Exchange rate pass-through

Exchange rate movements can have a direct bearing on CPI inflation through their effect on the price of tradables (see channel B in figure 3).[9] Prior to the float of the NZ dollar in 1985, New Zealand had regularly depreciated its exchange rate as the effects of easy monetary policy led to high inflation, a continued loss of competitiveness in the traded goods sector, and burgeoning current account deficits. In this environment, any depreciation of the exchange rate was widely (and correctly) regarded as permanent. As a result, the degree of pass-through from exchange rate changes to inflation tended to be high.

Research conducted in the late 1980s and early 1990s – which largely encapsulated this pre-float period – commonly put the exchange rate pass-through coefficient to the CPI at between 0.25 and 0.35 percentage points for a 1 percentage point fall in the trade-weighted exchange rate. With the overall import content of the CPI estimated to be about 20 per cent at that stage, these findings suggested not only complete exchange rate pass-through to prices, but also a lot of second round spill-over into inflation expectations. The speed of price adjustment was found to be rapid, with much of it occurring within 2 to 3 quarters.

As reported in Hodgetts and Clements (1989), the strong relationship between exchange rate movements and prices played an instrumental role in reducing inflation during the disinflation period of the late 1980s. A sharp rise in the New Zealand dollar between 1985 and 1988 contributed to a marked fall in inflation over that period.

During the 1990s, the Reserve Bank found that the exchange rate influence on consumer prices was becoming significantly more muted. Estimates of a small fall in exchange rate pass-through are reported by Corfield (1996), among others.

Hampton (2001a) estimates that the long-run pass-through coefficient dropped to about 0.15 for the period covering the 1990s, lower than earlier estimates. Hampton reported that Stage 1 pass-through – the impact of the exchange rate changes on import prices at the docks – had remained nearly 1 for 1 in New Zealand over the years. He attributed the reduction in exchange rate pass-through to a decline in Stage 2 pass-through – ie, from import prices to consumer prices.

Recent (unpublished) updates of the coefficient, which take into account the latest exchange rate cycle, point to a long-run coefficient of about 0.20 – broadly similar to Hampton's. This work has produced a coefficient of about 0.10 applying a year out from the exchange rate movement. These updates have confirmed Hampton's earlier finding of a high degree of Stage 1 pass-through (see figures 10 and 11).[10]

Both Hampton's work and more recent estimates confirm that the actual observed degree of exchange rate pass-through in the short run (ie, for periods out about 1 year) depends on the economic cycle. All things equal, a positive output gap leads to relatively more upward pressure on prices in response to an exchange rate depreciation. Given that consumer prices for tradables will partly be determined by the internal distribution sector (freight, storage, retail margins etc), this finding is to be expected.

[9] The exchange rate will also have an indirect bearing on inflation through its effect on economic activity. Changes in the influence of the exchange rate on activity are not considered further in this article.

[10] A recent cross-country study detected a more muted pass-through from the exchange rate to import prices for New Zealand (see Campa and Goldberg, 2005). However, this study was conducted using an extended sample period from 1975 to 2003 and may not be directly comparable. Moreover, the study did not directly investigate changes in exchange rate pass-through to import prices for New Zealand over time.

Figure 10

New Zealand tends to see complete 'stage 1' exchange rate pass-through

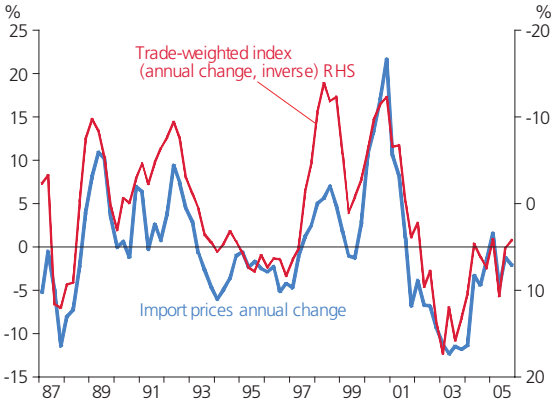
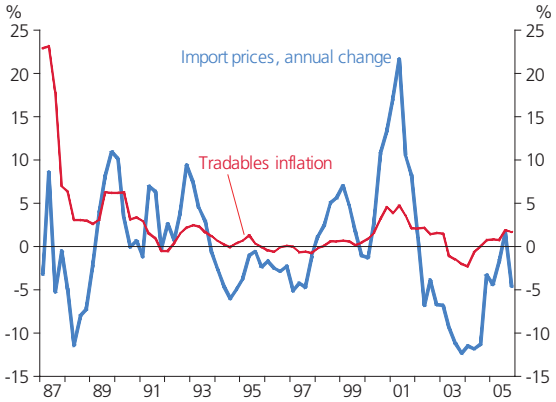


Figure 11

Pass-through from import prices to consumer prices has become muted



Over the years, a wide range of reasons have been advanced to explain the reduction in pass-through, although there has been little formal empirical verification of the competing theories. In a floating exchange rate environment, if businesses consider exchange rate fluctuations as temporary, they may well choose to absorb exchange rate -related changes in costs in margins, rather than risk losing market share by moving prices. This would certainly help to explain the lengthening of the time it takes for exchange rate changes to pass-through into prices. To the extent low inflation has resulted in a better anchoring of exchange rate expectations, it may also have resulted in more subdued second round effects from changes in import costs (which may have inflated early estimates of pass-through).

The predominance of pricing to market or price smoothing strategies on the part of international suppliers and/or their local subsidiaries may have increased. For New Zealand there is some evidence of this behaviour in the motor vehicle sector since the mid-1990s, with consumer prices for new cars remaining surprisingly stable despite considerable exchange rate movements. Discussions with the motor vehicle industry have tended to confirm this type of behaviour.

The increased use of exchange hedging by importers has also been advanced as a possible reason for more muted pass-through. This may be true at the margin. Briggs (2004) reports a study of hedging activity on the part of New Zealand's exporters and importers. Feedback by financial institutions providing hedging products pointed to an increase in hedging activity since the early 1990s. However, Briggs found that the degree of exchange rate hedging on the part of importers was relatively low (certainly in comparison to that undertaken by exporters), and where it does occur is usually for very short terms (periods of six months or less).

Globalisation, changing trade patterns, and the 'China effect'

Along with the exchange rate, changes in the foreign currency prices of imports have an important influence on the tradables component of the CPI (channel A, figure 3). For New Zealand, there are strong grounds to suggest that low trading partner inflation and the availability of lower cost imports from countries such as China have provided a powerful dampening influence on the tradables component of inflation. An examination of the CPI shows that the retail prices for some household goods, such as electrical appliances, have declined substantially over the past 15 years, while prices for some other items, such as clothing, have shown only very modest price increases over a sustained period (figure 12).

Although, as noted later in this article, 'domestic' factors may partly account for declining prices (or very weak price increases), falling import prices appear to be a key

Figure 12

Prices for selected tradable items in the CPI

(1990q1=100)

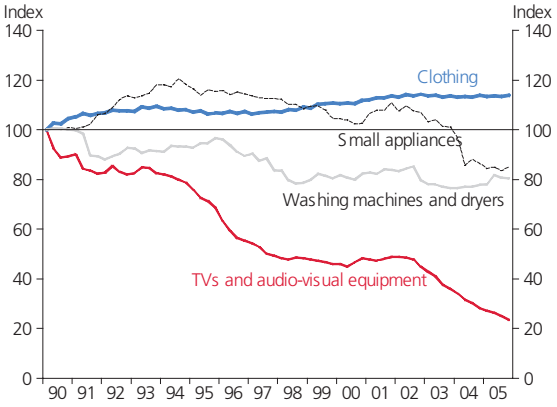
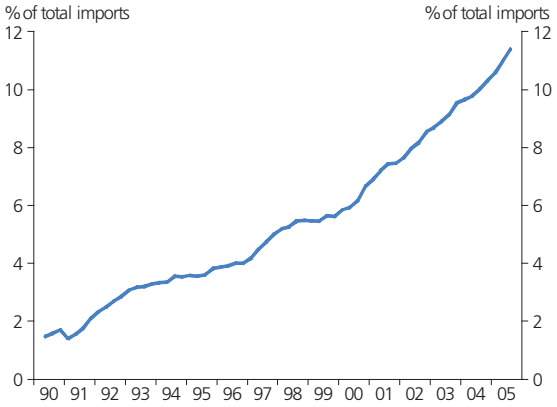


Figure 13

Imports from China as a share of total imports



influence.[11] Globally, a switch to low-cost production centres in China and elsewhere has clearly played a part in driving world prices lower as have technological advances and product life cycle effects. Since 1997, the estimated foreign currency price of imported manufactures has fallen by an average of about $2^1/_2$ per cent per annum. Up until 1996, positive rates of foreign currency inflation for manufactured goods had generally been experienced. Since then, an outright fall in foreign currency import prices has been evident for both finished and intermediate goods. The reduction in intermediate goods prices will have helped to contain production costs for local manufacturers.

Although a lack of country-specific import price data has hindered formal empirical analysis, changing trade shares are consistent with an ongoing switch to lower cost international suppliers. As figure 13 illustrates, New Zealand's (direct) import share from China has virtually doubled in the past 5 years (now standing at around 11 per cent of total imports). This switch in trade flows will have accentuated the reduction in import prices.

In the Reserve Bank's regular discussions with the business sector, manufacturers, wholesalers and retailers and others involved in importing have confirmed an ongoing switch toward lower cost suppliers such as China. Some businesses appear to have had a strategy of pursuing such products far more actively than in the past. In many cases, businesses have confirmed that these imports have displaced products sourced from traditional foreign suppliers, or produced locally. Many manufacturers also report an increased use of components sourced from Asia as a means of containing the costs of production of their own products and/or to help them compete with cheaper imports.

Changes in the wage-price relationship

As noted in section 2, the traditional approach to modelling inflation in New Zealand was to assume prices were set as a reasonably stable mark-up over the core costs of production – import prices, wages and labour productivity.

Underlying this approach were three key assumptions:

- that changes in import prices and unit labour costs tend to 'cause' prices rather than the reverse;
- that the coefficients on the import price and unit labour cost terms were relatively stable; and
- that the mark-up on costs was either fixed, or relatively 'predictable' (cycling with the strength of the economy).

Gradually, the cost plus model of inflation appears to have become less relevant for New Zealand. The reduction in exchange rate pass-through was discussed earlier. And while wage inflation had significant predictive power for inflation during the 1970s and 1980s, this relationship appears to have changed markedly over the 1990s.

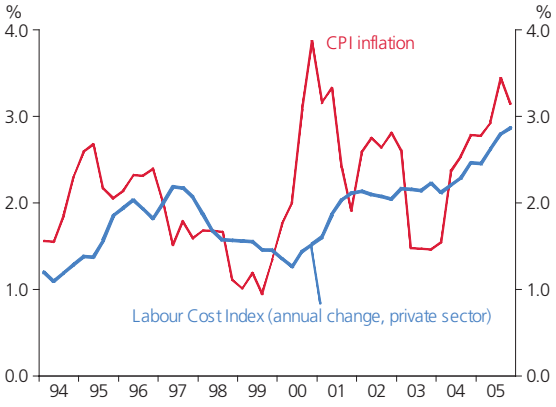
[11] Note that declines in the prices for some of these items, at least in the earlier half of the 1990s can also be attributed to the ongoing reduction in import tariffs

Hampton (2001b) provides evidence showing that although wages 'led' prices in the 1980s, the relationship reversed over the 1990s, with wage movements tending to follow inflation rather than the reverse. A pick-up in wage inflation is no longer seen as indicating an acceleration of CPI inflation pressures in the same way it might have in the 1980s. As shown in figure 14, wage settlements adjusted for labour productivity were often lower than actual inflation over much of the last decade, and rarely exceeded it significantly. This was often not the case in the 1970s and 1980s.

Labour market reforms in the early 1990s reinforced the trend toward a more decentralised (firm- and site-specific) wage bargaining system, displacing the centralised wage-bargaining system that had been in place during the 1970s and early 1980s. Increasingly, we have moved to a system where wages are set to reflect the underlying conditions of individual industries and firms, rather than an arbitrary 'claim' factor applying across a range of industries.[12]

Figure 14

Private sector wage inflation and CPI inflation



There has also been a been a decisive shift to longer-term wage agreements (eg, contracts spanning 2- or 3-year periods), no doubt partly encouraged by the lower inflation environment and more stable inflation expectations.[13] Longer contract lengths reduce the likelihood that temporary inflationary disturbances get passed into wages. Of course, they also raise the possibility that when wage inflation does increase, it is slower to adjust downwards again.

In recent years, against the background of a very tight labour market in New Zealand, there has been some evidence that firms have provided non-pecuniary benefits (such as training) in lieu of more aggressive wage increases as a means of attracting and rewarding staff. To the extent that this practice avoids the cost-ratcheting effect associated with larger wage increases, it may also reduce pressure on cost structures over the economic cycle. The increasing tendency for firms to use labour from overseas to help meet shortages may also have acted as a 'safety valve' for wage increases, although little research has been done to evaluate this effect.

The net effect of these sorts of changes has been to weaken the previously tight linkage between wages and CPI inflation. Wage inflation still accelerates following periods of labour market tightness, but less dramatically and with a somewhat longer lag than was previously the case. Helpful as this has been to containing inflation pressures during periods of strong economic activity, as policymakers, we have remained wary of the potential for wage inflation to re-assert itself as a direct driver of inflation.

Increased competition and other structural changes

A further factor undermining the cost-push model of inflation and muting inflationary pressures in some parts of the New Zealand economy over the past 15 or so years has been heightened competition. A myriad of factors have contributed to more intense competition:

- The opening up of the economy in the late 1980s, which saw the removal of import protection and other barriers to the entry of foreign goods;
- various industry regulatory changes, directly aimed at fostering greater efficiency and competition and allowing new players into markets;
- structural changes within industries, including retailing, such as the arrival of large discount chains, mega-stores

[12] Blackwood et al (2005) report that, as of 2005, only 8 per cent of private sector employees were covered by a multi-employer agreement.

[13] Blackwood et al (op cit) note that of collective wage agreements struck during the year to June 2005, 76 per cent were for terms in excess of 12 months. This was up from 65 per cent in 1996.

and international conglomerates with greater buying power and scale economies.

Mourougane and Wise (2005) conclude that New Zealand markets are now well exposed to competition, although they highlight several areas where competition could be further enhanced. Using data for 1997–2002, they find that New Zealand's price level is relatively low by international standards, consistent with strong competition (but possibly with many other factors too). They also find low barriers to trade and very high entry and exit rates in the New Zealand business sector. However, the authors do not attempt to quantify the effects of competition on inflation.

The Bank's own analysis of inflation outcomes confirms that the move to greater competition has had a material impact on pricing in a number of sectors such as air travel and utilities. For instance, international and domestic calling charges steadily declined by around 80 per cent between 1987 and 1999. To be sure, this was not purely 'competition' at work – technology also partly explains the decline. But competition certainly helped. This decline in calling charges shaved something in the order of 0.2 percentage points (on average) from each year's CPI inflation rate over this 12 year period.

Over the past 3 years, international airfares for New Zealand consumers have declined by around 30 per cent, primarily due to the entry of new market players on the important trans-Tasman route. This again has shaved something in the order of 0.2 percentage points from each year's CPI.

These (and other) downward adjustments in prices have been more prolonged than we expected and, in aggregate, have materially dampened CPI outcomes over the past 15 years. But the bigger question is the extent to which greater competition has had a permanent effect on the inflation process. There have been some cross-country studies such as Neiss (2001) and Cavelaars (2002), suggesting that increased competition can contribute to a structurally lower level of inflation. There have been no New Zealand specific studies, but as policymakers, we strongly suspect that competition has contributed to a more muted inflation environment.

Mourougane and Wise (*op cit*) conclude that New Zealand's retail sector is one of the most liberal in the OECD, with few restrictions on market entry. Consistent with that finding, recent work at the Bank has highlighted the extent to which structural changes in the retail sector may be acting to dampen price inflation. Kite (2005b) reports a sizeable expansion in both the number and average size of retail stores operating in New Zealand over the past 5 years. Kite notes that this expansion in retail infrastructure (relative to sales) appears to have constrained the sector's profitability, citing only a small rise in margins and very low rates of inflation in many parts of the retail sector. This is despite sustained, strong growth in retail sales over the same period. More sales have been spread over a larger pool of outlets.

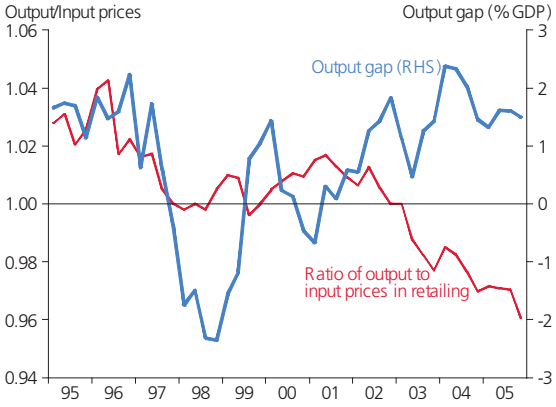
In explaining the shift toward larger stores, which has occurred in areas such as supermarkets, department stores, hardware, footwear and appliances, Kite notes that many retail operators have been pursuing competitive advantages in the form of greater buying power from local and overseas suppliers as well as other scale economies. Much of the expansion in capacity has been by companies with a wider international presence, providing them with further leverage in this regard. Although Kite's study covers only the period from 1999 to 2004, such changes appear to have been ongoing over a much longer period and may therefore have contributed to changes in the observed inflation 'process'.

It seems likely that changes in New Zealand's retail sector over the past decade mirror what some US economists, such as Robert Solow, have labelled the "Wal-Mart phenomenon". According to Solow (2001), a combination of technology, the large store format and improved logistics in areas such as warehousing, shipping and picking enabled Wal-Mart in the US to open up a large productivity gap over other retailers. This, in turn, meant Wal-Mart could offer substantially lower prices than its competitors. The rest of the industry has been forced to imitate Wal-Mart in order to survive.

The influence of the "Wal-Mart phenomenon" on inflation in New Zealand has yet to be empirically determined, but there is a strong suspicion that structural changes in the retail sector have assisted in dampening CPI inflation pressures (more than 60 per cent of the CPI is made up of retail prices). There is some evidence of a secular decline in

Figure 15

Ratio of retail sector output prices to input prices[14]



output prices relative to input prices in New Zealand's retail sector, notwithstanding variations across the economic cycle (figure 15). Of course, changes in retailers' buying power and supply networks may also help to explain the observed reduction in exchange rate pass-through to prices as well as the rapid rise in imports from cheaper non-traditional sources, such as China, noted earlier.

4 Conclusion

This article has briefly explored some of the changes in the inflation process in New Zealand over the past 15 or so years. It noted that the economy's inflation response to various factors such as demand conditions or the exchange rate appears to have become more muted since the introduction of inflation targeting. A sharp reduction in inflation expectations that occurred following disinflation has played a major role in keeping inflation low over this period and is probably the single biggest change. In addition, the reduced influence of the exchange rate on prices, globalisation effects, a weakening in the relationship between wages and price inflation, and heightened competition all seem to have played a role in dampening the economy's inflationary response to shocks.

Understanding how the inflation process works and how it is evolving is crucial for the effective implementation of monetary policy. As this article has highlighted, there are many aspects of the inflation process that are ripe for further research. The Bank continues to devote much of its efforts into understanding how the various influences on inflation are changing, drawing on international analysis and insights where relevant.

[14] Note that input prices cover the purchase of merchandise and all other operating expenses other than wage costs. Output prices are selling prices excluding GST and other sales taxes. The omission of labour costs from input prices means that figure 13 must be interpreted with caution. For example, a low rate of increase in labour costs would imply that margins may not have declined to the extent that figure 15 suggests.

References

Basdevant, O (2003), "Learning processes and rational expectations: an analysis using a small macroeconomic model for New Zealand", Reserve Bank of New Zealand *Discussion Paper* 2003/05.

Bean, C (2005), "Monetary policy in an uncertain world" Bank of England Quarterly *Bulletin*, Spring.

Blackwood, L, G Feinberg-Danieli, G Lafferty and P Kiely (2005), "Employment agreements: bargaining trends & employment law update 2004/2005", Victoria University of Wellington, Industrial Relations Centre.

Briggs, P (2004), "Currency hedging by exporters and importers", Reserve Bank of New Zealand *Bulletin*, 67/4 December.

Campa, J and L Goldberg, (2005) "Exchange rate pass-through into import prices" *Review of Economics and Statistics*, November 87(4): 679-690.

Cavelaars, P (2002), "Does competition enhancement have permanent inflation effects?" *De Nederlandsche Bank Staff Report No.92*.

Cecchetti, S. and G. Debelle (2005), 'Has the inflation process changed?' BIS *Working Paper* No. 185.

Corfield, I (1996), "Exchange rate pass-through", Reserve Bank of New Zealand, internal memo.

Hampton, T (2001a), "How much do import price shocks matter for consumer prices?" Reserve Bank of New Zealand *Discussion Paper* 2001/06.

Hampton, T (2001b) ,"Do wages lead prices?", Reserve Bank of New Zealand, internal memo.

Hodgetts, B and R Clements (1989), "Causes of the fall in inflation", Reserve Bank of New Zealand *Bulletin*, 52/3 September.

Hunter, L (2005), "Inflation expectations: an interim report", Reserve Bank of New Zealand, internal memo.

Kite, H (2005a), "A note on non-tradables inflation", Reserve Bank of New Zealand, internal memo.

Kite, H (2005b), "Overview of the retail sector", Reserve Bank of New Zealand *Bulletin*, 68/2 June.

Mourougane, A and Wise, M (2005), "Product market competition and economic performance in New Zealand", OECD *Working Paper* No.437.

Neiss, K. (2001), "The mark-up and inflation: evidence in OECD countries", *Canadian Journal of Economics*, 34(2), p. 570-587.

Ranchhod, S (2003), "The relationship between inflation expectations survey data and inflation", Reserve Bank of New Zealand *Bulletin*, 66/4 December.

Ranchhod, S and S McCaw (2002), "The Reserve Bank's forecasting performance", Reserve Bank of New Zealand *Bulletin*, 65/4 December.

Schoefisch, U (1993), "The Reserve Bank's approach to inflation forecasting", Reserve Bank of New Zealand *Bulletin*, 56/4 December.

Solow, R (2001), "Information technology and the recent productivity boom in the US", Address to NCN Summit, available at http://web.mit.edu/cmi-videos/solow/text.html.

Analysis of revisions to quarterly GDP – a real-time database

Cath Sleeman[1]

Gross Domestic Product (GDP) is one of the key data series used by the Reserve Bank to inform monetary policy decisions. The measures of GDP, published by Statistics New Zealand (SNZ), are estimates rather than exact figures and may be revised in subsequent releases. Analysis of the most recent measures of GDP should incorporate the extent of uncertainty that surrounds these estimates. To enable a more detailed examination of revision patterns, the Reserve Bank has constructed a real-time database containing each quarterly release of Expenditure GDP (GDP(E)) and its components. The database is available to users on the Reserve Bank's website and will be regularly updated. This article provides an introduction to the database and, by way of example, presents a basic analysis of the revisions made to GDP(E) and its components.

1 Introduction

Gross Domestic Product (GDP) is a measure of the value of economic activity within a country over a given period. SNZ publishes measures of GDP for New Zealand on both a quarterly and annual basis. As it is neither possible to observe all forms of economic activity nor calculate their values precisely, the published measures of GDP are estimates rather than exact figures.

The Reserve Bank uses the measures of quarterly GDP both to gauge the current pace of economic growth and as a basis on which to forecast future growth. These measures may be substantially revised by SNZ in later quarters to incorporate additional and improved data. It is helpful to have some idea of the extent to which the latest GDP measures are reliable indicators of the revised and more accurate measures that will come to be associated with the quarters in later years.

The Reserve Bank has formed a 'real-time' database that contains each quarterly release of Expenditure GDP (GDP(E)) and its components published by SNZ.[2,3] The first constant price measures of GDP(E) were released in June 1990 and the first current price measures were released in July 1994. For a selected series, the database provides the complete set of estimates that have been associated with each quarter. The database can be used to analyse the size and dispersion of the revisions made to each series, the results of which may assist in analysing the latest unrevised data.[4]

It is important to recognise that the revisions analysis undertaken in this article provides an assessment of the data's reliability, but not of its accuracy. The IMF's Data Quality Assessment Framework (DQAF) distinguishes the two concepts as follows (Carson and Laliberte, 2002, p.4):

- Accuracy refers to the closeness of the estimated value to the (unknown) true value that the statistic is intended to measure. In practical terms, there is no single overall measure of accuracy; accuracy is evaluated in terms of the potential sources of error.
- Reliability refers to the closeness of the initial estimated value to the subsequent estimated values. Assessing reliability involves comparing estimates over time. Data that are revised more frequently are not necessarily less accurate.

[1] I would like to thank Shaun Vahey and Özer Karagedikli for their assistance with this project. I am grateful to Nick Treadgold, Michael Anderson and Jeff Cope from Statistics New Zealand (SNZ) and Rochelle Barrow from the Reserve Bank for comments on an earlier version. I would also like to thank seminar participants at the Bank.

[2] 'Real-time data' refers to the set of measures for a series that were the latest available at a particular point in time.

[3] SNZ considers Expenditure GDP to be more volatile and consequently less reliable than Production GDP. The Reserve Bank uses both measures to inform monetary policy decisions.

[4] For example, if the revisions to a series were found to be consistently positive, this would suggest that the latest measures may be underestimates.

2 Measures of Gross Domestic Product

GDP can be measured in three ways, by estimating the value of the production, expenditure or income of an economy. SNZ publishes annual estimates of each measure and quarterly estimates of the production and expenditure measures.[5] The three measures are defined by SNZ as follows:[6]

Production GDP

This approach measures the value added by producers and is calculated by deducting the value of goods and services used up in production from the total value of goods and services produced. Production GDP is SNZ's headline measure of GDP and is released with a breakdown of value added by industry.

Expenditure GDP (GDP(E))

This technique directly calculates the value of goods and services produced for final use by measuring consumer purchases. Expenditure GDP can be broken down into the purchases by households, firms, the government and overseas residents, less any imports.

Income GDP

This approach measures the value added by producers and entails summing the incomes accruing to the factors of production ie, labour payments and profits.

Although all three measures of GDP are conceptually equivalent and should in theory equal each other, the combination of survey errors, timing differences, and other measurement errors in the various components typically give rise to statistical discrepancies between their values (SNZ, 1996, p.14).

At present, the real-time database contains the quarterly releases of Expenditure GDP and its components. Over the coming year, we hope to expand the database to include the quarterly releases of Production GDP and value added by industry.

[5] For recent releases of GDP visit http://www.stats.govt.nz/datasets/economic-indicators/national-accounts-and-gdp.htm.

[6] Further information about GDP can be found at http://www.stats.govt.nz/products-and-services/Articles/national-accounts-guide-Feb04.htm.

3 Causes of revisions to Gross Domestic Product

All three measures of GDP and their respective components are subject to revision. Each quarterly and annual release of these series by SNZ contains not only estimates of the series for the latest period but also revised estimates for previous periods. While the majority of revisions are made to the four most recent quarters of a series, there is no restriction on when an estimate of a series for a given period will no longer be revised. The five main causes of revisions are discussed in turn.

Incorporation of additional and improved data

Most revisions reflect the incorporation of a wider range of data. In particular, survey data that were not available at the release date are incorporated through revisions into subsequent releases. For example, the measures of quarterly Production GDP may be revised as a result of new data from the Retail Trade Survey. Similarly, data from the tri-annual Household Economic Survey may lead SNZ to revise past estimates of Expenditure GDP. Changes in the source data used to compile the measures may also lead to revisions.

Reconciliation of quarterly and annual measures

The process of reconciling the quarterly measures of Production and Expenditure GDP, and their respective components, to the annual measures can lead to further revisions. The quarterly measures of these series are based on a smaller range of data than the annual measures and are regarded by SNZ as less accurate. When a provisional annual measure is compiled, the four quarterly measures may be revised to ensure that the nominal quarterly estimates sum to the annual estimate. Provisional annual estimates are then subject to revision when balanced within the supply and use framework. This may result in further revisions to quarterly series.

Introduction of methodological changes

Infrequent revisions arising from methodological changes can have a substantial impact on the measures of GDP and their components. When the approach used to measure a series is changed, SNZ will attempt to use the new methodology to revise all the past values of the series. Large methodological changes are generally the result of new international standards or recommendations. The adoption of new methodologies allows New Zealand's statistics to remain internationally comparable. For example, in November 2005, SNZ changed the method used to estimate software investment from a demand-based approach to a supply-based approach as the latter was considered to provide more accurate measures. This change caused substantial revisions to past measures of GDP, and increased annual nominal Production GDP in 2004 by 1.4 billion.[7]

Re-basing and re-weighting of the constant price series

GDP measures expressed in constant prices enable users to compare the levels of GDP in different years without the distorting effects of inflation. Both the re-basing and re-weighting of these series can lead to further revisions.

Constant price measures of the quarterly GDP series are generated using the technique of chain-linking (see Box 1). The volumes of the components are weighted by the average prices of the previous year. Initially however, the volumes of the current year will be weighted using an earlier year and later re-weighted when the annual measures for the previous year have been reconciled within the supply-use framework.

At the time chain-linking was introduced, the base year (whose prices were used to benchmark volumes of the constant price series) was changed from 1991–92 to 1995–96. While re-basing will cause changes in the levels of the series, the growth rates will not be affected. In the past, however, changes in base years have coincided with the introduction of new methodologies.

[7] For further information about the measurement of software investment in the New Zealand national accounts visit http://www2.stats.govt.nz/domino/external/pasfull/pasfull.nsf/7cf46ae26dcb6800cc256a62000a2248/4c2567ef00247c6acc2570ba0010fbc5?OpenDocument.

Box 1

The adoption of chain-linking

In 2000, SNZ adopted the technique of chain-linking to generate volume measures of Expenditure and Production GDP, and their respective components.[8] Chain-linking involves weighting the volumes of a series using the average prices of the previous year. Prior to chain-linking, constant price series were generated using a 'fixed-weight' approach, in which the year whose prices were used to weight the volumes was only changed every five to ten years. As relative prices change, fixed weights become increasingly unrepresentative and may cause constant price series to become misleading. The changes in relative prices between consecutive pairs of years tend to be much smaller than the cumulative changes over a number of years. Countries such as the United States and Australia found that chain-linking can provide more accurate measures of growth (SNZ, 1998). Annual updating of weights, or chain-linking, was also recommended in the 1993 *System of National Accounts*.[9] Although annual re-weighting creates the need for addition revisions, these must be considered against the infrequent but large revisions required under the fixed-weight approach.

Re-estimation of the seasonal factors for seasonally-adjusted series

Seasonal variation is the regular pattern of behaviour displayed by a data series over the course of a year. For example, Christmas creates seasonal variation in retail trade, which in turn affects GDP in the fourth quarter of each year. Removing the seasonal variation from a series allows the more meaningful variation in the series to be observed.

[8] The first constant price Production GDP measures expressed in chain-linking terms were released in December 2000. Chain-linked Expenditure GDP measures were first released in June 2001.

[9] The 1993 System of National Accounts is a framework that set international statistical standards for the measurement of various economic series. The framework was published jointly by the United Nations, the Commission of the European Communities, the International Monetary Fund (IMF), the OECD, and the World Bank. For further information about the SNA93 visit http://unstats.un.org/unsd/sna1993/introduction.

Seasonally-adjusted series (ie, those without seasonal variation) are formed by estimating and then removing the seasonal factors for each period. The seasonal factors at the end of the data sample are particularly difficult to estimate. When a new estimate is added to the end of the series, SNZ will re-estimate the seasonal factors for all the quarters. This can lead to revisions in the seasonally-adjusted estimates ,particularly for the most recent quarters.

4 A real-time database for Gross Domestic Product

A real-time database is a collection of vintages, where a vintage is defined as the set of measurements for a series, each relating to a different period, that were published in the same release. The OECD has encouraged countries to take up 'the systematic archiving of all vintages of data' and further has described revision analysis as 'an integral part of the statistical production process' (di Fonzo, 2005, p.5). Many central banks have already constructed real-time databases for GDP and other series that are subject to revision. For example, both the Bank of England[10] and the Federal Reserve Bank of Philadelphia[11] have made their databases available to the public.

Following the recommendations of the OECD, the Reserve Bank has constructed a real-time database for New Zealand's quarterly measures of Expenditure GDP and its components.[12] Each series in the database may be viewed both in seasonally and non seasonally-adjusted terms, and in both current and constant prices.[13]

Table 1 shows a section of the real-time database for Expenditure GDP (GDP(E)) expressed in constant prices and seasonally adjusted. Each column of data represents a vintage, and corresponds to the set of GDP(E) figures released on the date shown at the top of the column. For example, the first estimates of quarterly GDP(E) expressed in constant prices were released on 06/06/1990, and contained estimates of GDP(E) for the quarters June 1982 to December 1989. In subsequent releases, the estimates of GDP(E) for these quarters were revised and estimates for later quarters released.[14] The lowest element of each column in the table shows the first estimate of GDP(E) for a given quarter. At the time of writing, the latest series of estimates for GDP(E) were those released on 29/09/2005. This release contained the first estimate of GDP(E) for the June 2005 quarter. The rows of the Table show the set of GDP(E) estimates that have been associated with each quarter. The two rows immediately above the date of release provide the INFOS number applied by SNZ (to classify the series) and the base year used to express the constant prices series.

5 The real-time problem

The most recent vintage of GDP, used to inform monetary policy decisions, may contain estimates that are later revised. These later estimates will be based on more accurate information. It is uncertain whether the initial estimates for recent quarters are sufficiently reliable indicators of the more accurate 'final' estimates. This uncertainty faced by policy-makers is known as the 'real-time problem'.

To illustrate the extent of the real-time problem, figures 1 and 2 show how the rates of quarterly growth in GDP(E) for the quarters December 1989 and June 1998 changed over time as a result of revisions made to the data. The first measure of GDP(E) for the quarter December 1989 was estimated to be NZD8.91 billion in 1982–83 prices and published in June 1990 (see table 1). As shown in figure 1, this level of GDP(E) was 6.3 per cent higher than September quarter's level. In subsequent releases, revisions to the September and December levels of GDP(E) caused the growth rate for the

[10] Bank of England's real-time database: http://www.bankofengland.co.uk/statistics/gdpdatabase/index.htm. A description of the database is provided in Castle and Ellis (2002).

[11] Federal Reserve Bank of Philadelphia's real-time database: http://www.phil.frb.org/econ/forecast/reaindex.html. This database is described in Croushore and Stark (2003).

[12] A database containing the consecutive quarterly releases of Production GDP and its components (at the industry level) is scheduled for release later this year.

[13] The OECD has recently constructed a real-time database for each OECD member country including New Zealand (di Fonzo, 2005). The database only contains the historical releases of Production GDP and does not include vintages before December 1994. The data were taken from MEI (Main Economic Indicator) publications released by the OECD.

[14] The number of quarters in each vintage varies. Blank spaces were filled in only when the estimates in the adjacent vintages were identical.

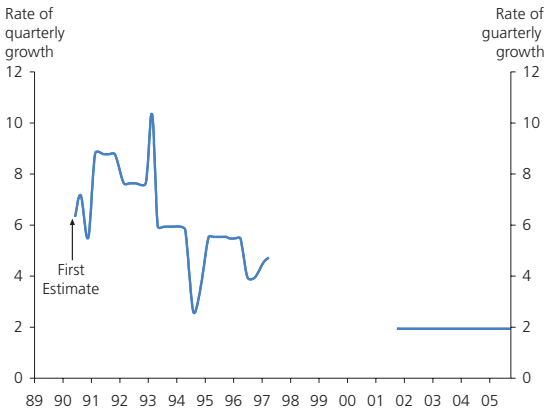
Table 1

A section of the real-time database

	Expenditure GDP *($millions)*		Constant Prices, Seasonally Adjusted				
	Vintage						
	SNBQ SWSN						SNCQ
	1982-1983 Prices					SNBQ SWSN 1982-1983 Prices	S1RB15S 1995-1996 Prices
Quarter	06/06/ 1990	16/08/ 1990	20/11/ 1990	19/02/ 1991	04/06/ 1991	20/08/ 1991	29/09/ 2005
Jun 1982	7,752	..	..	..	..	..	..
Sep 1982	8,060	..	..	..	..	..	..
Dec 1982	7,922	..	..	..	..	..	..
Mar 1983	7,770	..	..	..	..	..	..
Jun 1983	8,102	..	..	..	..	..	..
Sep 1983	8,274	..	..	..	..	..	..
Dec 1983	8,154	..	..	..	..	..	..
Mar 1984	8,503	..	..	..	..	..	..
Jun 1984	8,327	..	..	..	..	..	..
Sep 1984	8,283	8,283	..	..	..	..	..
Dec 1984	8,675	8,675	8,674	..	..	..	..
Mar 1985	8,894	8,894	8,894	8,994	..	..	..
Jun 1985	8,588	8,588	8,588	8,647	8,627	..	..
Sep 1985	8,436	8,436	8,436	8,520	8,499	8,499	..
Dec 1985	8,650	8,650	8,651	8,702	8,716	8,717	..
Mar 1986	8,242	8,242	8,242	8,325	8,334	8,334	..
Jun 1986	8,662	8,662	8,662	8,699	8,668	8,668	..
Sep 1986	9,230	9,230	9,230	9,364	9,289	9,289	..
Dec 1986	8,723	8,723	8,724	8,745	8,671	8,671	..
Mar 1987	8,501	8,501	8,501	8,543	8,486	8,486	..
Jun 1987	8,570	8,570	8,570	8,568	8,569	8,569	19,424
Sep 1987	8,640	8,640	8,640	8,759	8,791	8,791	19,471
Dec 1987	8,438	8,438	8,438	8,588	8,621	8,622	19,738
Mar 1988	8,900	8,900	8,899	8,848	8,838	8,839	19,820
Jun 1988	8,425	8,378	8,363	8,326	8,329	8,329	19,795
Sep 1988	9,001	9,108	9,063	9,256	9,254	9,254	19,925
Dec 1988	8,743	8,743	8,711	8,905	8,895	8,895	20,045
Mar 1989	8,865	8,804	8,755	8,946	8,843	8,843	20,133
Jun 1989	9,063	9,044	8,977	9,175	9,124	9,124	20,303
Sep 1989	8,359	8,327	8,350	8,177	8,190	8,190	19,617
Dec 1989	8,905	8,946	8,821	8,931	8,941	8,941	20,001
Mar 1990		8,681	8,781	9,022	8,992	8,992	20,130
Jun 1990			8,785	8,946	8,857	8,912	20,013
Sep 1990				8,898	8,881	8,793	20,035
Dec 1990					9,229	9,122	20,305
Mar 1991						8,742	19,750
…							…
Jun 2005							31,666

December quarter to climb as high as 10.4 per cent. Figure 1 contains a gap because the quarterly releases from June 1997 to September 2001 did not contain estimates of GDP(E) for quarters as early as in 1989. The more recent releases, which extend back further, estimate the rate of growth for the December quarter to be just under 2 per cent.

Figure 1
Revisions to the quarterly growth rate in GDP(E) for December 1989

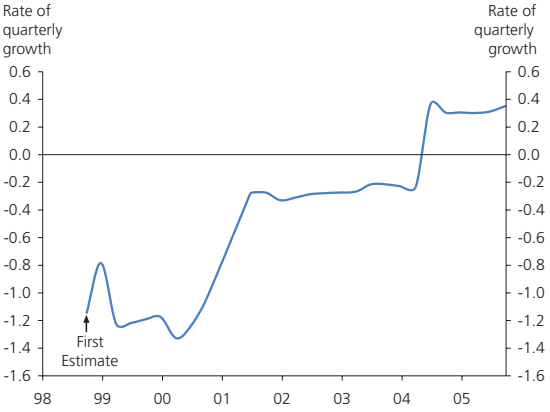


As a second example of the real-time problem, figure 2 shows the revisions made to GDP(E) in the June 1998 quarter. The first estimate for this quarter was -1.15 per cent lower than the level of GDP(E) for the previous quarter. This initial growth rate, however, was revised up substantially, both in the following quarter and then again in June 2001 when chain-linking was first applied to GDP(E). In mid 2004, the levels of GDP(E) for the March and June quarters of 1998 were revised up further, to the extent that the rate of growth for the June quarter became positive. Through the process of revisions, what was initially considered to be a quarter of contraction became a quarter of expansion.

For the two quarters illustrated in figures 1 and 2, the first estimates of quarterly growth were not reliable indicators of the estimates that came to be associated with the quarters in later years. Although the size of the revisions to the quarters are not atypical for the period in which they were made, later analysis will show that the revisions to GDP(E) have become smaller in recent years.

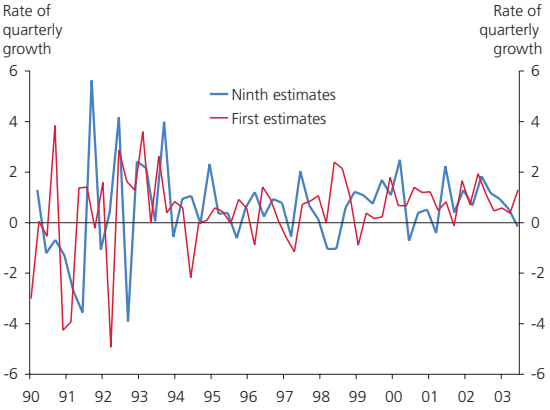
Revisions to quarterly estimates of GDP, such as those illustrated in figures 1 and 2, influence the Reserve Bank's view of the business cycle. Figure 3 contrasts the first

Figure 2
Revisions to the quarterly growth rate in GDP(E) for June 1998



estimates of GDP(E) growth in each quarter against the estimates of growth made nine quarters after each first estimate. Revisions over just a two year period can have a substantial effect on the timings and magnitudes of the peaks and troughs in the economic cycle. The large revisions made to the December 1994 and March 1995 quarters illustrate this effect.

Figure 3
A comparison of the first and ninth estimates of quarterly growth in GDP(E)



6 Analysis of the revisions to GDP(E) and its components

This section uses the real-time database to analyse the revisions made to GDP(E) and its components. The types of analysis used are similar to those recommended by the OECD (di Fonzo, 2005) and employed by other central banks (for example, see Castle and Ellis, 2002). All data are expressed in constant prices and are seasonally adjusted.

Over the vintages, three different base years have been used to express the volumes of the constant price series.[15] As it is not possible to compare the levels of constant price vintages that were formed using different base years, the following analysis examines how revisions influenced the quarterly growth rates of these series. The quarterly growth rate is defined as the percentage change from the previous quarter in the same vintage, and is calculated using logarithms.

6.1 Size and dispersion of total revisions

This sub-section examines the size and dispersion of the total revisions made to GDP(E) and its components. We define the total revision for a quarter as the difference between the 'final' estimate of the growth rate for the quarter and the first estimate of the growth rate for the quarter. A total revision that is positive indicates that the growth rate was initially underestimated.

The first estimates of each series are obtained from the lowest diagonal elements of the columns in the database. As SNZ may revise any previous quarter's estimate of GDP, there is no defined length of time after which the estimate for a quarter becomes 'final'. While there are several possible ways in which to define a set of 'final' estimates, we have used the set of estimates in the last available vintage, which at the time of writing was published on 29/09/2005 and contained the first estimate for the June 2005 quarter.[16] As the observations for the most recent quarters in this vintage are still likely to be revised, the last quarter included in the sample was June 2003.[17] Thus for each series, the following analysis is conducted for the first and final estimates of the quarters December 1989 to June 2003.

[15] For the constant price series, the first estimates of the quarters December 1989 to December 1995 were expressed in 1982–1983 prices, while the quarters March 1996 to June 2000 were first expressed in 1991–1992 prices. For both of these periods, the prices of the base years also served as the 'fixed-weights' that were used to compile the volumes of constant price series. From the vintage that contained the first estimates for the September 2000 quarter, the series have been compiled using the 'chain-linking' technique and the volumes have been expressed in 1995–1996 prices.

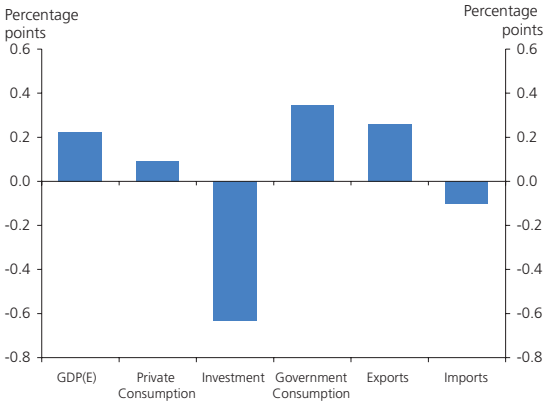
[16] Subsequent vintages have since been released.

[17] Alternatively, the final measures could have been defined as those estimates made a selected number of quarters after the first (ie, the set of ninth estimates, etc). However, in analysing past economic activity, it is the estimates contained in the latest vintage that are regarded as providing the 'true' figures.

Mean total revisions

Figure 4 shows the mean of the total revisions, expressed in percentage points, made to the quarterly growth rates of GDP(E) and its components over the quarters December 1989 to June 2003.[18] The mean revision to the quarterly growth rates of GDP(E) was 0.22 percentage points which, given an average first estimate for quarterly growth of 0.51 per cent, amounts to an increase of 44 per cent. The mean revisions made to the components of GDP(E) varied substantially. The first estimates of Investment growth were revised down on average by 0.64 percentage points, while the first estimates of growth in Government Consumption were revised up on average by 0.35 percentage points.

Figure 4
Mean total revisions to GDP(E) and its components



Mean absolute total revisions

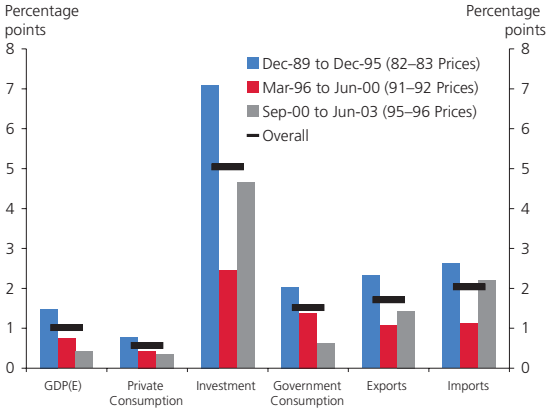
Changes in the size of the revisions over time can be compared using the mean of the absolute total revisions. Using absolute values prevents positive and negative revisions cancelling each other out. Figure 5 compares the mean absolute total revisions for GDP(E) and its components, both for the entire sample period (shown by the horizontal line) and for three sub-samples. The sub-samples represent the quarters over which different base years were used to express the volumes of the constant price series. Although changes in base years should not affect the growth rates, each re-basing coincided with the introduction of methodological improvements.

[18] The Investment series was created by summing several series published by SNZ.

For all the series, the mean of the absolute total revisions fell substantially between the first and second sub-samples, suggesting an improvement in the reliability of the first estimates. However, the same conclusion cannot be drawn

Figure 5

Mean absolute total revisions to GDP(E) and its components by sub-periods



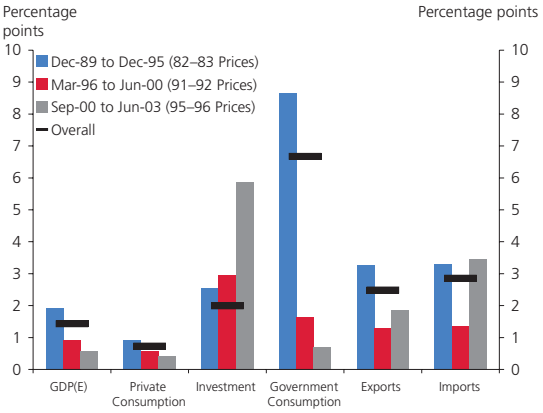
when comparing the second and third sub-samples. While the mean of the absolute total revisions made to GDP(E) and both Private and Government Consumption were smaller in the chain-linking period (the third sub-sample), the average revisions made to the Investment, Exports and Imports series all increased. This result may in part be due to the annual updating of the chain-linking weights, which has created the need for additional revisions.

Root mean square error of total revisions

The root mean square error is a measure of dispersion, where a higher value indicates greater volatility. As Figure 6 shows, the revisions made to GDP(E) and both Private and Government Consumption have become less volatile over time. However, the revisions made to both the Investment and Import series are more widely dispersed in the chain-linking period than in either of the fixed-weight periods.

Figure 6

Root mean square error of total revisions to GDP(E) and its components by sub-periods



6.2 Measuring the reliability of the total revisions

When analysing the latest quarterly measure of GDP(E) we assess whether this first estimate is an unbiased measure of the more accurate final estimate. Using the techniques employed by Mankiw, Runkle and Shapiro (1984) and more recently by Garratt and Vahey (2006) we test for bias in the revisions by estimating for each series the values of α and β in the following relationship:

$$\text{Total Revision}_t = \alpha + \beta \ \text{First}_t + \varepsilon_t \qquad \text{(Eq.1)}$$

where Total Revision_t (= Final_t - First_t) refers to the percentage point difference between the final and first estimates of the quarterly growth rate in quarter t, First_t denotes the first estimate of the quarterly growth rate and ε_t is a residual term. For the total revisions to be unbiased, the values of the two parameters, α and β, must be jointly insignificant from zero.

The results of the estimations are shown in table A1 of the Appendix. For each series, with the exception of Private Consumption, the values of α and β estimated using data from the first sub-sample (Dec-89 to Dec-95) were significantly different from the values estimated over the combined second and third sub-samples (Mar-96 to Jun-

Box 2

An international comparison of revisions to GDP(E)

To appreciate the relative size and dispersion of the revisions made to New Zealand's GDP(E), it is helpful to compare our revisions with those made by other countries' statistical agencies. Table 3 shows the key results from two major studies, by Faust, Rogers and Wright (2005) and by Ahmad, Bournot and Koechlin (2004), that analysed the revisions made to estimates of quarterly GDP(E) growth in each of the G7 countries. In the final column of table 3, we have computed the equivalent results for New Zealand, using where possible the same revision periods and definitions for the final estimates.

In comparison to the G7 countries, the revisions made to New Zealand's first estimates of GDP(E) growth were among the largest and most widely spread. Over both periods, New Zealand exhibited the largest mean total revision. In absolute terms, New Zealand's mean total revisions were first and second largest. For the period examined by Faust et al. (2005), revisions to New Zealand's GDP(E) had the largest root mean square error.

It is important to recognise that the statistical agencies of the G7 countries have been publishing quarterly estimates of GDP(E) for a much longer period than SNZ. As observed in figures 5 and 6, there have been substantial improvements in the size and dispersion of the revisions to New Zealand's quarterly GDP(E). For example, since the advent of chain-linking in New Zealand, the absolute mean total revision has been just 0.43 percentage points, which compares more favourably with the G7 countries. Both studies conducted their analysis using data from the Main Economic Indicators (MEI) published by the OECD. The first estimate released in the MEI is not necessarily the same as the first estimate released by the country's statistical agency.

More generally, it is important to remember that the size of the revisions will be dependent on the revisions policy of each country's statistical agency, and these sizes should not therefore be used as an indicator of data accuracy. Also, as countries release their first estimates of GDP(E) with different lags after the end of a period, any cross-country assessment of data quality should include measures of timeliness.

Interestingly, over both periods studied the mean of the total revisions were positive for all but two of the G7 countries. The tendency to underestimate initial growth rates, that was identified in New Zealand's GDP(E) estimates (see figure 4), appears widespread.

Table 3

Revision statistics for the GDP (E) measures of the G7 countries and New Zealand

	Canada	France	Germany	Italy	Japan	UK	US	NZ
Faust et al. (2005)	**Revision period:** 1988Q1 - 1997Q4* **Final Estimates:** April 2003 CD of MEI**							
Mean total revision	0.02	-0.02	0.22	0.03	0.05	0.25	0.11	0.28
Mean abs. total Revision	0.27	0.26	0.72	0.42	0.67	0.44	0.31	1.29
Root mean square	0.34	0.32	1.05	0.57	0.84	0.75	0.37	1.73
Ahmad et al. (2004)	**Revision period:** 1996Q1 - 2000Q4 **Final estimates:** June 2004***							
Final mean growth	1.05	0.74	0.44	0.50	0.51	0.75	0.98	0.74
Mean total revision	0.20	0.10	-0.08	0.13	0.22	0.16	0.06	0.26
Mean abs. total revision	0.28	0.27	0.40	0.39	1.02	0.34	0.38	0.75

* For New Zealand, the revision period used was 1989Q4 - 1997Q4.

** The authors used the October 2000 CD of MEI for Canada, West Germany and Japan. For New Zealand, the final estimates used were those released on 28/03/2003.

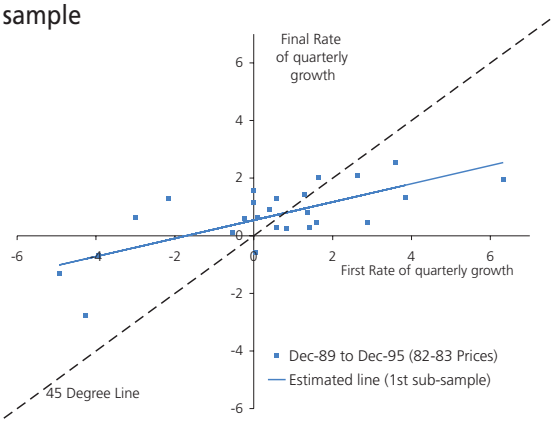
*** For New Zealand, the final estimates used were those released on 25/06/2004.

03).[19] Accordingly, we report two sets of results for these series.

From December 1989 to December 1995, the first sub-sample, the revisions made to all series were significantly biased.[20] In each series, it was found that the smaller the first estimate the greater the upward revision, and conversely the larger the first estimate the smaller the upward revision or the greater the downward revision. In this respect, the revisions compressed the amplitude of the business cycle.

Figure 7 illustrates the bias in the revisions made to GDP(E) present in the first sub-sample. The scatter points denote the actual values of the first and final rates of growth for each quarter, while the solid line shows the estimated relationship between the first and final rates. If the first estimates were unbiased, the estimated line would lie on, or close to, the 45 degree line shown in the figure. Instead, the slope of the line is substantially flatter than 45 degrees. First estimates of GDP(E) that were less than 0.79 per cent tended to be revised up, while those larger than this bound tended to be revised down. The mean first estimate of quarterly growth in GDP(E) over this period was 0.40 per cent and accordingly was revised up (by 0.27 percentage points) to 0.67 per cent.

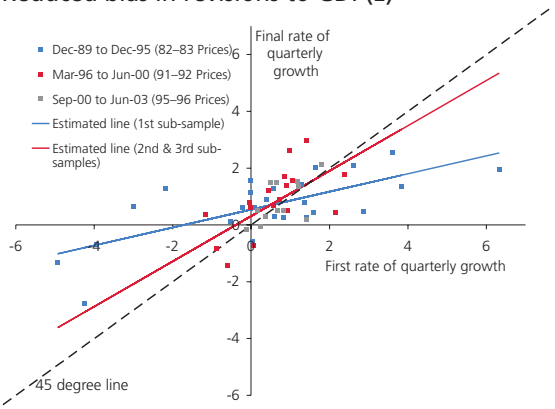
Figure 7
Bias in revisions to GDP(E) over the first sub-sample



Over the period March 1996 to June 2003, the second and third sub-samples, only the revisions made to Private Consumption, Government Consumption and Exports were significantly biased. In both series, there remained the tendency to compress the amplitude of the quarterly growth rates, by revising down the absolute size of expansions and contractions. However, for both the Government Consumption and Export series, the absolute revisions from this tendency were smaller than those estimated over the first sub-sample.

Figure 8 compares the relationship between the first and final estimates of growth in GDP(E) for quarters in the first sub-sample against quarters in the combined second and third sub-samples. The estimated line based on observations

Figure 8
Reduced bias in revisions to GDP(E)



from the last two sub-samples is clearly closer to the 45 degree line, implying a reduction in bias. Over these two sub-samples, the mean first estimate of quarterly growth in GDP(E) was 0.59 per cent and was revised up by only 0.19 percentage points to 0.78 per cent. As indicated by the results of table A1 and figure 8, there appears to have been a marked increase in the degree to which the first estimates of GDP(E) and the majority of its components provide reliable measures of the series final estimates.

[19] For each series (with the exception of Private Consumption), the structural break was found to be statistically significant at the 5 per cent level using a Wald test for structural change that allowed for unequal variances between the sub-samples. There was no significant difference in the estimated values of α and β between the second and third sub-samples for any of the series.

[20] That is, the probability that the values of α and β were jointly zero was less than 0.05.

6.3 Improvements in reliability provided by subsequent estimates of GDP(E)

Analysis of economic activity is most frequently conducted using the latest released vintage of GDP. Each quarter's estimate has had the opportunity to be revised one more time than the following quarter's estimate. Thus, it is important to focus not just on the extent to which first estimates of GDP are reliable indicators of the final estimates, but also on the marginal improvements offered by each subsequent estimate.

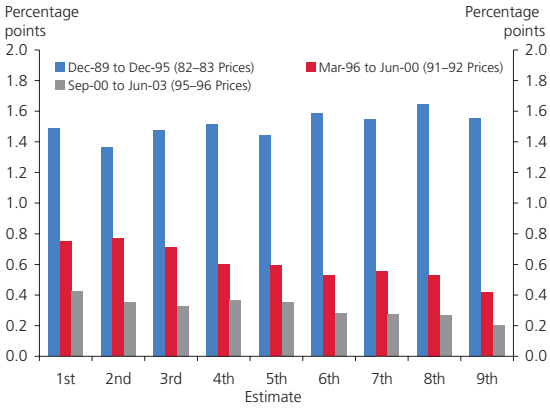
Figure 9 shows, for each of the three sub-samples, the mean revision (in absolute terms) between each of the first nine estimates of a quarter's GDP(E) growth and the quarter's final estimate. For example, the columns in the '9th Estimate' group provide the absolute mean revisions needed to reach each final estimate two years after the first estimates were released. Ideally, the size of the revision still to be made would decay quickly and smoothly with each subsequent quarter. This would imply that the early estimates are reasonably good approximations of their final figures.

For the first sub-sample however, the average value of the ninth estimate was no closer to the final estimate, in absolute terms, than the average value of the first estimate. The revisions made over the first two year period did not tend to move an estimate of growth closer to its final figure. In contrast, over the second and third sub-samples, the first nine estimates of GDP(E) growth show evidence of converging to their final estimate. Indeed, over the chain-linking period (the third sub-sample), more than half of the total revision had been made within the first two years. For these two sub-samples, subsequent estimates provided increasingly better indicators of the final estimate.

The results illustrated in figure 9 are supported by tests for bias shown in table A2 of the Appendix. For each estimate, the relationship between the revision still to be made and the measurement itself was estimated using Equation 1 and estimated values of the parameters α and β were obtained.[21,22] Over the first sub-sample, the bias detected in the total revisions made to GDP(E) was also found to persist in each of the eight subsequent estimates, and showed no sign of decay over time. Thus, the large upward revisions made to the first estimates of GDP(E) typically occurred after the two year period. Over the second and third sub-samples, all but one of the first nine estimates was unbiased. Furthermore, the estimated values of α and β generally became less significant in each subsequent quarter.

The general tendency to converge towards the final estimate, identified over the last two sub-samples shows a clear trade-off between the timeliness of an estimate and its reliability. The greater the length of time that an estimate has had to be revised, the closer the estimate is to its final value. The methodological changes made at the time chain-linking was introduced appear to have reduced the severity of this trade-off. Of course, in formulating monetary policy, the Reserve Bank faces time constraints. Analysis proceeds while bearing in mind the level of reliability associated with each figure.

Figure 9
Mean absolute revisions to the estimates of GDP(E)



[21] The values of α and β were found to be significantly different between the first and second sub-samples for each of the nine estimates.

[22] While Table A1 provides the relationships between the final and first estimates of different series, Table A2 shows the relationships between the final and each of the first nine estimates of GDP(E). The estimated values of α and β for GDP(E) shown in Table A1 are the same as the values for the 1st estimate shown in Table A2.

7. Conclusions

This article has introduced the real-time database constructed by the Reserve Bank. The database was created to provide greater insight into the latest measures of GDP(E) that are used to inform monetary policy decisions. As shown, the first estimate of GDP(E) for a quarter can be a noisy indicator of the eventual revised estimate at times.

Analysis was conducted of the revisions made to the constant price and seasonally-adjusted measures of GDP(E) and its components. Prior to chain-linking, revisions to New Zealand's GDP(E) measures were greater than those of some G7 countries. After the adoption of chain-linking in June 2001 the reliability of the first measures of GDP(E) and its components improved markedly.

We hope that the release of the New Zealand real-time database will prove to be useful to researchers interested in forecasting and policy issues.[23] Orphanides (2001) demonstrated the importance of using real-time data for policy evaluation. Recommendations for US monetary policy based on data available at the time the decision was made were found to differ considerably from those based on revised data. Garratt, Koop and Vahey (2006) used UK real-time data to forecast the probability of 'substantial' revisions (to which monetary policy may be sensitive). Researchers should find our real-time database helpful for similar New Zealand policy and forecast evaluations.

Appendix

Tables A1 and A2, opposite, report the estimation results discussed in sub-sections 6.2 and 6.3 respectively. The equations were estimated using Ordinary Least Squares. The estimated values of α and β are shown in the third and fourth columns of each table. The figures in brackets below each estimated parameter provides the probability that the coefficient is insignificantly different from zero.[24] The last columns of each table show the probability that the regression coefficients are jointly insignificantly different from zero. Small numbers (such as 0.05) in this column imply biased revisions.

When analysing the estimation results, several aspects of their computation should not be overlooked. First, the number of quarters in each of the two periods was small and this increases the likelihood of incorrectly inferring unbiased revisions. For example, Mankiw and Shapiro (1986) found no bias in US GDP when they used the sample 1975–1982. When Runkle (1998) used a larger sample, 1961–1996, he found that there was in fact a bias in US GDP. Second, the first estimates of quarters in the second and third sub-samples have had fewer opportunities to be revised, those estimates made in the first sub-sample. This may overstate the improvement in reliability.

[23] For a bibliography of papers that use real-time data, compiled by Dean Croushore, visit http://oncampus.richmond.edu/~dcrousho/docs/spf_bibliography.pdf

[24] These probabilities were calculated using Newey-West adjusted standard errors to correct for any heteroskedasticity and autocorrelation (Newey and West, 1987).

Table A1

Tests for bias in the revisions to GDP(E) and its components

Variable	Sample of quarters	α	β	Pr($\alpha = \beta = 0$)
GDP(E)	Dec-89 – Dec-95	0.54 (0.0135)	-0.68 (0.0000)	0.0000
	Mar-96 – Jun-03	0.31 (0.0394)	-0.20 (0.2779)	0.0718
Private Consumption	Dec-89 – Jun-03	0.31 (0.0096)	-0.36 (0.0040)	0.0061
Investment	Dec-89 – Dec-95	0.04 (0.9697)	-0.54 (0.0000)	0.0000
	Mar-96 – Jun-03	-0.47 (0.3332)	-0.07 (0.5840)	0.3505
Government Consumption	Dec-89 – Dec-95	0.42 (0.1293)	-0.74 (0.0014)	0.0007
	Mar-96 – Jun-03	0.24 (0.1671)	-0.15 (0.0000)	0.0000
Exports	Dec-89 – Dec-95	1.20 (0.0032)	-0.70 (0.0003)	0.0000
	Mar-96 – Jun-03	0.40 (0.0105)	-0.20 (0.0141)	0.0022
Imports	Dec-89 – Dec-95	0.62 (0.1210)	-0.47 (0.0000)	0.0000
	Mar-96 – Jun-03	-0.08 (0.7855)	-0.05 (0.6485)	0.6958

Table A2

Tests for bias in the revisions to GDP(E) over subsequent estimates

Estimate	Sample of quarters	α	β	Pr($\alpha = \beta = 0$)
1st Estimate	Dec-89 – Dec-95	0.54 (0.0135)	-0.68 (0.0000)	0.0000
	Mar-96 – Jun-03	0.31 (0.0394)	-0.20 (0.2779)	0.0718
2nd Estimate	Dec-89 – Dec-95	0.43 (0.0476)	-0.66 (0.0000)	0.0000
	Mar-96 – Jun-03	0.29 (0.1258)	-0.20 (0.3927)	0.2005
3rd Estimate	Dec-89 – Dec-95	0.47 (0.0475)	-0.69 (0.0000)	0.0000
	Mar-96 – Jun-03	0.27 (0.0747)	-0.19 (0.3125)	0.1582
4th Estimate	Dec-89 – Dec-95	0.48 (0.0704)	-0.77 (0.0000)	0.0000
	Mar-96 – Jun-03	0.21 (0.1452)	-0.05 (0.7074)	0.0716
5th Estimate	Dec-89 – Dec-95	0.46 (0.0450)	-0.71 (0.0000)	0.0000
	Mar-96 – Jun-03	0.19 (0.2107)	0.05 (0.7507)	0.0049
6th Estimate	Dec-89 – Dec-95	0.49 (0.0334)	-0.75 (0.0000)	0.0000
	Mar-96 – Jun-03	0.13 (0.3833)	-0.00 (0.9842)	0.1847
7th Estimate	Dec-89 – Dec-95	0.48 (0.0357)	-0.72 (0.0000)	0.0000
	Mar-96 – Jun-03	0.12 (0.5016)	-0.01 (0.9497)	0.2529
8th Estimate	Dec-89 – Dec-95	0.44 (0.0889)	-0.74 (0.0000)	0.0000
	Mar-96 – Jun-03	0.14 (0.3625)	0.02 (0.9032)	0.0741
9th Estimate	Dec-89 – Dec-95	0.48 (0.0440)	-0.74 (0.0000)	0.0000
	Mar-96 – Jun-03	0.07 (0.5510)	0.01 (0.9212)	0.4349

References

Ahmad, N, S Bournot and F Koechlin (2004), "Revisions to quarterly GDP estimates: a comparative analysis for seven large OECD Countries", OECD Paper presented at OECD-ONS Workshop, *Assessing and improving statistical quality – Revisions Analysis for the National Accounts*, 7-8 October 2004.

Carson, C and L Laliberte (2002), "Assessing accuracy and reliability: a note based on approaches used in national accounts and balance of payments statistics", *IMF Working Paper* 02/24.

Castle, J and C Ellis (2002), "Building a Real-time database for GDP(E)", *Spring Quarterly Bulletin*, Bank of England.

Croushore, D and T Stark (2003), "A real-time data set for macroeconomists: does the data vintage matter", *The Review of Economics and Statistics*, Volume 85, Issue 3.

di Fonzo, T (2005), "Revisions in quarterly GDP of OECD countries", *OECD paper prepared for working party on national accounts*, held on 11-14 October 2005.

Faust, J, J Rogers and J Wright (2005), "News and noise in G7 GDP announcements", *Journal of Money, Credit, and Banking*, Volume 37, Issue 3.

Garratt, A and S Vahey (2006), "UK real-time macro data characteristics", *Economic Journal*, Volume 116, Number 509.

Garratt, A, G Koop and S Vahey (2006), "Forecasting substantial data revisions in the presence of model uncertainty", RBNZ *Discussion Paper* 2006/02.

Mankiw, N, D Runkle and M Shapiro (1984), "Are preliminary announcements of the money stock rational forecasts?", *Journal of Monetary Economics*, Volume 14, Issue 1.

Mankiw, N and M. Shapiro (1986), "News or Noise? An analysis of GNP revisions", *NBER working paper series*, Working Paper No.1939.

Newey, W and K West (1987), "A simple positive semidefinite, heteroskedasticity and autocorrelation consistent covariance matrix", *Econometrica*, Volume 55, Issue 3.

Orphanides, A. (2001), "Monetary policy rules based on real-time data", *American Economic Review*, Volume 91, Issue 4.

Runkle, D. (1998), "Revisionist history: how data revisions distort economic policy research", *Federal Reserve Bank of Minneapolis Quarterly Review*, Volume 22, Issue 4.

Statistics New Zealand (1996), "Quarterly gross domestic product – sources and methods", SNZ Publication.

Statistics New Zealand (1998), "Chain volume measures in the New Zealand National Accounts", SNZ Publication.

Economic and financial chronology 2005

Alex Deans

January

19 Statistics New Zealand figures show that the CPI rose 0.9 per cent in the December 2004 quarter, bringing CPI inflation for the year to December 2004 to 2.7 per cent.

27 The Reserve Bank decides to keep the OCR unchanged at 6.5 per cent. The Bank notes inflation is expected to remain in the upper part of the 1–3 per cent band, with strong domestic demand and rising wage and salary pressures being partly offset by weakness in the export sector.

February

4 Public submissions close on the Reserve Bank's proposal to modernise New Zealand's 'silver' coins. Consultancy firm AC Nielsen begins analysis of public feedback.

March

10 The Reserve Bank increases the OCR 25 basis points to 6.75 per cent when releasing its *Monetary Policy Statement*. The inflationary pressures associated with continued employment growth and high consumer and business confidence are cited as reasons for the tightening of policy. The Bank notes that the economy is close to a turning point and slower growth is expected later in 2005.

18 A letter is sent to all New Zealand banks regarding proposed consultation about the implementation of the new Basel II capital framework. The new rules aim to increase the banks' solvency.

20 The New Zealand dollar buys US$.7465, a 23 year high.

24 Statistics New Zealand's GDP figures show an increase in economic activity of 0.4 per cent for the December 2004 quarter. Annual growth in GDP was 4.8 per cent for the year to December 2004.

31 The Reserve Bank confirms changes to the currency. Fifty, twenty and ten cent coins will be smaller in the future and made of lower cost steel-plate. The five cent coin will be removed from circulation.

April

11 Statistics New zealand figures show the CPI rose 0.4 per cent in the March 2005 quarter, bringing CPI inflation for the year to March 2005 to 2.8 per cent.

28 The Reserve Bank keeps the OCR unchanged at 6.75 per cent. The Bank notes that overall household demand is very strong, especially in the housing sector. The labour market shows little sign of softening. There are some signs the economy is slowing in some sectors but further tightening of policy cannot be ruled out in the near future, given strong inflation pressures

May

4 Minister for the Environment Pete Hodgson announces details of the proposed Kyoto Protocol based carbon tax. It will commence in April 2007, and be set at $15 per tonne of carbon dioxide. This will apply to 2012.

13 Commerce Minister Pete Hodgson announces proposed changes to legislation governing friendly societies and credit unions, included in a general review of non-bank financial products.

17 The Reserve Bank releases its first *Financial Stability Report* for the year. It notes that, despite an increase in risks faced by households and some businesses, the financial system is in a good position to weather a possible downturn in the economy.

19 The Minister of Finance, Dr. Michael Cullen, releases the 2005 Budget. Key features include:

- Additional spending especially in health, education, defence, police and social welfare (via an increase in the Working for Families package).
- the creation of Kiwisaver, a new work based savings scheme.

- changes to tax, including cuts to encourage savings and investment and to assist small business;
- a carbon charge in line with Kyoto Protocol obligations; and
- the OBERAC (Operating Balance Excluding Revaluations and Accounting Changes) is projected to be a surplus of $7.4 billion for 2005/2006.

June

9 The Reserve Bank decides to keep the OCR unchanged at 6.75 per cent when it releases its *Monetary Policy Statement*. It notes that the balance of inflation risks is on the upside with continued strength in the household spending and housing markets. However, the effect of past monetary policy tightening has not yet been fully realised and a number of indicators point to a slowing economy.

16 The Finance Minister, Dr. Michael Cullen, announces changes to tax laws. Changes include:

- foreign owned banks having to pay sufficient tax on income earned in New Zealand;
- making it easier for businesses to claim tax deductions on environmental expenditure; and
- the income of banks cannot be sheltered by interest deductions arising from excessive debt.

24 Statistics New Zealand figures show GDP increased 0.6 per cent over the March 2005 quarter. Annual growth in GDP was 4.2 per cent for the year to March 2005.

July

14 Statistics New Zealand figures show the CPI rose 0.9 per cent in the June 2005 quarter, bringing CPI inflation for the year to June 2005 to 2.8 per cent.

28 The Reserve Bank keeps the OCR unchanged at 6.75 per cent at its interim review. It notes a weaker exporting sector influenced by the high New Zealand dollar, and the subsequent softening of GDP growth, as partly offsetting the inflationary effects of the strong housing market. The Bank does not rule out increasing the OCR in the future if short-term pressures from rising oil prices start to affect medium-term inflation expectations.

August

30 The price of Brent crude oil hits a record high of US$70.58 a barrel following Hurricane Katrina. The storm hits the southern coast of the United States causing loss of life, widespread destruction to oil drilling and refining facilities, and flooding to the city of New Orleans and surrounding areas.

31 Following a tender process, the Royal Canadian Mint is chosen to manufacture the new range of New Zealand coins.

September

15 The Reserve Bank leaves the OCR unchanged at 6.75 per cent when it releases its *Monetary Policy Statement*. With the housing market still strong, consumer spending continues to rise despite high oil prices. Inflationary pressures remain strong, although there is now growing evidence of a slowdown in sectors such as tourism and manufacturing.

18 The General Election results in Labour winning 50 seats, National 48, New Zealand First seven, the Greens six, the Maori Party four, United Future three, Act two, and the Progressives one.

28 Statistics New Zealand figures show total foreign investment in New Zealand at 31 March 2005 was $224.1 billion, up $21.9 billion (10.8 per cent), from a year earlier. Of this increase, increased investment by Australian investors accounted for $6.7 billion. The value of New Zealand's investment abroad was $98.0 billion.

29 Statistics New Zealand figures show GDP increased 1.1 per cent over the June 2005 quarter. Annual growth in GDP was 3.1 per cent for the year to June 2005.

October

4 The NZSX-50 Sharemarket index reaches a record high of 3470.74.

14 Reserve Bank Governor, Dr. Alan Bollard, voices concerns about perceived "imbalances" in New Zealand's economy including the current account deficit (now at 8 per cent of GDP), and steady growth in the household debt to income ratio.

17 Statistics New Zealand figures show the CPI rose 1.1 per cent in the September 2005 quarter, bringing CPI inflation for the year to September 2005 to 3.4 per cent.

18 Prime Minister Helen Clark announces details of the new Labour-led Government. It consists of a Labour-Progressives coalition with confidence and supply agreements with New Zealand First and United Future. Progressives leader Jim Anderton will have a post in cabinet, with New Zealand First's Winston Peters and United Future's Peter Dunne both being Ministers outside Cabinet.

27 The Reserve Bank increases the OCR 25 basis points to 7.00 per cent at its interim review. The Bank notes its concerns about high oil prices, a housing market that shows little sign of weakening, and the expansionary fiscal policy of the new government.

November

10 Statistics New Zealand figures show that the employment rate, as measured by the Household Labour Force Survey, reached the lowest level in the survey's 19 year history at a figure of 3.4 per cent in the September quarter. This represents the lowest rate among the OECD group of countries.

11 The Reserve Bank announces a joint project with The Treasury and Inland Revenue Department that will explore whether ancillary instruments could be deployed to complement monetary policy in the task of managing inflation pressures. The Bank notes that the project has been prompted by the strength and persistence of domestic demand, the scale of the accompanying external imbalances, and the key role being played by the current house price cycle. The Bank notes that such tools, if they exist, may enable less reliance to be placed on the Official Cash Rate, thereby reducing some of the pressure on the exchange rate.

17 The APEC ministerial meeting concludes in Busan, South Korea. Member nations agree to continue to support the Doha Round of global trade talks despite the current deadlock at the World Trade Organisation.

18 The Reserve Bank releases its second *Financial Stability Report* for the year. Overall the financial sector is still well placed to weather a slowdown in the economy. The risks to the market continue to grow, however, as the combination of rising household debt and a large current account deficit increases the chance of a hard-landing from a fall in the New Zealand dollar.

December

8 The Reserve Bank increases the OCR 25 basis points to 7.25 per cent when releasing its *Monetary Policy Statement*. It highlights that consumer demand and household spending remains strong, despite previous interest rate rises. These inflationary pressures are being driven by a housing market that still shows limited signs of cooling.

19 The World Trade Organisation, meeting in Hong Kong, agrees to end farm export subsidies by 2013.

21 It is announced that Cabinet has agreed in principle that the Reserve Bank should be the sole prudential regulator of the financial sector. This announcement follows a review of financial products and providers undertaken by the Ministry for Economic Development.

Labour Minister Ruth Dyson announces the adult minimum wage is to increase from $9.50 to $10.25 an hour from 27 March 2006.

The Government announces it has scrapped plans to introduce a carbon tax in April 2006 and will instead look at alternative methods of meeting commitments to cut greenhouse gas emissions.

22 Statistics New Zealand figures show that GDP increased 0.2 per cent for the September 2005 quarter. Annual growth in GDP was 2.3 per cent for the year to September 2005.

The current account deficit reaches 8.5 per cent of Gross Domestic Product, the highest since 1986.

DISCUSSION PAPERS

This section sets out the abstracts of recently issued Reserve Bank Discussion Papers. Papers are available for download on www.rbnz.govt.nz, and may also be requested in hard copy from the Reserve Bank.

DP2005/06

A simple, structural, and empirical model of the Antipodean transmission mechanism

Thomas A Lubik

This paper studies the transmission of business cycles and the sources of economic fluctuations in Australia and New Zealand by estimating a Bayesian DSGE model. The theoretical model is that of two open economies that are tightly integrated by trade in goods and assets. They can be thought of as economically large relative to each other, but small with respect to the rest of the world. The two economies are hit by a variety of country-specific and world-wide shocks. The main findings are that the pre-eminent driving forces of Antipodean business cycles are worldwide technology shocks and foreign, ie, rest-of-the-world, expenditure shocks. Domestic technology shocks and monetary policy shocks appear to play only a minor role. Transmission of policy shocks is asymmetric, and neither central bank is found to respond to exchange rate movements. The model can explain 15 per cent of the observed exchange rate volatility.

DP2005/07

Discretionary policy, potential output uncertainty, and optimal learning

James Yetman

We compare inflation targeting, price level targeting, and speed limit policies when a central bank sets monetary policy under discretion, and must learn about the level of potential output over time. We show that if the central bank learns optimally over time, a speed limit policy dominates [is dominated by] a price level target if society places a high [low] weight on inflation stability. Inefficient learning on the part of the central bank can radically change this conclusion. A speed limit policy is favoured if the central bank places too much weight on recent data when estimating potential output, while a price level target is favoured if the central bank places too much weight on historical data.

DP2006/01

Phillips curve forecasting in a small open economy

Troy Matheson

Stock and Watson (1999) show that the Phillips curve is a good forecasting tool in the United States. We assess whether this good performance extends to two small open economies, with relatively large tradable sectors. Using data for Australia and New Zealand, we find that the open economy Phillips curve performs poorly relative to a univariate autoregressive benchmark. However, its performance improves markedly when sectoral Phillips curves are used which model the tradable and non-tradable sectors separately. Combining forecasts from these sectoral models is much better than obtaining forecasts from a Phillips curve estimated on aggregate data. We also find that a diffusion index that combines a large number of indicators of real economic activity provides better forecasts of non-tradable inflation than more conventional measures of real demand, thus supporting Stock and Watson's (1999) findings for the United States.

DP2006/02

Forecasting substantial data revisions in the presence of model uncertainty

Anthony Garratt, Gary Koop and Shaun P. Vahey

A recent revision to the preliminary measurement of GDP(E) growth for 2003Q2 caused considerable press attention, provoked a public enquiry and prompted a number of reforms to UK statistical reporting procedures. In this paper, we compute the probability of "substantial revisions" that are greater (in absolute value) than the controversial 2003 revision. The pre-dictive densities are derived from Bayesian model averaging over a wide set of forecasting models including linear, structural break and regime-switching models with and without heteroskedasticity. Ignoring the nonlinearities and model uncertainty yields misleading predictives and obscures the improvement in the quality of preliminary UK macroeconomic measurements relative to the early 1990s.

NEWS RELEASES

Reserve Bank issues *Financial Stability Report*

18 November 2005

The Reserve Bank today released its *Financial Stability Report*, a twice-yearly report that assesses the robustness of the New Zealand financial system. Reserve Bank Governor Alan Bollard commented: "The New Zealand financial system, overall, is well placed to weather a possible slowdown in the economy. The economic expansion of recent years has been reflected in strong financial sector balance sheets, and levels of trading in financial markets that have given them depth and liquidity.

"However, these same developments have also sown the seeds for a more testing time ahead. Household indebtedness has continued to climb, relative to household incomes, and house prices have become more inflated. Farm debt and farm land prices also appear stretched.

"A counterpart to these developments has been a further widening of the balance of payments current account deficit, to 8 per cent of GDP. This deficit is very large by OECD standards and is not sustainable over the medium term.

"Adjustment to these imbalances, if abrupt, could test the resilience of the financial system.

"In financial markets, large imbalances invariably trigger changed risk assessments at some point. These can be abrupt and can result in financial market volatility.

"There are also implications for borrowers, and for the lending institutions. Adjustment to imbalances will mean changes in the circumstances facing many households and firms, and possible strains on the abilities of some to service debt.

"We do not see those strains as spilling over to the financial system on a scale that would undermine its overall stability - though specific stresses cannot be ruled out.

"All in all, the risk conditions facing the financial system over the next six months could be more testing than during the past six months. Maintenance of ongoing financial stability will require prudent management and pricing of risk by all participants – by those who borrow, by the institutions that lend, and by those who invest in the financial markets."

Reserve Bank issues Briefing

22 November 2005

The Reserve Bank today released a Briefing on the Reserve Bank of New Zealand. The Briefing was prepared prior to the General Election as a resource for the incoming Minister of Finance.

The Briefing outlines the key functions of the Reserve Bank, each of which contributes to the goal of promoting and maintaining a stable macroeconomic environment and a sound and efficient financial system.

Section one summarises the Bank's institutional arrangements, and, in particular, the mandate established by the Reserve Bank of New Zealand Act 1989.

Sections two, three and four cover respectively: monetary policy, financial system stability, and the Bank's other functions and activities. Each section provides an accessible summary of both the institutional context within which the Reserve Bank operates and the policy issues that the Bank is currently working on.

The Briefing on the Reserve Bank of New Zealand is available on the Bank's website at www.rbnz.govt.nz.

Reserve Bank increases OCR to 7.25 per cent

8 December 2005

The Official Cash Rate (OCR) will increase by 25 basis points to 7.25 per cent.

As emphasised in our September MPS, and again at the October OCR Review, we remain concerned about the tightness of resources and the persistence of inflation pressures. Exporters and other businesses exposed to the very high exchange rate are under considerable pressure and general business sector confidence is falling in the face of declining profit margins. However, overall demand continues to outstrip available capacity. The main driver of the strong demand is household spending, linked to a still-buoyant housing market. Increasing government spending and continued strong business investment are also boosting total demand. The resulting excess demand, reflected in a growing current account deficit, is continuing to fuel inflation.

Excluding one-off oil price effects, inflation has been trending upwards. Furthermore, while headline inflation is expected to return below the upper end of our target band by mid-2006, it is projected to remain high throughout the projection period. In addition, there is a risk that inflation could track higher. Mortgage credit growth and house prices have held up longer than anticipated; we are forecasting these to slow markedly in 2006, but continued strength remains a risk. The current high rates of increase in labour and other business costs present a further risk, particularly if inflation expectations become locked in at current high levels.

The main downside risk to our projections is the prospect of a faster-than-expected correction in domestic demand, leading to a harder landing for the economy and a more rapid easing of inflation pressures. A further downside risk arises if the current exchange rate strength persists, putting greater downward pressure on activity and medium-term inflation.

This outlook, combined with the lack of inflation headroom, has led us to increase the OCR today. Whether further tightening is needed will depend on the extent to which housing and demand pressures show signs of moderating over the months ahead. However, we do not yet see any prospect of a policy easing in the foreseeable future.

RBNZ releases finalised outsourcing policy for banks

18 January 2006

The Reserve Bank today published its finalised policy on the requirements which will apply to large New Zealand banks that have entered into outsourcing arrangements. The final policy follows consideration of comments on a draft policy issued in October 2005.

Reserve Bank Deputy Governor Adrian Orr said: "While outsourcing of banks' business functions is increasingly common and often a sensible business practice, it can expose banks and the financial system to new or increased risks that must be managed appropriately. Under the Reserve Bank's policy, outsourcing is permitted so long as it does not undermine a large bank's ability to continue to provide core liquidity, payment and transaction services both in good times and under stress."

"Failures of banks and of service providers to banks are low-probability events, but they can have a potentially high and immediate impact across the economy. The outsourcing policy provides safeguards to the stability of the New Zealand financial system against the possibility of such occurrences.

"Consistent with our earlier proposals, the policy focuses on ensuring that the boards of large New Zealand banks maintain the legal and practical ability to control outsourced functions so that the banks can continue to provide critical services in a crisis situation. The policy also requires the boards to exercise meaningful control and oversight over the bank's chief executive and staff."

Mr Orr commented that "the policy maintains our approach of focusing on the outcomes we require of banks, rather than being prescriptive about banks' systems. This approach allows banks more flexibility in meeting the requirements and means that the policy will not involve excessive costs for them. The emphasis also remains on bank directors managing outsourcing risk as part of their normal business processes".

The Reserve Bank will now work on implementation of the policy with those banks that are subject to it. Implementation will take into account each bank's individual circumstances and investment cycles.

OCR unchanged at 7.25 per cent

26 January 2006

The Official Cash Rate (OCR) will remain unchanged at 7.25 per cent.

Reserve Bank Governor Alan Bollard said: "The economy has continued to slow in recent months, broadly in line with the outlook contained in our December *Monetary Policy Statement*. GDP growth slowed in the third quarter of 2005, due to the impact of the high exchange rate on the export and import-competing sectors, and a fall in construction. Looking to 2006, while there are some early indications, we are yet to see hard evidence of a sustained slowdown in domestic demand. To date, strong domestic demand has

been fuelled by strong employment, wage growth, rising house prices, and growth in Government spending. Overall, total spending continues to outstrip growth in production, contributing to an unsustainably large current account deficit.

"Over recent years, considerable pressures have built up on resources, leading to the current high level of inflation. While capacity and resource constraints appear now to be easing, inflation pressures remain of concern. Annual CPI inflation stands at 3.2 per cent, and our forecasts point to inflation remaining toward the upper end of the target band over the next couple of years. Continuing increases in wages, energy prices and other business costs suggest that inflation pressures will not subside quickly. Of particular concern, inflation expectations remain uncomfortably high.

"Given this situation, we do not expect to raise the OCR further in this cycle; however, this possibility cannot be ruled out until we see clear evidence of a sustained weakening in domestic demand. Certainly we see no prospect of an OCR easing, given the relatively high medium-term inflation outlook. An early decline in interest rates, as expected by some in the financial markets, would risk reigniting spending and hence inflation pressures."

Big changes afoot in the world economy

27 January 2006

Big changes occurring in the world economy could impact significantly on New Zealand's competitiveness and ultimately its economic performance, Reserve Bank Governor Alan Bollard said today.

In a speech to the Canterbury Employers' Chamber of Commerce in Christchurch, Dr Bollard identified three major global developments that are making a significant difference to the pricing of particular goods and services.

These developments are:

- The integration into the global economy of China and other emerging market economies with large reserves of labour.
- An increased 'premium' placed on security, arising from geopolitical and bio-security considerations, global warming and acts of nature.
- A housing boom in some OECD countries.

"New Zealand has been growing strongly over the last decade, driven by improved efficiency, high participation and stronger terms of trade," Dr Bollard said. "Ultimately our future performance will depend on our ongoing relative competitiveness. These big global changes have the potential to impact that in a significant way."

The integration of China and other emerging economies had improved productivity in the global economy and made capital more available. In particular, the production and distribution of manufactured goods had become cheaper.

"In New Zealand – like most OECD countries – we have known for some time we cannot compete across a range of general manufactures with the big low-cost producers," Dr Bollard said.

The trend had been good news for household and business consumers, but the price of resources had increased, particularly oil.

"On balance, we have had good news: strong commodity prices for much of our primary sector, and a significant improvement in our terms of trade" Dr Bollard said. The price of global security had also increased. "New Zealand is by no means immune to personal and environmental risks, but on balance our isolation and vigilance to bio-hazards has largely protected us from these, enhancing our competitive position in food production, tourism and education," Dr Bollard commented.

Dr Bollard commented that there had been a big adjustment to OECD balance sheets from the housing boom. This phenomenon also carried significant risks, leaving New Zealanders highly leveraged within a world of growing imbalances. Dr Bollard said the Reserve Bank had put considerable effort into ensuring that New Zealand's financial system remained robust in the face of shocks.

"But New Zealand has a challenge ahead as it learns to reduce household debt and work down its deficit with the rest of the world."

Dr Bollard concluded that the big global changes were hard to assess in the short term, but were probably bigger than most New Zealanders had seen in their working lives.

"There is some good news for New Zealand's international position in the medium term, but some big policy challenges to adjust in the short term. For business and households, acumen and agility will be rewarded as the world changes around us," he said.

Reserve Bank to temporarily raise Settlement Cash Level

31 January 2006

The Reserve Bank of New Zealand will temporarily raise the Settlement Cash Level (SCL) from its current level of $20 million to $500 million, for value date 2 February 2006. The SCL is the amount of cash that the Reserve Bank targets to leave in the banking system each day.

This change in the settlement cash level reflects the Reserve Bank's concern over recent liquidity pressures in the New Zealand financial market, which it expects will be exacerbated by the upcoming New Zealand Government Bond maturity on 15 February 2006. The bond maturity will reduce the amount of collateral available for banks to use to raise funds for their intra-day liquidity, to meet payment and settlement obligations.

The Reserve Bank will review the impact of this increase over the following days and may increase the SCL further, if it considers this appropriate. This is a technical adjustment to the way the Reserve Bank conducts its liquidity management operations and all other aspects of its daily operations will remain unchanged. This change has no monetary policy significance.

The Reserve Bank will reassess the SCL on an ongoing basis.

Technical information on how the Reserve Bank conducts its liquidity management operations can be found in the December 2004 *Bulletin* located on the Reserve Bank's website (www.rbnz.govt.nz).

Reserve Bank to raise Settlement Cash Level to $2,000 million

10 February 2006

The Reserve Bank of New Zealand will raise the Settlement Cash Level (SCL) from its current level of $500 million to $2,000 million, for value date 13 February 2006.

This change in the settlement cash level reflects the Reserve Bank's concern over liquidity pressures in the New Zealand money market created by the upcoming New Zealand Government Bond maturity on 15 February 2006. The bond maturity reduces the amount of collateral available for banks to use. Banks use collateral to raise funds for their intra-day liquidity to meet payment and settlement obligations.

The Reserve Bank will assess the SCL on an ongoing basis.

This is a technical adjustment to the way the Reserve Bank conducts its liquidity management operations and all other aspects of its daily operations remain unchanged. This change has no monetary policy significance.

Technical information on how the Reserve Bank conducts its liquidity management operations can be found in the December 2004 Bulletin located on the Reserve Bank's website (www.rbnz.govt.nz).

New Zealand's new coins introduced on 31 July 2006

20 February 2006

The Reserve Bank announced today that New Zealand's new 50, 20 and 10 cent coins will be introduced on 31 July 2006.

The new coins will be smaller and lighter than the existing coins. The coins will retain the same designs, and the 10 cent coin will be copper-coloured. The $1 and $2 coins will not change.

"There will be a transition period of three months, from 31 July 2006 to 31 October 2006; during which time both old and new coins can be used. From 1 November 2006 you will not be able to use the old coins, including the 5 cent coin, but you will always be able to redeem them at the Reserve Bank," commented Brian Lang, Reserve Bank Currency Manager.

The Reserve Bank has been working closely with banks, security companies, vending machine suppliers, retailers and community groups over the last year to ensure a smooth transition to the new coins.

Brian Lang said these are important changes that will affect everyone in New Zealand. They will bring major benefits to all New Zealanders, especially businesses involved in handling coins.

PUBLICATIONS

Annual Report	Published in October each year.
Financial Stability Report	Published six-monthly. A statement from the Bank on the stability of the financial system. First copy free.
Monetary Policy Statement	Published quarterly. A statement from the Bank on the conduct of monetary policy. First copy free, subsequent copies $12.00.

Reserve Bank of New Zealand Statement of Intent, 2004–2007
Snakes and Ladders – a guide to risk for savers and investors

Recent Reserve Bank Discussion Papers

2005

DP2005/01	Factor model forecasts for New Zealand Troy Matheson
DP2005/02	Mind your Ps and Qs! Improving ARMA forecasts with RBC priors Kirdan Lees and Troy Matheson
DP2005/03	A happy 'halfway-house'? Medium-term inflation targeting in New Zealand Sam Warburton and Kirdan Lees
DP2005/04	Reaction functions in a small open economy: What role for non-traded inflation? Ana Maria Santacreu
DP2005/05	UIP, expectations and the Kiwi Anella Munro
DP2005/06	A simple, structural, and empirical model of the Antipodean transmission mechanism Thomas A. Lubik
DP2005/07	Discretionary policy, potential output uncertainty, and optimal learning James Yetman

2006

DP2006/01	Phillips Curve forecasting in a small open economy Troy Matheson
DP2006/02	Forecasting substantial data revisions in the presence of model uncertainty Antony Garratt, Gary Koop and Shaun P. Vahey

Full lists of Discussion Papers are available from Administration, Economics Department. Lists of the Working Papers and the Research Notes can also be obtained from the Economics Department.

Pamphlets

Central banking in New Zealand
This is the Reserve Bank
Your Bank's disclosure statement – what's in it for you?

For further information, go to www.rbnz.govt.nz, or contact:

Knowledge Centre
Knowledge Services Group
Reserve Bank of New Zealand
2 The Terrace, P O Box 2498
WELLINGTON
Phone (04) 4722–029

Articles and speeches in recent issues of the Reserve Bank of New Zealand *Bulletin*