The Costs of Inflation Revisited

In this article, Samantha Johnson provides a detailed discussion on the costs of inflation, with particular reference to the considerable amount of new literature on this topic produced in the last two or three years.

Executive Summary

Monetary policy arrangements in New Zealand reflect the view that inflation is very costly, and that price stability is the appropriate policy objective, setting aside from measurement issues. The costs of inflation arise in a variety of forms depending, for example, on whether inflation is anticipated or unanticipated, and on how it interacts with the tax system, or with institutional practices, conventions or constraints in various markets. These costs reflect both the direct effects of inflation, and the costs incurred as individuals and businesses devise ways of protecting themselves against inflation.

The core costs of inflation, arising even when inflation is fully anticipated, reflect the fact that economies are not fully indexed. Specifically, costs arise from the lack of indexation of currency; relative price confusion, ‘search’ costs and ‘menu’ costs; incomplete indexation of the tax system; and incomplete indexation of financial contracts.

Inflation is seldom fully anticipated, however. The effects of anticipated inflation (eg in respect of income and wealth redistributions and relative price confusion) and exacerbated when inflation surprises people, or when the future path of inflation is uncertain. There are also additional effects in these cases. The additional effects include increased inflation risk premia in financial and other contracts; a reduction in the length of financial and wage contracts; and consequent difficulties for longer-term business planning. Furthermore, these effects worsen as the average level of inflation increases.

Views differ as to whether the negative effects of inflation on aggregate output, or on output growth, are very significant. But there is now a fairly considerable amount of international evidence which consistently shows that an inflation rate of, say, 5 percent could reduce annual economic growth by at least 0.5 percent for an extended period.

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Introduction

New Zealand used to have one of the worst track records on inflation in the OECD. Now, we have Consumer Price Index (CPI) inflation outcomes of around 1 percent, and one of the lowest rates of inflation in the OECD. Much of this achievement is due to the commitment on the part of New Zealand Governments over the last eight years or so, to use monetary policy consistently as the primary tool to remove inflation. This decision in turn reflects the judgement that persistent inflation is costly to economic and social well being, and that controlling inflation is the only objective monetary policy can achieve on a sustainable basis.

Yet the judgment that inflation involves significant costs is not one that has always been universally accepted. Indeed, especially in the period up to the 1960s, many economists and policy makers were convinced that some inflation was actually beneficial for income and employment growth. From the 1960s, however, there were growing empirical and theoretical grounds to doubt that any such gain was stable, or even existed outside of the short-term. Instead, any positive relationship between inflation and employment would only last until inflation expectations caught up with actual inflation, nullifying the effect on employment. Consequently, there was a 'natural' rate of output and (un)employment which was immune to the influence of inflation, except in the short-term through the effect of inflation surprises.

In the 1970s, the experience of simultaneous high unemployment and high inflation in many countries started to fuel the view that even the 'natural rate' model did not adequately capture the relationship between inflation and output or growth. The costs of inflation might well be sufficiently large to have a significant and long-lasting negative impact on the level and possibly growth rate of aggregate output and employment.

Ultimately, the costs of inflation arise because money forms an integral part of the market mechanism in capitalist societies. In contrast with a barter economy, goods are exchanged for money, which acts to separate the process of purchase from the process of selling. Money serves as a means of exchange and a store of value, as well as a unit of account - i.e., a measure through which the price of goods and services are expressed so as to reflect the relative value of each item in comparison to all others. Inflation imposes costs because it reduces the capacity of money to fulfil these functions by distorting the true value of money, the value of individual's wealth held in money-like forms, and the value of goods and services bought using money.

These costs arise in a variety of forms, depending, for example, on whether inflation is fully anticipated or whether the inflation outcome surprises people; and on how it is interacting with the tax system, or with institutional practices, conventions or constraints in financial or labour markets. The purpose of this article is to provide a fairly detailed review of the professional literature on the costs of inflation, with particular emphasis

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1 Friedman (1977) suggested that the negative relationships between inflation and employment arose because an economy was not able to fully adjust for the effects of inflation. In time, if inflation were to remain stable for many years, the economy would ultimately find ways to fully adjust to this level of inflation but, in Friedman's view, this could take many decades.

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on relatively recent work. Indeed, there has been a considerable amount of new work in this area in the last two or three years. The article therefore extends and updates previous material published by the Bank.²

The article first considers the costs that arise from fully anticipated inflation. This discussion highlights the 'core' costs that can be expected from any type of inflation. Next, the costs of inflation surprises, inflation variability, and uncertainty about the future inflation path are considered. The article then examines the extent to which the effects of inflation impact on the level or growth rate of aggregate output. Following this, the article discusses whether an optimal rate of inflation would be some (low) positive rate of inflation or zero inflation. A summary section concludes the article.

It should be noted that this article does not address the costs of achieving price stability from a starting point of high inflation. The mainly transitional costs of disinflation are a large topic in their own right, outside the focus of this article. The discussion here represents instead an examination of the relative merits of maintaining price stability versus allowing inflation to re-emerge.

The Costs of Anticipated Inflation

It is sometimes argued that the important costs from inflation arise from inflation surprises (ie, ‘unanticipated’) inflation and uncertainty about future inflation. Hence, undertaking a process of disinflation is unnecessary. The central bank ‘only’ has to stabilise inflation, thereby removing any uncertainty or unanticipated element. However, even if it were possible to stabilise inflation at some positive, fully anticipated rate (and it is doubtful that this is possible), significant economic distortions will arise from anticipated inflation because, in various ways, economies are not fully indexed for inflation. More specifically, in the absence of full indexation, costs will arise due to the lack of indexation of the currency; ‘menu’ and search costs, and temporary relative price distortions; and the incomplete indexation of financial contracts and the tax system.

The Non-indexation of Transactions Balances

Inflation erodes the purchasing power of currency and non-interest bearing deposits (‘transactions balances’) by reducing over time the amount of real goods and services that can be bought by given amounts of such balances. Holding money in the presence of inflation therefore leads to a transfer of resources away from money holders to the Government (the ultimate issuer of currency), or to borrowers (in the case of loans funded from cheap deposits). People respond to inflation by holding less cash and consequently face instead the cost of using other methods to maintain an adequate level of liquidity for their level of real consumption. Since these costs may involve making more ‘trips to the bank’, they are sometimes known as ‘shoe leather’ costs.

Beyond this effect, views differ as to whether a decline in the demand for (real) transactions balances has a uniformly negative impact on economic output. One view is that when the cost of holding real balances increases, the substitution out of holding

money is partly into holding capital. Therefore, higher inflation leads to a higher capital stock. An opposing view is that when individuals economise on real money balances, real purchases decrease. Consequently, the capital stock decreases. The evidence on this question is not very clear cut, but may point more towards the second view.

It seems likely that the size of the above costs and redistributions has declined over the years, as currency holdings have shrunk relative to incomes due to innovations in payments and banking technologies, and with interest-bearing cheque accounts becoming more common. Not all of the new payments technologies would necessarily be economic in an environment of price stability however, and to that extent still involve a loss of economic welfare. Gillman (1992), for example, suggests that this applies to the substitution of credit for cash in the transactions process. In general, empirical tests for the net welfare costs of the non-indexation of currency suggest that these costs are small, but not insignificant. Some studies have suggested that this welfare cost is between 0.1 and 0.4 percent of GNP for a sustained 10 percent rate of inflation.

'Menu' Costs, Relative Price Distortions, and Search Costs

'Menu' costs are the direct costs of changing prices, and recalculating wage or interest payments and the like. In the absence of inflation, such costs will only occur with changes in relative prices. Higher inflation will require more frequent changes in all prices and so involve greater costs. The direct cost of changing prices is most probably very small in individual cases, but can nevertheless add up to a reasonably significant amount in aggregate.

A related issue arises from the fact that sellers do not change prices continuously, but tend to do so at discrete points in time. As inflation increases, more frequent adjustment is needed. But because sellers cannot co-ordinate price adjustments to ensure relative prices remain unaffected, relative prices will become temporarily distorted. Given that the efficient functioning of modern market economies improves with the accuracy of the information received on relative prices, relative price distortion could lead to some misallocation of resources. Alternatively, in order to minimise the risk of being misled by individual price movements, buyers may invest more time and resources searching for useful information on relative prices. Such additional search costs also reduce welfare relative to the price stability case.

However, it is important not to overstate the costs arising from this type of relative price distortion, as nominal prices will eventually adjust for anticipated inflation. For the most part, any relative price distortion that arises from anticipated inflation should therefore be transitory. There may be some residual ongoing effect, as inflation is itself an ongoing process, but relative price confusion is likely to be much more important in the context of unanticipated or uncertain inflation.

3 This is known as the Tobin-Mundell effect.
4 Kormendi and Meguire (1985) test these two opposing views. Their findings support the second hypothesis and suggest that a country which reduces its rate of inflation by 2 per cent per year each year, would experience 1.7 per cent greater economic growth. The authors didn’t consider these specific figures to be plausible, but felt they supported the notion of a negative effect from inflation to the level of capital stock, via reduced real money balances.
Liquidity Constraints

The Treasury evidently believed that the inflation rate could be increased without a corresponding need to raise interest rates and without bond holders noticing that the real value of their capital was diminishing. This belief had some plausibility until 1955 when Professor Sir Dennis Robertson remarked on hearing that the Church of England was switching from government bonds to equity shares, "if you can't fool the Church of England, there is no one left you can fool any more."6

It is well known that, as the above quote suggests, nominal interest rates tend to adjust in line with changes in anticipated inflation - though perhaps not fully so, as discussed later. Savers will require the return on their savings to include compensation for the effects of inflation. Similarly, borrowers will be prepared to pay higher interest rates because the nominal value of their real assets can be expected to increase with the rate of inflation.

However, an increase in nominal interest rates, following an increase in anticipated inflation, gives rise to liquidity constraints that have their greatest impact on the consumption and investment plans of households. Households in particular tend to be forced to respond to nominal rather than real interest rates, because most financial contracts are not fully indexed - they are specified in nominal terms, with repayments based on nominal, not real, interest rates.7 Higher nominal interest rates typically increase the real repayments required to service debt in the early stages of a loan but lower the real repayments required later. These higher initial repayments make it harder for households to maintain the level of borrowing they would choose to undertake if inflation were zero, even if rising nominal incomes are expected to eliminate the cash flow problem in future. Therefore, an increase in anticipated inflation may cause a decrease in household consumption and investment.8 Full indexation of loans would solve this problem, as the effective interest rate would always be equivalent to the real interest rate, and the nominal value of the loan would increase in line with inflation. Even so, such indexation would involve costs (in the nature of higher menu costs) relative to zero inflation.

This type of liquidity constraint is generally less important for business investment, partly because interest expenses are tax deductible for businesses. Also the capital stock of a typical business is comprised of both old and new capital stock. When anticipated inflation increases, there is an increase in the cash flow on the existing capital stock, which tends to offset the low initial net cashflow on new capital. The borrowing patterns of businesses thus tend to be more responsive to real (as opposed to nominal) interest rates than those of households, and less affected by an increase in anticipated inflation.9

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7 Households face liquidity constraints, even in the absence of inflation, because they cannot usually borrow on the basis of expected increases in future incomes in order to alter current consumption patterns.
8 A study by Throop (1990) supports the suggestion that US households are more responsive to nominal rather than real interest rates. He finds that when real interest rates fall, but nominal rates increase, household investment in durables and residential investment both decrease.
9 New firms, however, may be somewhat more subject to liquidity constraints than established firms.

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The Incomplete Indexation of the Income Tax System

The interaction of the tax system with anticipated inflation leads to the most serious costs of anticipated inflation. The tax system in most if not all countries, is based on nominal rather than real income. Thus, it is nominal, rather than real interest returns which are taxed, and historic nominal cost (rather than replacement cost) is used to calculate depreciation allowances. These interactions mean that even anticipated inflation can substantially distort savings behaviour, business and labour market behaviour, and wealth and income distributions.

The Impact on Savings Behaviour

The impact of anticipated inflation on the after-tax real return on financial contracts can be readily demonstrated. For example, if the real rate of interest is 4 percent and the tax rate is 25 percent, the after tax return from investing in financial contracts, in the absence of inflation, is 3 percent. However, if inflation is 4 percent, and nominal interest rates increase correspondingly to 8 percent, the real after tax return declines to 2 percent, as the tax is levied on the full 8 percent nominal return. In other words, the post-tax real return declines, even though the pre-tax real return (here, 4 percent) is unchanged. This reduction in the after tax real return, due to higher inflation, reduces the reward from investing in financial contracts. Those who had previously invested in financial contracts may switch to investment in shares as a hedge against inflation. However, as savers substitute into shares, the price of shares will increase, progressively reducing the real return from additional investments in shares until the return equals the after-tax real return from investing in financial contracts. Frustrated savers may also turn to investment in real assets such as buildings and land to protect their real returns from inflation. But eventually, the real return from these assets will also decline. Therefore, following a transitional period of investment switching, the real rate of return on all forms of saving will fall to the level of the after-tax real return from investment in financial contracts.10

Consequently, as part of a rational response to the combined effect of anticipated inflation and the tax system, the actions of investors wishing to protect themselves from inflation lead to a decline in the economy’s overall after-tax real rate of return, a distortion in the pattern of savings and investment, and a possible decline in the overall level of savings.11 Even if the level of savings is not reduced, the net welfare cost arising from the lower real post-tax return could be significant.12

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10 This process will not necessarily be a smooth one, of course. Some asset prices may tend to follow boom-bust cycles, which can involve substantial economic costs. Such cycles are more likely to build up in an environment of generalised, even if anticipated, inflation.

11 Strictly, the effect on the overall level of savings cannot be predicted a priori, as the substitution and income effects from a change in the real post-tax return on saving work in opposite directions. Also, the liquidity effects of higher nominal rates could work to reduce household consumption (increase savings). There is some empirical evidence of a net positive relationship between real post-tax interest rates and aggregate saving, in the broad sense of aggregate income less consumption, when aggregates are carefully defined - see Clemens (1982) in the New Zealand context. But overall the empirical results are mixed. In any event, a positive relationship is more likely between real post-tax interest rates and the narrower concept of saving in financial assets.

12 Fisher (1981b) suggests that the net welfare loss through the reduced real return on savings could be at least 0.7 percent of GDP in the US, for a sustained 10 percent rate of anticipated inflation.
Box 1
Inflation and Interest Rates

There are three factors which may contribute to nominal interest rates not adjusting fully for both inflation and taxation. First, as discussed in the text, the use of historic cost to calculate depreciation allowances lowers real post-tax profit, and acts as a disincentive to borrow for the purpose of new business investment. There are other effects working in the opposite direction, however (though there is some overseas evidence suggesting that the depreciation effect may dominate). To the extent that the demand for business borrowing does decline, this reduces the upwards pressure on interest rates arising from an increase in anticipated inflation.

Second, the upward pressure on nominal interest rates may be reduced because liquidity effects reduce household borrowing at higher nominal interest rate levels.

Third, and probably most important for a small open economy like New Zealand, international funds flows also tend to reduce the upward pressure on nominal interest rates. This is because foreign exchange losses (gains) are normally tax deductible (assessable) in most countries. To the extent that a rising inflation rate is expected to lead to an exchange rate depreciation, which is usually the case, an overseas investor will not require the nominal interest rate on local currency financial assets to increase as far as a local investor would to maintain the real post-tax return.

This effect could be avoided if tax was levied only on the real interest return to savers, or if nominal interest rates rise by more than the rate of inflation so as to leave post-tax real rates unchanged. However, nominal interest rates do not in fact seem to rise sufficiently to offset both the effect of inflation and the accompanying increase in real taxation. Indeed, there is some evidence to suggest that pre-tax nominal rates may not even increase to the full extent of a rise in anticipated inflation.13 Box 1 outlines some of the possible explanations for nominal interest rates being less than fully responsive to inflation and the tax-inflation interaction.

The Impact on Business Behaviour

An increase in anticipated inflation interacts with the tax system to significantly influence business behaviour in several different ways. The first effect arises because nominal interest payments rather than real interest payments are tax deductible for businesses. When there is an increase in anticipated inflation, this tax treatment has the effect of reducing the real after-tax cost of debt finance relative to the cost of equity.

13 Throop (1990) suggests that nominal interest rates in the US rise by only 0.7 of a percentage point for each percentage point increase in inflation.

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finance, at least in the absence of full dividend ‘imputation’. Therefore, businesses are encouraged to increase gearing beyond a level that is optimal in a period of price stability which tends to increase the risk of corporate failure. In addition, this effect represents a form of taxpayer subsidy that encourages investment in projects with a social rate of return below the true cost of finance, the world real interest rate. Moreover, any increase in business borrowing may be partly funded from overseas sources - especially if the level of domestic saving does indeed fall. Since such overseas borrowing would tend effectively to fund assets that yield a real return that is lower than the real cost of the debt, there is additional potential for an increase in the risk of business failure, not to mention the fact that the build-up in overseas debt may itself be problematic from a macroeconomic perspective.\textsuperscript{14}

The second main effect arises from the use of historic cost accounting, rather than replacement cost for the purpose of calculating depreciation allowance for tax purposes. This practice understates the replacement cost of business assets in the presence of inflation and increases the real tax burden for businesses. The real post-tax rate of profit therefore falls in response to an increase in inflation, which tends to reduce new businesses investment.

The third type of impact is an allocational one, arising from the fact that the depreciation effect varies in importance for different types of business. In particular, those businesses which claim a greater percentage of current income against tax for depreciation purposes can expect a greater increase in their real tax burden. Other things being equal, investment patterns tend to become distorted towards activities which are less affected by the increase in the real tax burden, such as those with longer-lived assets like buildings and land. The shift into buildings and land, rather than more directly productive assets, may also be driven strongly where there is no capital gains tax, as has been the case in this country.

The net impact on overall business borrowing and investment of the different tax-related effects may be either up or down. One study in the US context, however, attempts to differentiate between the positive effect of the lower real post-tax interest rate, and the negative depreciation-related effect, and finds a small net negative effect overall on non-residential fixed investment.\textsuperscript{15}

**The Impact on the Supply of Labour**

In a progressive tax system (ie, one where the marginal rate of income tax rises for higher levels of income), tax brackets are set in terms of nominal rather than real incomes. In the presence of anticipated inflation these tax brackets could in principle be adjusted continually to prevent the real tax burden on wage and salary earners from increasing. In practice, however, there is often substantial delay between the onset of inflation and tax bracket adjustment. During this time, the real tax burden on income earners increases. This effect tends to act as a disincentive to additional effort, and even to the supply of labour at higher income levels. This may result in a negative impact on overall economic welfare.

\textsuperscript{14} The tendency for higher inflation to result in increased external debt is emphasised by Bayoumi and Fagnon (1992).

\textsuperscript{15} Throop (1990).

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The Impact on Social Equity
The interaction of the tax system with inflation also causes arbitrary redistributions of wealth. While some investors may be able to hedge against the low relative return from investment in financial assets, others such as lower income earners, the elderly or prospective first-home buyers, may have no choice but to hold a portion of their wealth as financial, rather than real assets. The elderly, for example, often require reasonable reserves of financial assets in order to meet day-to-day living expenses out of interest income. First-home buyers have to save for a deposit on a house, at the same time as inflation is increasing real house prices. But the tax-inflation interaction means that real after-tax returns on financial assets are likely to be relatively low, or even (judging by the New Zealand experience) negative for a time, so that the real value of these people’s savings is eroded over time. If the inflation is serious enough, or lasts long enough, the extent of the erosion may be sufficient to create significant pressures on fiscal policy to reduce those groups’ loss of wealth.

Unanticipated Inflation, Inflation Variability and Inflation Uncertainty

The costs of inflation discussed in the previous section arise as a result of even fully anticipated inflation. These costs can therefore be seen as core costs of inflation - they will arise whenever there is inflation, unless there is complete indexation. But of course, inflation is never fully anticipated by everyone in the economy. Even economic forecasters, who invest considerable time and effort in predicting economic trends, fail to fully anticipate future inflation outcomes - particularly medium to long-term inflation outcomes. Consequently, the costs of both unanticipated inflation and inflation uncertainty also have to be considered. Even putting aside the impact on economic efficiency and aggregate output levels/growth, they will still reduce overall economic welfare, as uncertainty is in itself costly.\textsuperscript{16}

It is worth noting here that there is a logical distinction between unanticipated inflation and inflation uncertainty. The latter essentially relates to the variability of the former, and can be thought of as the difficulty people feel they will experience when trying to accurately predict future inflation. Some writers do not make this distinction, though many of the costs commonly attributed to unanticipated inflation probably result strictly from inflation uncertainty instead.

Obtaining a direct measure of inflation uncertainty is difficult, and many writers use the variability of inflation as a convenient proxy. But a second distinction has to be noted here as well - namely, that between inflation uncertainty and the variability of total (anticipated plus unanticipated) inflation. By definition, an increase in the variability of anticipated inflation will not increase uncertainty, because the path of anticipated inflation is known. Thus, it is difficult to discern whether the empirical evidence demonstrating the costs of inflation variability is evidence about the variability of

\textsuperscript{16} This is because individuals are usually “risk averse”. Given a choice between a situation where they receive a particular level of income, say $1,000 with absolute certainty, and a situation where their actual level of income is uncertain but can be expected on average to be $1,000, individuals generally prefer the first situation.

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unanticipated inflation (inflation uncertainty), or the variability of anticipated inflation, or both.17 A few studies have endeavoured to test for the uncertainty effect alone, and the evidence does tend to support the view that this effect is significant.18

All of this should not be taken to mean that variability of anticipated inflation is costless, however. In particular, greater anticipated inflation variability could increase the costs related to short-term relative price confusion. A number of studies show a strong correlation between relative price variability and overall price variability.19 In addition, there may be increased costs associated with devising successful methods of forecasting inflation.

But overall, the costs of anticipated inflation variability seem unlikely to be as important as those related to unanticipated inflation and its variability. The remainder of this section therefore concentrates on these latter factors.

The Costs of Unanticipated Inflation

Unanticipated inflation will clearly exacerbate the costs which arise from anticipated inflation. Ignoring any associated influence on inflation uncertainty, the main additional impact of unanticipated inflation is on the distribution of wealth and income. A redistribution of income occurs as unanticipated inflation impacts on the real incomes of those with relatively fixed nominal incomes. In the case of wage income, the direction of the redistribution is dependent on the source of the inflation shock. If the shock arises from non-wage sources, the real wages of workers who are locked into fixed nominal wage contracts will decrease, and the redistribution will tend to favour employers (at least until the contracts are renegotiated). On the other hand, if an upward exogenous wage shock (such as a general wage order) is the cause of unanticipated inflation, the income redistribution will initially favour employees (at least until firms adjust prices). Other fixed income groups will be adversely and more permanently effected in either case.

The effect of unanticipated inflation on the ex-post real interest rate is responsible for redistributions of wealth. For example, when debtors and creditors are surprised by a higher inflation outcome, there is a reduction in the ex-post real interest rate and wealth is redistributed from nominal creditors to nominal debtors. The magnitude of the wealth redistributions may well be very significant.20

However, even though the wealth and income redistributions may be large, they may not necessarily represent a decline in overall economic welfare (apart from the indirect effect associated with inflation uncertainty - see below). The amount lost by those on the wrong side of inflation shocks is balanced by the gain for those on the other side. While there

18 See, eg, Garfinkel (1989) in particular. Some other studies test for the effects of an increase in the variance of monetary shocks, rather than (directly) the variance of inflation shocks. (See, eg Mascaro and Meltzer (1983), Barro (1980) and Kornendi and McGuire (1985)). To the extent that money shocks do cause inflation shocks, however, these results provide indirect evidence on the effects of inflation uncertainty.
19 See Taylor (1981) for a review.
20 Fischer and Modigliani (1978) believe that wealth transfers are larger than income transfers, and estimate the wealth transfer for every 1 per cent of unanticipated inflation to be in the region of 1 per cent of GNP.
may well be major concerns from an equity point of view, there may be no overall loss of welfare and, in principle at least, society could organise compensatory wealth and income transfers to reduce the net effect of unanticipated inflation to zero.21

The Costs of Inflation Uncertainty
While the direct effect of unanticipated inflation on overall economic welfare may be relatively small, there may well be more important indirect effects to the extent that unanticipated inflation contributes to inflation uncertainty. For example, people who have been surprised by inflation outcomes in the past and who form expectations of future economic outcomes based at least partly on what has gone before, may become less confident of accurately picking future inflation. But whether or not related to changes in unanticipated inflation, the welfare costs of inflation uncertainty are likely to be substantial. The main types of costs are as follows. As already noted, even if the effects discussed below are assumed to be negligible in aggregate, inflation uncertainty still reduces overall economic welfare, as it is costly in itself.

Uncertainty, the Labour Market, and Business Planning
Wage contracts in labour markets are nominal contracts, where the nominal wages employers will pay to employees are fixed for the period of time defined in the contract. When inflation uncertainty increases, both employers and employees believe they face the increased prospect of mis-forecasting inflation. Those who are risk averse will not wish to be subject to the transfers of income or wealth that accompany an unanticipated shift in inflation. Consequently, the patterns of behaviour in the labour market may change as employers and employees both seek to minimise the risk posed by inflation uncertainty. There are two results. First, because higher inflation uncertainty increases the risk of larger reductions in the reward to both employers and employees from employment, both the demand for and supply of labour may fall. Secondly, the costs of nominal wage contract negotiations may increase if employers and employees become more reluctant to sign nominal wage contracts. Therefore, an increase in inflation uncertainty may contribute to a fall in employment and, more particularly, greater costs in the ongoing operation of the labour market.22

Over time, the impact of inflation uncertainty will abate as the labour market at least partially adjusts for uncertainty. This adjustment may take the form of indexing nominal wages to inflation or reducing the term of wage contracts. However, such adjustment is not without cost. Reducing the term of nominal wage contracts leads to an increase in the number of contract renegotiations that must be undertaken. Even if such arrangements involve lower administrative costs than would be the case without reduced contract lengths, they nevertheless represent increased costs relative to the case where inflation uncertainty is negligible.

A related point is that the shorter-term nature of wage contracts, as well as other aspects of inflation uncertainty (such as relative price uncertainty - see below) may be associated with disincentives to long-term business planning. Long-term planning is also likely to

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21 This conclusion assumes that the process of compensation is without cost. However, administrative costs would be incurred if such compensation was implemented, so the conclusion is only a first approximation.
22 Hollland (1986) finds that employment falls below trend as an initial effect of an increase in long-term inflation uncertainty, but a subsequent rise in indexation causes employment to move back towards its trend level.
be made more difficult in some respects, the closer that labour market arrangements and practices are to full indexation of wages (even though there are also some advantages to both parties from indexation). In particular, wage indexation will tend to reduce flexibility to make efficient adjustments to adverse real (relative price) shocks - if wages are fully indexed to changes in the price level, the real wage adjustment that is required will be frustrated, exacerbating the effects of a real shock.23 This applies even more at firm and industry level than it does at the economy-wide level.

Uncertainty and the Risk Premia in Financial Contracts
An unanticipated movement in inflation will have a greater impact on the value of an investment in long-term nominal bonds, than investment in short-term bonds. Consequently, an increase in long-term inflation uncertainty increases the degree of risk associated with holding long-term nominal bonds and therefore also increases the risk premium in longer nominal interest rates. This pushes up the cost of capital for businesses and households.

Moreover, if an increase in uncertainty reduces the length of long-term securities, businesses may find it difficult to obtain funding that is sufficiently long-term in nature. Long-term planning and investment may become more difficult and more risky as a result.

Economic efficiency may be further eroded by a misallocation of economic resources if investors readjust the asset composition of their portfolio in favour of real assets (such as property) and away from assets denominated in nominal terms. Resources may also be transferred into financial institutions and instruments that specialise in reducing the risk of inflation uncertainty. In the absence of inflation uncertainty, these institutions and instruments would be uneconomic. Therefore, this effect represents a further misallocation of resources.

Uncertainty and Relative Price Confusion
An increase in long-term uncertainty also erodes economic efficiency and welfare by making it more difficult for individuals to distinguish relative from aggregate price changes - as already noted, appropriate resource allocation decisions depend importantly on good information on relative prices. In particular, search costs increase if more information is required to distinguish the true nature of individual price movements. Alternatively, it may be very difficult, or simply too costly, to analyze sufficiently the nature of individual price changes, but in either case the result is a misallocation of resources relative to a zero inflation environment. Relative price uncertainty may also mean that investment becomes riskier and declines as a result.24

Finally, to the extent that relative price confusion provides businesses with increased scope to raise nominal prices as an alternative to tackling more deep-seated problems, inflation uncertainty may perpetuate and even encourage inefficient business practices, further adding to the misallocation of resources.

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23 See Gray (1976) for further discussion on this matter.
24 See Barro (1980), for example.
The Relationship Between the Level of Inflation and Inflation Uncertainty

It is often assumed that inflation uncertainty is positively related to the rate of inflation. On the face of it, however, there is no particular reason to assume that simply because inflation is high, inflation uncertainty would also be high.

One type of explanation for such a link is outlined by Friedman (1977), and focuses on political behaviour. According to Friedman, in the past, trend inflation has been high not by deliberate policy intention, but more as an unwelcome side effect of other economic policies. A permanent increase in inflation (either anticipated or unanticipated) is not politically popular and consequently governments wish to reduce inflation while also being conscious of all their other objectives, some of which may conflict in the short-term with lowering inflation. Inflation creates uncertainty about the future direction of monetary policy, and in particular, about whether or when a policy of disinflation will be followed and the extent and duration of any such disinflation. Such uncertainty may well increase with the level of inflation.25 In addition, taking into account the existence of positive (as well as negative) price or inflation shocks, the same sort of explanation gives rise to uncertainty about whether inflation may continue to be ratcheted upwards, as well as about the path of disinflation.

Empirical work has examined, as a starting point, the relationship between the level of inflation and inflation variability, and many studies have found a positive relationship between the two.26 Identifying a positive relationship between the level of inflation and inflation uncertainty has been more difficult. In the past, mixed empirical evidence has made it difficult to draw definitive conclusions. However, more recent work has attempted to distinguish between the relationships between the level of inflation and short-term inflation uncertainty, and the relationship between the level of inflation and long-term uncertainty.27 The latter relates to the variance of trend inflation shocks, and the former to the variance of temporary inflation shocks, which by definition balance out over time. (It seems likely that the costs of inflation uncertainty discussed above relate more to long-term uncertainty than short-term uncertainty.) The more recent work helps to reconcile the divergent results of previous studies and finds that the level of inflation is unrelated to short-term uncertainty but positively related to long-term uncertainty.28

Inflation, Output and Growth

As discussed in the preceding sections, there are a range of different effects from inflation, not all of which work in the same direction (e.g., in the case of the effects on aggregate business investment). However, even if the level of investment or output is

25 In addition, to the extent that higher inflation encourages innovations which reduce the demand for transactions balances, there is an increased potential for monetary policy errors. Any such errors will add to uncertainty about monetary policy and future inflation. See Ball (1990a) for further discussion of this matter.

26 One of the earlier proponents of a positive relationship between the level and variability of inflation was Okun (1971). Subsequent studies include those undertaken by, or reported in, Fischer (1981b), McTaggart (1992), Cozier and Selody (1992), Ball and Cecchetti (1990) and Chowdhury (1991). The Chowdhury study notes that work in this area has not always found a positive relationship; but, using a more rigorous analysis than often used previously and covering a longer sample period including both fixed and floating exchange rate periods, Chowdhury produces results strongly supporting Okun’s hypothesis.

27 See Evans (1991) and Ball and Cecchetti (1990) in particular.

28 In particular, the length of the time horizon used in previous studies may have had an implication for whether or not a positive relationship was found between inflation and inflation uncertainty.
not significantly damaged in the shorter-term, these influences have a corrosive impact on economic efficiency (especially allocational efficiency) which is likely to involve significant cumulative damage beyond the short-term. This is not to mention their major equity implications. Nevertheless, some writers doubt that output effects are very significant, or argue that they do not impact on the longer-run growth rate of output.29

Exogenous vs Endogenous Growth Theory
At the heart of this issue is traditional neo-classical growth theory, where output is a function of capital and labour, but where there is diminishing marginal output from an increase in capital. In other words, capital accumulation reduces the marginal product of capital. Consequently, anything which influences the rate of investment will not affect the long-run rate of growth, but will only alter or shift the path of transition to this rate of growth. Thus, if inflation reduces investment, it will not affect long-run growth on this view (though it may affect the level of output, and hence wealth).

However, unless the time horizon defined as the long-term is very long indeed, the growth implications of this model do not match the empirical experience of the last few decades. In particular, returns from investment in the last few decades have been higher than in the previous one hundred years, and a positive correlation between savings and growth has been evident. In the neo-classical view, such discrepancies are explained by the advent of new technology which has slowed but not eliminated the tendency for the marginal productivity of capital to continually fall back to the level of the real interest rate.30

Other writers, however, consider it unsatisfactory to rely on coincidental exogenous technology gains to explain such a key part of actual economic experience. ‘Endogenous’ growth theory is a proposed alternative which allows for changes in investment to alter the long-run rate of growth, by abandoning the assumption of diminishing returns to output from an increase in capital.31 It accomplishes this by extending the concept of capital accumulation to include the accumulation of knowledge and human capital. Investment in this type of capital can have constant or increasing returns to output, since there is no particular reason why a new innovation cannot be just as productive, if not more so, as an old innovation.32 Empirical studies suggest that endogenous growth models provide a better explanation of observed growth patterns than do traditional exogenous growth models.

29 Even if these views are correct, they do not imply that economic welfare in a broader sense is not adversely affected, e.g. through greater uncertainty.
30 Another type of model in which inflation has no impact on economic growth is real business cycle models. Exogenous technology shocks are an integral feature of real business cycle models and shift the economy from one equilibrium state to another. Money is not an integral feature of these models, however, and in particular, the quantities and relative prices that simultaneously match demand and supply at each equilibrium point are set in the absence of money. Therein lies the difficulty with these models. The absence of even real short-run disequilibrium makes it difficult to see how these models can explain the evolution of money. Real business cycle theorists acknowledge the point that their treatment of money is problematic, and some effort has already gone into incorporating money into these models, (see Plosser (1989) and Cooley and Hansen (1988).
31 See ‘The Economist’ (January 4 1992), p.17., Barro and Romer (1990), and Helpman (1992) for further clarification of this discussion on the role of endogenous growth models in economic growth theory.
32 For example, when people successfully search out new ways of doing things, their discoveries may add to a virtuous circle of increasing returns to investment if the results of this search add to other people’s store of knowledge. As the knowledge of others rises, so does their productivity and the potential private return from their own search for innovations.
In the context of endogenous growth models, inflation uncertainly has the potential to influence growth through its impact on productivity, longer term planning (including research and development) and the levels and patterns of investment and savings. On the other hand, even in endogenous growth models, such an effect on growth does not automatically follow. To the extent that inflation matters, it may still only matter to the relative level of long-run income rather than the long-run rate of growth. Whether there is an effect on long-run growth is therefore essentially an empirical question. It is an important one, however, because even a small change in growth will cumulate over time into a significant change in the level of income. If growth is not fundamentally affected, the affect on the level of income is more limited.

Empirical Evidence on the Output Effects of Inflation

Empirical studies on the relationship between inflation and economic output usually fall into two different groups, cross-sectional and time-series studies. Individual studies in both categories point to the existence of a negative relationship between higher inflation and economic growth, and not only between higher inflation and a lower level of output. Of the time series studies, recent examples include Lebow, Roberts and Stockton (1990), who use US data from 1914-89 and find that a negative correlation exists between inflation and the growth rate of real output and productivity; and somewhat more sophisticated models such as those by Novin (1991), Selody (1990b), and two others reported in Cozier and Selody (1992), all of which suggest the presence of a negative relationship between inflation and productivity growth. Several of these studies use Canadian data and suggest that a one percentage point decrease in inflation will increase annual labour productivity growth by between 0.2 and 0.3 percentage points. Selody’s work also uses US data and finds a productivity growth rate increase of 0.1 percentage points per annum. In addition, one of the studies cited by Cozier and Selody uses US data to find a negative relationship between inflation and productivity growth, and suggests the existence of one-way causality from inflation to lower productivity growth.

Another recent study is by Grimes (1991), who regresses data for 21 countries over 27 years and estimates that a one percentage point reduction in inflation increases output growth by 0.1 percentage points. He also finds that even a low rate of inflation will harm economic growth.

Of the cross-sectional studies, relatively simple ones show a high degree of negative correlation between inflation and growth. For example, Gyftason (1989) presents cross-sectional data to show that between 1980 and 1986, the GDP growth rate in countries with high inflation was 3.4 percentage points lower on average than that in countries with low inflation. Reddell (1990) extended this work and showed that the growth rates of countries with ‘average’ levels of inflation were half way between those of high and low inflation countries.

More complex models also support the hypothesis of a negative relationship between inflation and growth. For example, Kornendi and Meguire (1985) regress data from 47 countries between the period 1950 and 1972, to estimate that a one percentage point reduction in inflation increases growth by 0.16 percentage points. De Gregorio (1991) uses data from 12 Latin American countries over the period 1950 to 1985, to find a negative relationship between inflation and growth. His work suggests that the cause of this outcome is a negative relationship between inflation and factor productivity growth.
Although there is substantial consistency between the results of such studies, the results do need to be interpreted with some caution. In particular, as pointed out by Cozier and Selody, some of these studies do not adequately determine whether the impact of inflation on economic growth is permanent or temporary - i.e., whether the long-run influence of inflation is on the long-run rate of growth, or only on the long-run level of income.33

Cozier and Selody attempt to avoid such problems in their study, and their results differ from earlier ones by finding that, over time, the negative relationship between inflation and growth is only transitory. Instead, the main relationship is between inflation and the long-run level of income. However, their work suggests that the transition period may last for several decades, and the impact on growth during this time is very similar to that found in other studies.34 Given such a long transition period, the distinction between effects on output levels versus growth is perhaps overdrawn.

**Inflation and International Competitiveness**

A different reflection on the effect of inflation on the level and/or growth of output, at least for an interim period, is changes in international competitiveness. Inflation can cause relative price distortion at the macro level when there are differing degrees of price flexibility in different markets. For example, it has been suggested that traded goods’ prices are more flexible than the prices of non-traded goods, and that consequently, the prices of traded goods are more responsive to inflation than non-traded goods’ prices. Therefore, in the presence of inflation, there will be a temporary real exchange rate depreciation that will lead to a temporary increase in competitiveness. However, Dwyer and Lewis tested this hypothesis on Australian data and found that, for a small open economy, the opposite conclusion holds. Small, open economies tend to be world pricetakers rather than setters. Thus, in the presence of tardy exchange rate adjustment for inflation in the short-term (as found in this study), non-traded goods are more responsive to inflation than traded goods. In other words an increase in inflation will lead to a temporary decline in competitiveness.

There may also be other, indirect effects on international competitiveness which can last for a reasonably extended period. In particular, to the extent that inflation erodes efficiency and productivity nationwide, the cost base of the traded goods sector is continually being pushed up, and international competitiveness is lost until either the nominal exchange rate is adjusted and/or traded goods producers find other ways to reduce costs and improve productivity.

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33 Cozier and Selody also raise other problems with some of the time series and cross-sectional models. These include the lack of a proper theoretical structure, problems distinguishing long-run relationships from cyclical relationships (time series models) and problems discerning the causal direction of relationships (cross-sectional).

34 In particular, the authors suggest that a one percentage point reduction in inflation will raise the growth rate of income by about 0.1 percentage points for about thirty years, before the economy settles down to a new level of income that is about 3 percent higher than it would otherwise have been without the reduction in inflation.
What is the Optimal Inflation Target?

The benefits of low inflation appear to be significant. But is zero inflation necessarily the best target? Or is there a case for some small but positive level of inflation? For that matter, would mild deflation be preferable?

The Case for Some Positive Level of Inflation

To the extent that the costs of inflation rise with the rate of inflation, this points to the desirability of zero inflation. However, there are arguments in favour of maintaining some positive (but moderate) level of inflation instead. These arguments are usually either that the costs of maintaining zero inflation are too high in some sense (ie, outweigh the benefits); or that inflation is an important source of tax revenue.

Nominal Wage Rigidities

The most common reason for suggesting that the costs of maintaining zero inflation are too high is that nominal wages are inflexible downwards. Such wage rigidities are thought to arise if employees suffer from money wage illusion and are more willing to accept a real wage cut caused by a decline in purchasing power, than a cut effected by a decrease in nominal wages. Another explanation assumes that workers care about relative wages: when a real wage cut is required and the price level is not rising, workers will resist a nominal wage cut because no group of workers wants to be the first to take a very obvious (albeit probably temporary) wage cut relative to other workers, as well as relative to other income earners.

Consequently, the argument runs, the closer the level of inflation comes to zero, the more likely it is that real wage reductions over the course of the business cycle will require nominal wage reductions, which will be resisted by workers. As a result, the maintenance of price stability over the business cycle will require average unemployment to be higher than otherwise. Thus, when downwards real wage adjustment is required, inflation may benefit the economy by enabling real wages to adjust through slower, rather than negative nominal wage growth.

Work by Ball, Mankiw and Romer (1988) on US data implies that, in the short-term, the costs of disinflation increase as inflation falls. This work is consistent with the presence of nominal wage rigidities at very low levels of inflation.35 Also, Holden (1990) cites some evidence in support of downwards wage rigidity during recessions and provides reasons for this rigidity, based on the assumptions that workers continue to work under the terms of an old agreement whilst a new one is negotiated, and are legally protected from unilateral decreases in nominal wages. The existence of nominal wage rigidity in Holden’s framework depends on the bargaining strength of workers and employers. The model raises the possibility that even in a recession, there is a bias against nominal wage cuts because workers have to agree to a cut in nominal wages and can delay negotiations without having to call a strike.

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35 See also Grubb (1986) in respect of other OECD countries.
The counter-argument to this sort of model is that especially if a recession is a severe one, workers may accept nominal wage cuts when there is a significant threat of firm closure, mass non-renewals of contracts, or redundancies; or if unemployment is sufficiently high and employers can use threats of 'lock-outs' to reduce nominal wages.

Also, there is a reasonable amount of contrary empirical evidence suggesting that nominal wage rigidities are not in fact very significant. An example is the work by Lebow, Roberts and Stockton, which finds no evidence of nominal wage rigidities in the United States. They examine data on the growth rate of average hourly earnings for 255 private industries over the period 1973 to 1989, and find no indication of smaller real wage cuts during periods of low inflation compared to high inflation. Moreover, they do not find any shortage of nominal wage cuts during 1986 when US inflation reached a low point of 2.6 per cent. Similarly, work by Cozier and Wilkinson (1990) on Canadian data finds no evidence of nominal wage rigidities at low levels of inflation.

Apart from the issue of relative bargaining strength during recessions, there are a number of other reasons why nominal wage rigidities may not be very significant at an aggregate level, even if it is true that individuals suffer from money-wage illusion and are reluctant to take a cut in nominal wages. Modern economies tend to be characterised by a fairly high degree of labour mobility and, at least in the case of present day New Zealand, labour market flexibility. Individuals change jobs fairly frequently, and even if they stay with the same company, they receive promotions, the nature of their job changes or they become more productive with experience. Any of these movements allow an effective real wage reduction through lowering the nominal remuneration for particular jobs at the point of personnel changes, freezing the nominal remuneration of an employee who has become more productive, or by increasing nominal remuneration on promotion less rapidly than otherwise.

At the most general level, it is not at all clear why pressure to take a nominal wage reduction in a low or zero inflation environment would be resisted more strongly than pressure to forego a nominal wage increase during a period of high inflation. In either case, a real wage cut is envisaged and there is no strong evidence that individuals are unaware of the effect of inflation on their nominal purchasing power. In addition, while workers may wish to avoid a cut in wages relative to other workers, the absence of inflation is not likely to make this concern any more important. Declining real wages, whether in the presence or absence of inflation, still involve a loss for the workers concerned relative to other income earners.

**Negative Real Interest Rates**

Another argument, somewhat analogous to the nominal wage rigidity argument, is that negative real interest rates are required to assist the economy out of the recessionary phases of the business cycle. DeLong and Summers (1992) suggest that some small positive level of inflation is needed because zero inflation stops real interest rates becoming negative. While it is true that short-term interest rates in the US have often been negative in recessions, this is not the general experience in other countries, nor has it always been true in the US, especially if one looks back beyond relatively recent cycles. It is therefore difficult to see this argument as one that has general validity.
Supply Side Shocks
The focus on supply side shocks is most often on those shocks that have the effect of lifting the price level. The concern of some is that maintenance of zero inflation will require a period of depressed activity to bring measured inflation back down again. Three important considerations are overlooked in this argument. First, there is no reason to expect all supply side shocks to lift the price level. Indeed, over time there will be a number of both negative and positive price shocks.

Secondly, maintaining zero inflation is a task which is inherently oriented toward the medium-term. Monetary policy would not necessarily act to offset the first-round effect of a significant relative price shock in order to maintain zero inflation at all times. More likely, it would focus on some concept of trend or underlying inflation, assessed over some relevant time scale. Depending on the precise nature of monetary policy objectives, large relative price shocks (in either direction) might well be reflected in a temporary divergence of measured inflation from the level defined as price stability. This is the approach in New Zealand.

Thirdly, for a positive price shock to increase inflationary pressures (rather than simply result in step-wise increase in the price level), it has to be assumed that, in a country where zero inflation is generally maintained, inflation expectations are not only predominantly backward looking, but are focused entirely on the most recent outcome. But in such a country, backward looking individuals will see both the price shock of the immediate past period, and the price stability of the periods previous to that. Consequently, it seems reasonable to expect that the output costs of maintaining medium-term price stability in the face of a positive price shock, would not be high.36

The Inflation Tax
Inflation can be treated by a government as a source of tax revenue. It is generally accepted that all taxes give rise to economic distortions, but in some respects at least, the inflation tax may be seen as less distortionary than other taxes. Consequently, it is possible that, in choosing an optimal taxation mix, the inflation rate would not be set equal to zero.

However, to address this particular issue carefully, a number of points need to be considered. The first is that the inflation tax is a relatively minor form of government revenue in most developed countries. Estimates vary, but a ball park figure suggests that it is about 2 - 3 percent of GDP in such countries.37 This figure is not insignificant, but neither does it form a substantial amount of government revenue in countries where government revenue as a percentage of output is relatively high.38

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36 Managing the ongoing inflation effects of a price shock may well be difficult in a country which still has relatively high inflation, or which is still undergoing a disinflation process. In such circumstances, there may be more scope for confusion between future inflation trends and the effect of a price shock. But even here, the costs of managing the ongoing effects of a positive price shock may not be too severe. For example, a study by Chadha, Masson and Meredith (reported by Rae (1992) suggests that only 50 per cent of individuals need to be forward looking for disinflation to involve no output costs at all; and their work indicates that almost 50 percent of individuals in the countries studied appeared to be forward looking.

37 See Fischer (1991), 'Lessons in Moderate Inflations'.

38 Over the 1980s, average total tax revenue in OECD countries was just under 40 percent of GDP.
Moreover, reports in Garfinkel (1989) and Lebow, Roberts and Stockton (1990) suggest that the costs of inflation significantly outweigh the costs of alternative taxation. In addition, as pointed out by Lipsey (1990), inflation can be considered as a form of tax on money, which is an intermediate good. Optimal taxation theory suggests that it is inefficient to tax intermediate goods.

Finally, the inflation tax does not meet one of the most basic criteria of a good taxation system - that it be transparent and its impact predictable. In most democracies, tax changes have to be passed by the legislature, which is indicative of the widespread and traditional acceptance of the need for transparency.

The Case for a Negative Rate of Inflation

Some writers argue that the optimal rate of inflation is actually negative. Usually, this view takes the form argued by Friedman (1969), that the optimum steady-state rate of deflation is equal to the real rate of interest. Underlying this argument is the view that only a zero nominal rate of interest produced by the rate of deflation exactly offsetting the real interest rate, will minimise the opportunity cost of holding money (ie, currency).

Contrary arguments have suggested that zero nominal interest rates are sub-optimal in the presence of economic uncertainty. Money takes on an additional ‘buffer stock’ quality when there is uncertainty and holding money provides individuals with the means to deflect the impact of a shock. Consequently, a lower rate of return on money balances may be an acceptable cost of hedging against uncertainty, and the optimal deflation rate may be less than the real rate of interest.39 It should also be noted that the underlying presumption that it is prohibitively expensive to pay interest on currency is open to question. For example, governments could if they wished, pay the equivalent of interest on their currency issues, at quite low administrative cost, through a lottery system.

Zero Inflation

Zero has a special appeal on political grounds that is not shared by any other number. Zero is - as a psychological matter - qualitatively different ... [it is] a natural point at which people tend to agree.40

The arguments for a rate of inflation other than zero are not particularly strong. Moreover, as suggested by the quote above, zero has the psychological appeal of being a good focal point for the expectations of individuals and policy makers alike. A zero target, because it is “zero”, may be less subject to change than a non-zero target and may consequently minimise inflation uncertainty. If an inflation rate of 3 or 4 percent, say, is chosen, there is no strong defence to the suggestion ‘if 3 or 4 percent, why not 4 or 5 percent’, and so on.

39 However, Den Haan (1990) tests for the impact of uncertainty on the optimal rate of deflation and finds the impact to be very small.
40 A quote from Friedman, as reported in Selody (1990a).

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Zero also has additional advantages not found in other targets. These include the minimisation of relative price distortions and the removal of any necessity for indexation.

The main qualification to the case for zero inflation is a measurement issue. Whatever price index is used as the indicator of inflation, there are some statistical measurement weaknesses or biases. Aiming for price stability in practice is therefore likely to involve aiming for an inflation rate slightly above zero in terms of the chosen measure. This is precisely the case in New Zealand. The Reserve Bank's statutory objective establishes the principle that monetary policy should be aimed at price stability; but the specific quantification of that goal involves a target inflation range of 0-2 percent in order to take account of the measurement bias in the chosen inflation indicator, the CPI.

Final Comments

Inflation causes significant costs and distortions, even when fully anticipated, but especially when unanticipated and uncertain. The following table summarises the main effects related to anticipated inflation, unanticipated inflation, and inflation uncertainty respectively. These effects cause important inefficiencies, both allocational and operational, which are reflected in a significant permanent reduction in the level, and possibly also the growth rate, of national income. A number of international studies suggest that an inflation rate of, say, 5 percent could reduce annual economic growth by at least 0.5 percent for an extended period, relative to an environment of zero inflation.

The redistributive effects of inflation, meanwhile, are likely to impact most adversely on lower income groups and those who are least able to protect their own wealth. Such redistributions may well place pressure on fiscal policy to compensate those worst affected. Furthermore, the process of arranging and administering such fiscal responses will itself involve additional resource costs for the economy.

Many of the costs of inflation could be reduced, or eliminated, with widespread indexation of the tax system, financial contracts and incomes. But such arrangements would likewise involve substantial resource costs of their own. The fact that the private sector has always been free to enter into various types of indexation contracts, but has done so only to a very limited extent; and the fact that widespread statutory indexation has eventually broken down in those very high inflation countries which have established it, suggest that indexation is not as simple, cheap and effective as sometimes suggested.

The presence of a significant negative relationship between inflation and economic welfare has thus been instrumental in persuading governments of the need to reduce inflation, even in countries which have established extensive indexation. However, a policy of price stability has not always been the first choice of governments in New Zealand and elsewhere. Fear of electoral disfavour has at times dissuaded politicians from the pursuit of consistent anti-inflation policies. Instead, policy makers have sometimes attempted to suppress the symptoms of inflation in other ways. These have included controls on wages, prices and nominal interest rates, and the use of fiscal policy to implicitly correct for the redistributive effects of past inflation. Like indexation, these
methods have had important costs of their own, and have not provided a long-term solution to the costs of inflation.

What policies should governments adopt then? This article points clearly to an optimal policy focus on price stability. For practical measurement purposes, this policy target is likely to translate into a very low measured inflation target. That is why the target in New Zealand is specified as 0-2 percent in CPI terms. Furthermore, while it is likely that long-term inflation uncertainty will be reduced in line with the choice of a very low average inflation level, policy should nevertheless also strive to maximise the predictability of inflation.

Monetary policy in New Zealand over the last few years has reflected exactly these considerations. Underlying the choice of monetary policy arrangements in this country has been the view that the costs of inflation in New Zealand are not likely to be any less significant than they have been overseas.
Summary of the Main Costs of Inflation

Anticipated Inflation:
1. Erodes the purchasing power of money with a consequent decline in the demand for real money balances and a loss of economic welfare though, eg, the costs of devising alternative methods of maintaining liquidity.

2. Causes temporary relative price distortions, which distort resource allocations, including through obliging economic agents to incur higher search costs.

3. Leads to liquidity constraints that distort the consumption and investment plans of household.

4. Interacts with the tax system and:
   - lowers the real after-tax rate of return on savings and investment, and tends to reduce the level of saving;
   - reduces real post-tax borrowing costs and encourages a shift from equity financing to debt financing (in the absence of dividend inflation), increasing the risk of corporate failure;
   - tends to encourage increased overseas borrowing;
   - reduces real post-tax profit rate and shifts investment expenditure towards longer-lived assets such as land and buildings (especially in the absence of a capital gains tax);
   - provides a disincentive to supply labour.
   - causes arbitrary and inequitable redistribution of wealth.

Unanticipated inflation:
1. Exacerbates arbitrary redistributions of income and wealth, and the other costs of anticipated inflation.

2. Tends to increase inflation uncertainty.

Inflation Uncertainty:
1. Reduces the term length of nominal wage and financial contracts.

2. Increases the costs associated with wage contract negotiations.

3. Increases the risk premia in financial contracts.

4. Increases the difficulty of differentiating between general inflation and relative price changes.

5. Makes longer-term business planning more difficult.
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