BIS ECONOMIC PAPERS
No. 11 – February 1984

INFLATION, RECESSION AND RECOVERY

A nominal income analysis of the process of global disinflation

by
J.A. Bispham

BANK FOR INTERNATIONAL SETTLEMENTS
Monetary and Economic Department
BASLE

"Monetarists . . . (believe) in the 'inherent stability' of the private sector . . . the system tends . . . to operate at or near 'full employment', regardless of the inflation rate, if policy-makers do not upset matters."

Laidler 1981

". . . to bring about a sound recovery from both depression and inflation is a problem with no precedents."

Sir John Hicks 1983

Table of Contents

INFLATION, RECESSION AND RECOVERY
A nominal income analysis of the process of global disinflation

Introduction*

1. The economic and policy background

The world economy has recently been through a period of severe, policy-induced disinflation. It is probably no exaggeration to say that the experience has been without precedent. For never before has the attempt been made – on a global scale and in a fairly concerted manner – to end such a prolonged period of inflation as the world has experienced since the mid-1960s.

The immediate trigger to a new degree of policy resolve was, of course, the second oil shock. The first oil price rise in 1973–74 had already apparently demonstrated how a pre-existing inflationary situation could be seriously inflamed by such an external event. Consequently, as the magnitude of the second oil price rise became apparent in 1979, policy-makers in most of the major industrial countries resolved together on a much less accommodative policy position than some of them had adopted in 1974–75. It may be noted at once, however, that while the oil shock made such a policy stance the more necessary, it also increased – at least to many minds – the likely short-run costs of disinflation in terms of low output growth and high unemployment. That is to say, policy was forced to confront both an ongoing, underlying, inflation as well as the direct and indirect effects of a further sharp rise in the cost of energy. But, short-run costs or no, policy-makers and others had become

* The author wishes to thank S.V. Arthur and H.J. Bernard of the BIS Monetary and Economic Department who made material contributions to the technical calculations underlying parts of this paper.

increasingly aware of the possible costs of inflation itself, especially those of an inflation apparently becoming more and more unstable. In this sense, the range of policy choices was felt by many to be narrower than it might have appeared at first sight.

Speaking broadly, the policy approach adopted gave primacy to monetary policy in the form of targets for one or more measures of the stock of money. For the purpose of the present paper, however, it will be more convenient to view the approach as one involving the setting of limits to the growth of nominal demand for output, that is, of money national income. Indeed, given that fairly stable relationships had been assumed between money stock changes and nominal income, the two amounted, in qualitative intent at least, to the same thing.

The important point about this policy setting was the "cap" which it placed on possible economic developments in nominal terms. Beyond the general intention that the secondary price effects of the oil shock should be firmly resisted, and that inflation should be brought down appreciably, no quantitative targets were set either for inflation itself or for real output and employment. Thus, the actual behaviour of prices and of output would depend on how the so-called price/quantity "split" developed. In other words, the more that any slowdown in nominal income growth was reflected in a slowdown in inflation, the less would the "real" economy be adversely affected by disinflation, and vice-versa. Or, again, even if eventually the whole of the decline in nominal income growth appeared in the price component, the extent of any lag in the reaction would determine the severity of the temporary loss of output and employment. The nature and development of the price/quantity split is thus crucial to the working-out of the process of disinflation.

Aware of this fact, policy-makers could be expected to wish to influence the split as much as possible in a favourable direction. However, one possible line of attack – namely incomes policy – was in many important cases judged either to be impracticable or to carry with it unacceptable side effects. Hence the major hope for

exerting influence on the price/output division was seen to lie in any possible "announcement effects" associated with the promulgation of rather tight monetary (and, implicitly, nominal income) targets. In the language of economists, the effect on "expectations" could be potentially very important in minimising the real costs of disinflation. Indeed, for some economists of the "rational expectations" school of monetarism there need be hardly any cost at all. The announcement of a credible policy approach would itself help to make the necessary price adjustment instantaneous.

We now know, of course, that this account of the disinflationary process was over-sanguine – at least on this occasion. Output growth in the industrial world over the period 1980–82 was the slowest for any three-year period since the second world war and unemployment has reached record levels. On the other hand, we also know that there has been – albeit after some lag – a most spectacular reduction in inflation, at least taking the industrial world as a whole. The weighted average increase in OECD consumer prices over the year to September 1983, at around 5 per cent., implies that world inflation is now the lowest it has been for ten years, and well below the peaks of 13–14 per cent. seen in 1974 and again in 1980.

Nevertheless, the years since 1979 would seem to demonstrate that disinflation – especially at a time of external price shock – is not a simple one-stage affair, but rather the more drawn-out process suggested in the title of this paper. The world economy has passed from inflation into recession and falling inflation and now, apparently, to recovery. It is, of course, this last stage that has recently been of concern, the questions being, firstly, whether sustained non-inflationary recovery would come fairly automatically or whether, if not, macro-economic policy would be able to do anything to help. On this occasion, this concern has been particularly acute for two reasons. First of all, unemployment in the industrial world is not only very high, but in some cases it is still rising. Secondly, and more novel, there is the international debt crisis for which growing markets in the industrial countries would be

a significant alleviation. Without such alleviation the adjustment pressures on already very poor populations could become even more severe.

In these circumstances the relevance of the nominal income type of analysis is twofold. There is first the question of whether, after a period of disinflation, the price/output split is likely to improve automatically, thus facilitating some recovery of real output even with a continuing, and appropriately moderate, rate of nominal demand growth. Secondly, there is the rather different question of whether – especially at the moment – nominal income might be both a more appropriate indicator of policy stance and a better target for policy-makers than the more usual macro-economic magnitudes. Put more directly, some observers feel that, at a time when income velocity in some major countries has clearly become very unstable for a variety of reasons, any or all measures of the money supply may be seriously biased indicators. In particular, a fall in velocity – an increase in the demand to hold money – could, under rigid money supply targeting, lead to an unnecessarily tight stance of monetary policy. A similar argument would apply – mutatis mutandis – in the case of an acceleration in income velocity. Perhaps more controversially, the argument could also apply to fiscal indicators to the extent that these have also become inadequate measures of the demand and price effects of fiscal policy.

The targeting of nominal GNP would thus represent a "middle way" between the former tendency to concentrate on relatively short-term "real" objectives – which proved inflationary – and exclusive concern with a price level targeted via intermediate variables which may from time to time give misleading signals. That said, however, it is considerably nearer in spirit to the policy approach adopted by the world's policy-makers in 1979 and 1980, in the sense that the "cap" to economic developments in nominal terms would be kept in place. Assuming that an adequate nominal growth rate can be assured, attention can then be shifted to other possible means by which non-inflationary recovery could be encouraged – that is, the "split" improved.

Indeed, one important rationale for the pursuit of a rigorous disinflationary policy in the first place was no doubt that such a policy might itself automatically improve the underlying situation in some way or other. The route could be through some "changing expectations" mechanism. Or, it could be based on new perceptions of the possible consequences – both for labour and for firms – of taking the risk of "pricing oneself out of the market". At all events, the possibility of changes in behaviour of this kind should obviously not be ignored. To the extent that they occur, they would of course imply that empirical analyses – such as that presented in this paper – based purely on history, would produce overly pessimistic results. The recovery might, in other words, be stronger on the side of real growth and weaker on that of prices than history alone would suggest. In fact, without the hope of such an outcome some countries might well not have been able to summon up the degree of policy resolve which they did. For others, however, this was one of the main points of the whole exercise, namely to eliminate inflation permanently as at least one of the indispensable means to securing sustainable growth in the longer term.

2. *Résumé and plan of the paper*

Despite its intimate connection with these current and important policy themes, this paper sets itself a relatively modest and limited task. Its basic concern is with a fairly simple empirical investigation of the behaviour of nominal income in the industrial countries over the past thirty years, and, in particular, during the two oil crises of the 1970s. This with a view to shedding some light, however faint, on the likely course of the process of worldwide disinflation. The analysis is conducted at a highly aggregated level, namely, the group of industrial countries comprising the OECD. It is thus important to bear in mind that individual country experience of disinflation may well differ from the average, particularly as the policy has been

applied in various forms and with varying degrees of firmness and perceived resolve.

The starting point of the empirical investigation is the simplest possible model of the inflation process, a model in which it is assumed that – apart from the effects of lags – the only determinant of inflation is the excess of nominal income growth over the underlying trend growth of real output. The latter is determined by other – non-monetary – factors. This model, though simple in the extreme and probably espoused by no school of economic thought in such a pure form, is nevertheless a convenient abstraction with which to begin the analysis. It embodies – albeit in extreme form – one of the basic ideas which now informs the background thinking of many people – policy-makers and others alike.

Perhaps not surprisingly – all other factors being omitted – empirical estimates of this type of model do indeed suggest some rather strong conclusions for the industrial countries taken as a whole. In the long run, all excess nominal growth apparently feeds through into prices. Macro-economic policy is thus unable to aim for some high target level of output and employment except at the expense of ever-accelerating inflation. Equilibrium, or normal, output is determined by other factors. In addition, however, – a point not often reported – when simulation experiments are carried out with them, models of this type also suggest a very pessimistic conclusion to any process of disinflation. Although the output growth rate may well recover to its trend after inflation is eliminated, the fall in actual output *levels* below earlier trends is large. Implicitly, in other words, the analysis apparently suggests a very high figure for the so-called NAIRU, the non-accelerating inflation rate of unemployment.

However, when this simple model is tested against the data of the 1970s alone – the period of large external price shocks – its performance is very poor indeed. And, in turn, when the rigorous character of the model is accordingly relaxed to permit exogenous influences on prices (that is, influences independent of movements in nominal income) the picture is somewhat different. In particular,

if import price changes are allowed for (though their complete exogeneity must be in doubt), or if at least the two oil shocks are assumed to have involved some independent element, then the conclusions of the analysis are modified appreciably. Similarly, the "split" is also found to vary significantly with the degree of slack in the world economy, implying that from low levels of capacity utilisation output recovery may be faster and less inflationary than otherwise – so long as policy is able to generate the requisite nominal demand. Even so, taken literally, the results suggest only limited room for manoeuvre.

One question, however, is how literally such results *should* be taken. A one-equation model of the industrial world's economy seems a rather weak reed on which to base serious policy analysis. And indeed, as the results themselves also demonstrate, the implications of the econometric estimates vary importantly with what the researcher is prepared to assume a priori about the nature of the inflation process. If he begins with the "classical dichotomy" – that is the independence of the real and monetary sectors of the economy – then he is likely to assume that, apart from the effect of lags, only money, or nominal income growth, *can* affect the rate of inflation. If, on the other hand, the nominal demand split is assumed to vary from time to time with other factors, then, apparently, a somewhat different answer is obtained.

Nevertheless, despite a fairly high degree of "first sight plausibility", acceptance of the purer nominal income explanation of inflation carries some rather strange implications when applied to the 1970s. This fact is illustrated in the final empirical section of the paper, which computes the hypothetical development of trend, or equilibrium, output which would be required in order to account for the actual inflation performance of the post-oil shock period without invoking the intervention of exogenous factors. The results suggest an underlying output path in which it is very difficult to believe wholeheartedly, involving, as it does, a highly erratic profile.

Around the empirical sections just summarised, the body of the paper is organised as follows. First a fairly straightforward version of

a nominal income theory of inflation is sketched out and its implications noted. Next the basic data for the OECD countries combined are examined in simple tabular and graphical form, noting especially that for virtually the whole of the period under review, nominal income growth has clearly been above any likely long-term trend of real growth, not only on average but on a year-by-year basis, too. Then the various regression analyses already mentioned are reported. The extreme case is contrasted with more eclectic formulations in which import prices, oil shocks and the utilisation of capacity are allowed to play a rôle. And finally, the analysis is reversed to calculate the kind of underlying output path which has to be assumed for the post-1973 period in order to make a pure nominal income model able to account for the observed variation in prices. The results of this and the earlier analyses are then reviewed and some of their implications drawn out in a final, concluding section.

A nominal income theory of inflation

We begin – as is often convenient in economic enquiry – with the absurdly simple. This device serves as a means of establishing the fundamental idea of a particular theory while at the same time providing a base upon which modifications of increasing realism can be built. The first panel of the diagram (page 14) thus depicts a no doubt non-existent world in which real and nominal quantities are entirely divorced. Real output is determined independently of purely monetary factors and, for convenience, is depicted as following a constant growth rate trend which is some form of inevitable "equilibrium" probably involving some "optimal" utilisation of resources.

Meanwhile, the money value of this output – assumed here to be synonymous with the flow of nominal demand – may vary as shown around the real equilibrium trend. Nominal demand is often

assumed to be determined exogenously by policy – monetary policy in particular – though in fact it does not much matter for this basic version of the theory whether other factors – such as autonomous movements in private-sector demand – also play a rôle, at least in the short term. The point, however, is that all such movements in nominal demand are reflected immediately in changes in the level of prices, that is in the rate of inflation. The ship of output and employment has so much momentum of its own, and is fitted with such exceptional stabilisers, that it sails steadily on completely oblivious of the waves of nominal demand. Macro-economic policy is thus completely powerless to affect real magnitudes, even in the very short run, price flexibility being complete. In any case, policy changes must be presumed to be unnecessary in such a world, as output is always on its optimal employment trend.

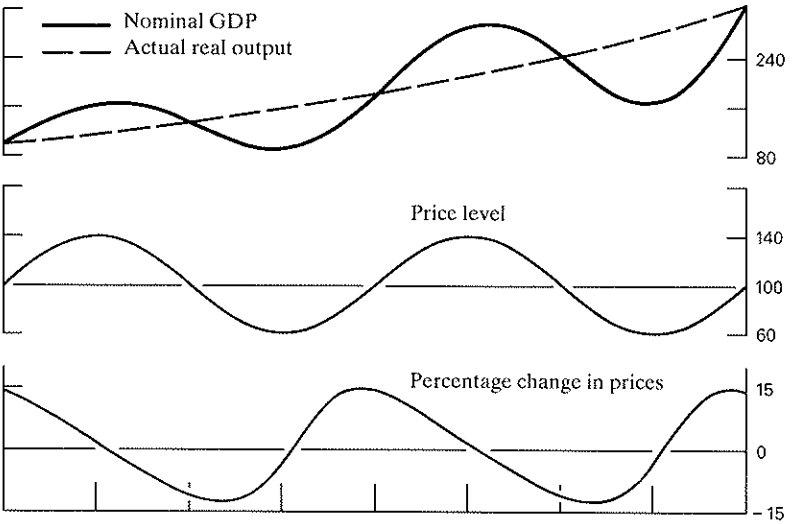
It is, of course, the case that no school of economic thought subscribes to such an extreme position. Differing views can nonetheless be characterised in terms of how close they come to the abstraction just described. Staying within a fairly rigorous framework, however, probably implies that the only major modification to the pure theory which can be envisaged is to admit the possibility of a lag between nominal demand changes and the resulting changes in prices.

As the second panel of the diagram illustrates, when price changes lag changes in nominal income, then indeed a cycle in real output can be generated by nominal quantities alone. It is, however, still a movement about a fixed trend – fixed, that is, independently of nominal developments.

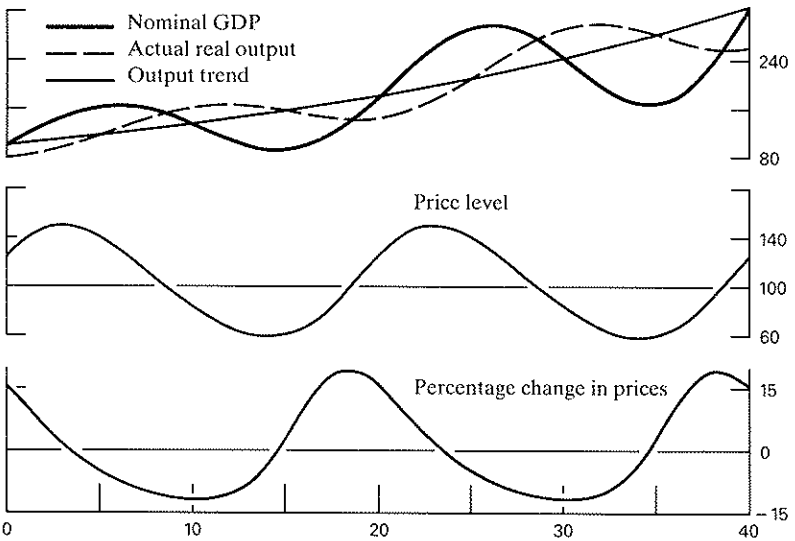
In the policy context, opinion varies as to the possible significance of such a mechanism. Some would argue that – perhaps because of the existence of rational expectations mechanisms – the lag in the price response is so short that for practical purposes at least it can be ignored. Macro-economic policy then remains incapable of any useful influence; indeed, any attempt at such very fine tuning could easily be counter-productive. And again, so long as nominal income growth is kept low and steady an occasion can never

Stylised representation of a nominal income theory of inflation

A. Rigid output trend



B. Lagged price response



arise when one might wish to use it anyway. Output would, by definition, be on trend.

On the other hand, the suspicion that the lag may sometimes be rather long has led some to suggest at least a minor, temporary, rôle for policy. For example, the economic journalist, Samuel Brittan, in his "How to end the 'monetarist' controversy" seems to countenance some small rôle for discretionary policy in countering recession "....if a recession is defined as unemployment *above* the... 'natural' rate... and self-correcting forces act too slowly". He doubts, however, whether the world is often in a situation where governments can be wholly sure that expansionary actions will not merely be inflationary.

Indeed, as a strict interpretation of the diagram also suggests, an active policy rôle may only be possible – *without contributing to further inflation* – if nominal income growth is already below the long-term real output trend. Otherwise, as is the case by assumption, any positive deviation of nominal income growth eventually finds its way entirely into higher prices. As we shall see later, this gives rise to problems in interpreting the recent world economic situation. The world is generally assumed to have been in recession, though nominal income growth has not fallen below any reasonable estimate of trend real growth.

One route out of this problem – but also out of the relatively pure nominal income world – is of course to allow that the price level may at times live a life of its own. A life, that is, influenced by factors other than nominal income. Thus, independent forces may arise, for example, from the non-economic manipulation of oil supplies, or from trade union pressures for higher wages. To the extent that these are not matched by equivalent downward flexibility of other prices and costs in the economy, the general price level would then tend to rise. With given nominal income, the implication is that actual output would be pushed down. Nominal income theorising would force one to assume that this fall in output was *also* a decline in trend, or equilibrium, output as well. In other words, a given path of nominal income growth would represent a greater excess over the

real output trend as the "natural rate" output level had been pushed down by purely supply-side factors. A fall in supply implies, ceteris paribus, an increase in excess demand.

At first sight, this may seem merely to be giving two different names to the same phenomenon. A rise in oil prices can be called either a reduction in the economy's supply potential or an exogenous rise in costs. As will become clear in the empirical estimation and simulation experiments reported below, however, the two ways of looking at the matter imply considerably different levels of the current trend of equilibrium output. Estimates of the pure (lagged) nominal income model, taken literally, seem indeed to imply that the world economy may still be above such a level – a disturbing thought.

Algebraic formulation of the model

The simplest representation of the nominal income model of inflation begins with the basic identity that nominal GDP is equal to the index of prices times a measure of the volume of output

$$Y = P \times \hat{Y}$$

where $\hat{Y}$ is the volume of actual output.

In terms of percentage changes, and using logarithms simply to linearise the relationship, we have

$$\dot{y} = \dot{p} + \hat{\dot{y}}$$

where lower case letters represent logarithms.

Then let $\dot{y}^*$ be the trend rate of growth of potential output, that is, the rate of growth of output at constant full (or high) employment. Subtracting $\dot{y}^*$ from both sides,

$$\dot{y} - \dot{y}^* = \dot{p} + \hat{\dot{y}} - \dot{y}^*$$

or

$$\dot{p} = (\dot{y} - \dot{y}^*) - (\hat{\dot{y}} - \dot{y}^*)$$

The rate of change of prices is then roughly equal – at low rates of inflation – to the difference between "excess" nominal income growth and the deviation of the actual output growth rate from trend growth. Excess nominal income growth is simply the difference

between actual nominal growth and trend real growth. Unless output can grow permanently above trend (something which is inherently unlikely!), all excess nominal growth (or "adjusted" nominal income in Gordon's terminology) must eventually go into prices (see Gordon 1981).

In the meantime, however, if prices do not respond immediately to adjusted nominal income changes, output must vary relative to trend for the necessary identity to continue to hold.

Assuming then that movements in nominal demand are exogenous to the model, and that the adjustment of prices is the operative mechanism determining the "split" (and therefore short-term movements in output) the precise form of the adjustment process may be found by estimating an equation of the form:

$$\dot{p}=f(\dot{y}-\dot{y}^*)$$

where f summarises the price adjustment process. Assuming the simplest lag mechanism, we might have:

$$\dot{p}_t=a+b(\dot{y}-\dot{y}^*)+c\dot{p}_{t-1}$$

One practical problem with this kind of formulation is that it contains one unobservable magnitude, namely $\dot{y}^*$, the underlying trend rate of growth. The only solution that is not completely arbitrary is to assume that, on average, actual output has in fact been on this trend. But, as will be discussed in more detail below, there must (within this particular theoretical framework) be some doubt about using this procedure over a period of secularly accelerating inflation. The latter fact ought to imply that actual output has been above equilibrium for an appreciable period. There is also the difficulty that many observers strongly believe that this underlying trend changed after 1973 but that, even so, actual output on average fell short of the potential trend.

The basic facts, 1953–82

A preliminary, non-technical, examination of the data reveals at once that actual developments in the industrial countries taken as a

whole have not entirely matched the stylised world of the diagrams presented above. In particular, for virtually every year since 1953, nominal output growth has on average exceeded both actual real growth and any reasonable estimate of the underlying real trend. (The analysis is conducted at the level of the OECD countries as a whole basically for two reasons. Firstly, the recent process of disinflation has effectively been global, and secondly, during the period of floating, exchange rate under and over-shooting may have interfered with the relationships between nominal income and prices in individual countries.)

The nominal GDP split: OECD countries 1960–82

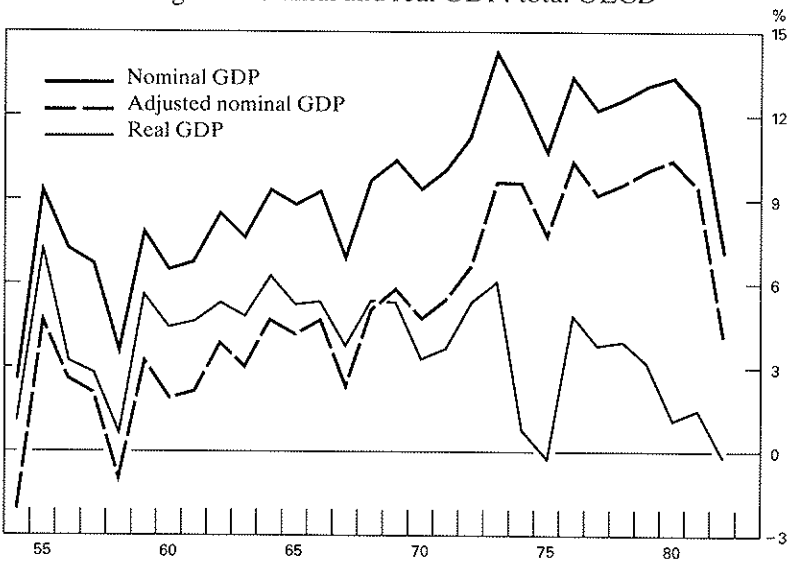
Period	Nominal income growth	Output growth	Price change (GDP deflator)	Proportion of nominal GDP growth accounted for by price changes (percentage)
	in percentages per annum			
1960–67	8.3	5.1	3.0	37
1968–73	10.8	4.9	5.6	52
1974–79	12.5	2.8	9.4	78
1980–82	10.0	0.6	9.3	94

Indeed, as the table shows, nominal output growth tended to accelerate secularly over the period from 1960 to 1979 while real growth declined. In the 1980–82 period, when some deceleration in nominal growth was achieved as disinflationary policies were more firmly applied, output growth virtually disappeared. Consequently, the proportion of nominal demand growth going into price – rather than output – changes has risen continuously and strongly until, in the three years to 1982, the figure reached nearly 100 per cent. On the face of it, this would seem to be fairly strong evidence on the side of those who assert that demand policies have become increasingly ineffective, and that therefore the only rôle for policy is to be found in eliminating inflation.

However, as was demonstrated in the theoretical section above, even under a still-pure nominal income theory of prices, the presence of any lag in the relationship is potentially important. In

this case, a sharp change in nominal growth might temporarily leave prices relatively unaffected (and output correspondingly affected). And indeed, as the graph shows, the deceleration in nominal income growth has been particularly dramatic in the most recent period, especially in 1982. Thus, while nominal growth rates of the order of 12–13 per cent. were common in the years leading up to the second oil shock, by 1982 the rate had fallen to 7 per cent., a figure not seen since 1967. At the same time, however, output growth came to a halt.

Changes in nominal and real GDP: total OECD

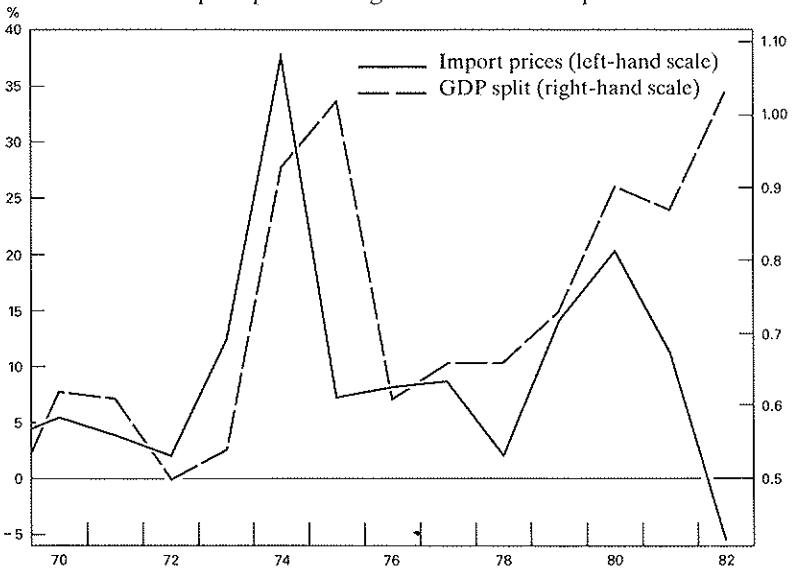


If one is prepared to make a more fundamental break with the pure nominal income theory, then the worsening income split can be the more easily explained. Specifically, if independent – exogenous – price/cost rigidities and pressures are admitted (even relatively temporarily) then the output-depressing effects of disinflationary policies (or even of unchanged – i.e. non-accommodating – policies

in nominal terms) are likely to be the more severe. The two forces most often considered under this heading are, of course, independent wage-cost-push pressures and external price shocks such as the oil price explosions. The first of these is notoriously difficult to capture in a time series of statistics – a fact which no doubt helps to explain the long and continuing debate over the very existence of such forces. The second, however, is more amenable to measurement. And in fact when the nominal income split is graphed year by year in the 1970s against total import price changes, a fairly clear relationship is observed. At times of external price shock, the proportion of nominal output change accounted for by price increases rises quite sharply. This fact does not of course *prove* that import price changes are entirely exogenous. Indeed, non-oil commodity price changes are often linked with general demand developments in the industrial world. And clearly, the oil price shocks themselves could not have happened at *some* – very low – level of demand for oil. Nevertheless, in this latter case, one can probably fairly say that for some given – relatively modest – pressure of demand in the oil-importing world, the de facto restriction of oil supplies in 1973–74 and again in 1978–79 involved some purely independent element – independent, that is, of nominal developments in the OECD area.

Even so, the influence of oil prices on the split is not quite as simple as it appears at first sight. The definition of GDP in the industrial world of course excludes imports, domestic output being confined to domestic value added alone. Thus, given that only part of total oil consumption (34 per cent. in 1973) in these countries is accounted for by domestic oil production (which *does* enter into GDP), some of the effect of the oil shocks on the *GDP deflator* is likely to be indirect. This may occur in two ways. Firstly, the rise in oil prices may well affect the prices of other, domestically produced, sources of energy. And secondly, other (non-energy) prices and, especially, wages may be influenced by the jump in consumer prices (which do contain the direct effects of changes in import prices). At all events, however, there does seem to be a visible relationship

Import price changes and the GDP split



between overall changes in import prices and the price/quantity division of nominal GDP. (In addition, any output/productivity effects of oil price shocks may, temporarily, affect the overall price level).

But the graph also shows two occasions, in 1975 and again in 1982, on which the relationship between import prices and the split apparently broke down. In both years, the split worsened significantly while import price increases declined sharply. In 1982 the latter were even negative. On both occasions, however, nominal growth was decelerating sharply, especially in the case of 1982. This may be a further pointer to the existence of a lag in the income-prices relationship.

Another point suggested by a simple examination of the data involves the source of changes in nominal income itself. Pure theory tends to assume, at its extreme, that nominal growth is exogenous, being set essentially by public policy. But, of course, the flow of

Forecasts and outcome for 1982: total OECD
Percentage changes; annual rates

		1981	1982			1982 HII levels, index: 1981 HII = 100
			Year	First half	Second half	
Forecast published in July 1981	Nominal GNP	11.1	10.9	10.9	11.5	111.2
	Price level	9¾	8¾	8¾	8½	108.6
	Output	1¼	2	2	3	102.4
Forecast published in December 1981	Nominal GNP	10.4	9.9	9.6	11.5	110.6
	Price level	9	8½	8¾	8	108.4
	Output	1¼	1¼	¾	3¼	102.0
Outcome	Nominal GNP	10.6	6.9	6.3	6.7	106.5
	Price level	8.9	7.2	7.4	6.0	106.7
	Output	1.6	−0.3	−1.0	0.6	99.8

Source: OECD Economic Outlook, various issues.

nominal demand for output is not directly controlled by policy-makers at all. In addition, the control instrument, now normally assumed to be monetary growth, is itself not accurately targetable, especially over short periods. And even if it were, the relationship between money and income is not always reliable. The reason for raising this question is the rather unusual profile of nominal income growth during the 1980–82 period of disinflation. In particular, the sharp decline in income growth in 1982 seems at first sight to cast doubt on the supposedly "gradualist" nature of the intended disinflationary programme.

Policy-makers' intentions regarding nominal GDP are of course not known with any precision. However, the accompanying table does suggest that disinflation may have become somewhat sharper in 1982 than might have implicitly been intended. The table shows consensus international forecasts made by the OECD Secretariat in 1981 against the actual outcome. Nominal income growth clearly fell well below expectations in 1982. Indeed, by the second half of the year, nominal demand was running some 4 per cent. below earlier

expectations, prices and output volume taking roughly equal shares in the shortfall. In short, the recession was deeper than expected, and so was the decline in inflation.

While this fact casts some doubt on the assumption that nominal demand developments are completely in the (exogenous) hands of the policy authorities alone, it may not matter too much for the analysis that follows. For, under the influence of import cutbacks in heavily indebted developing countries and restrained private investment at home, nominal demand movements may still have been, so to speak, the prime mover on the scene (though see the qualifying note for page 49). Their provenance presumably does not much matter for the resulting change in inflation. But what would cast doubt on the econometric analysis of the nominal income theory of inflation would be any influence of exogenous price movements on nominal income itself – that is, the possibility of reverse causation. And clearly, the more one leans to the view that some price movements may have causes other than changes in nominal demand, the greater is the possibility of some such reverse causation. Either such price shocks might temporarily raise the nominal income flow in the face of an unchanged money supply policy (i.e. increase velocity) or the authorities might react by accommodating them to some degree. In this latter case the policy-makers would themselves become endogenous to the system, and econometric estimates of a nominal income-to-prices model would be to some extent invalid because of the simultaneous existence of another, reverse, relationship between the two variables.

However, the purpose of this paper is considerably more limited than to provide a full and final explanation of world inflation and disinflation. Rather it is to apply what is currently a fairly popular method of analysis and to observe some of the implications of such an analysis both in relatively pure and more eclectic forms. And for this purpose, as was noted in the exposition of the model, estimates of nominal GDP growth are required adjusted for the underlying trend real growth rate. This adjustment poses something of a problem, particularly for the period after 1973 when actual growth is

generally acknowledged to have been on average below its "full employment" trend, but when many also believe the trend itself to have shifted downwards. Consequently, it is not possible to measure the underlying trend on the assumption that actual output was on average on such a trend in this period.

The solution adopted here is in two parts. For the period up to 1973 the trend of actual output was assumed to be also the underlying rate of growth. This gave a figure of a little over 4½ per cent. per annum for the industrial countries as a whole. As the graph shows, however, to have assumed the continuation of such a trend into the post-oil-shock period would have implied that output has recently been nearly 20 per cent. below trend, which most would find absurd. For example, although labour forces have continued to grow (and even accelerate slightly on average), investment performance and technical progress have been such – in combination – that the rate of growth of productivity in the industrial world has fallen sharply from just under 4 per cent. per annum between 1960 and 1973 to less than 1½ per cent. since then. After a decade of such experience it is difficult to ascribe much of this productivity shortfall to the usual cyclical factors. And in turn, this leads to the conclusion that the full employment trend of output must have been significantly lower in the post-1973 period.

The main assumption adopted here is that in the most recent period trend growth has averaged 3 per cent. per annum. Given that actual growth has averaged 2½ per cent. per annum and unemployment has risen on average from 3½ per cent. in 1973 to an estimated 9½ per cent. now, this seems a reasonable, perhaps somewhat conservative, estimate. It implies that by mid-1983 output in the industrial countries was on average some 6–7 per cent. below trend.

The changes in nominal GDP adjusted for the trend so calculated are to be seen in the graph on page 19. Speaking very broadly the graph shows that "excess" nominal income growth, which had varied around 5 per cent. in the 1960s and very early 1970s, accelerated sharply from 1972 onwards, so that for nearly all years from then

until 1981 the figure was about 10 per cent. Only in 1982 was a sharp reduction achieved back to earlier norms.

Estimates of a pure nominal income model

Armed with the data thus constructed, we may now proceed to the estimation of a nominal income model for the industrial countries taken together. It was fairly clear from a preliminary examination of the facts that the extreme – instantaneous price adjustment – version of the model did not correspond with reality. Hence, the "purest" nominal income model would be unlikely to deliver good results. And indeed, as the table shows, estimated equations containing a lagged price change term deliver a highly significant coefficient on that term and a better goodness of fit than equations assuming no lagged adjustment effects.

The table also shows, for the record, the results obtained using alternative adjusted nominal income variables. That which assumes the continuation of the previous 4½ per cent. real output trend into the post-oil-shock period, though fitting comparably well, nevertheless delivers an implausibly high estimate of the long-run adjustment of GDP prices to adjusted nominal income changes.

The preferred specification, which works on an assumed 3 per cent. trend real growth rate after 1973, gives the kind of result which seems to support the nominal income hypothesis quite strongly. The long-run adjustment coefficient turns out to be almost exactly unity. Thus all "excess" nominal income growth finds its way into prices. In the short run, output may change somewhat in response to income changes, but before long the underlying trend level of output will reassert itself. Policy can thus influence only prices in anything but the short run: it cannot stimulate the economy permanently, nor can a policy of disinflation have more than temporary recessionary effects. On the face of it, the results are thus quite striking and suggest only a limited rôle for policy in the so-called policy effectiveness debate. The existence of a lag in the relationship gives

Price response equations for three alternative assumptions about trend real output growth after 1973[1]

	Whole period		1954–73		1974–82	
	A	B	A	B	A	B
1. Earlier trend continuing (4.6 per cent. per annum) Coefficients:						
Constant	1.31	−0.14	1.86	0.04	6.96	4.33
	(1.7)	(0.3)	(4.1)	(0.1)	(3.0)	(0.8)
Adjusted nominal GDP change	0.87	0.43	0.48	0.28	0.37	0.43
	(6.3)	(4.0)	(4.8)	(3.3)	(1.2)	(1.3)
Lagged price change	–	0.67	–	0.75	–	0.22
		(7.8)		(5.5)		(0.6)
Long-run adjustment coefficient	0.87	1.30	0.48	1.15	0.37	0.55
$\bar{R}^2$	0.58	0.87	0.54	0.81	0.05	−0.05
Standard error	2.11	1.17	1.12	0.69	1.72	1.81
Durbin h statistic	1.21[2]	0.36	1.37[2]	−0.54	1.18[2]	n/a
2. Actual trend 1974–82 (2.6 per cent. per annum) Coefficients:						
Constant	1.16	0.18			6.22	3.46
	(2.0)	(0.4)			(2.9)	(0.6)
Adjusted nominal GDP change	0.80	0.43			0.37	0.43
	(8.9)	(4.3)			(1.2)	(1.3)
Lagged price change	–	0.55			–	0.22
		(5.6)				(0.6)
Long-run adjustment coefficient	0.80	0.96			0.37	0.55
$\bar{R}^2$	0.74	0.88			0.05	−0.05
Standard error	1.68	1.13			1.72	1.81
Durbin h statistic	1.52[2]	0.71			1.18[2]	n/a
3. Assumed 3 per cent. per annum trend Coefficients:						
Constant	1.15	0.11			6.37	3.64
	(1.9)	(0.2)			(2.3)	(0.6)
Adjusted nominal GDP change	0.82	0.43			0.37	0.43
	(8.4)	(4.3)			(1.2)	(1.3)
Lagged price change	–	0.58			–	0.22
		(6.0)				(0.6)
Long-run adjustment coefficient	0.82	1.02			0.37	0.56
$\bar{R}^2$	0.72	0.88			0.05	−0.05
Standard error	1.75	1.13			1.72	1.81
Durbin h statistic	1.48[2]	0.62			1.18[2]	n/a

[1] Figures in brackets show t-statistics. [2] Durbin-Watson statistic.

the only – relatively minor – policy lever and allows only for some speeding-up of an otherwise assured recovery back to trend output.

The equation does not, however, perform quite as convincingly when restricted to the earlier, faster growth, period. More spectacularly, and disturbingly, it does not perform at all in the more recent period, when inflation has risen to new and unacceptable heights. It is true, of course, that the post-oil-shock period still contains too few (annual) observations for one to expect well-determined parameter estimates. Even so, to find no detectable statistical relationship at all must be considered as raising serious questions about the approach.

Nevertheless, the whole-period estimates are of the kind that could well influence opinions, both of policy-makers and others, so that a deeper examination of the hidden implications of such a relationship are worth investigating.

One important characteristic of the simple formulation is that, given that it relates the price deflator of GDP to nominal GDP itself, the level and growth of real output are themselves automatically implied once starting values and a particular nominal income pattern are specified, and the corresponding movements in the deflator calculated. In other words, with two elements in the $Y=P\times\hat{Y}$ identity specified, the third is given automatically. This allows us to conduct the simulation experiments shown in the following graphs. In particular, the responses of both domestic inflation and output to various "policies" for nominal income can easily be calculated.

The simulation experiments were performed, not on the actual (whole-period) estimates of equation 3, but rather using the following equation:

$$\dot{p}_t=0.42(\dot{y}-\dot{y}^*)+0.58\dot{p}_{t-1}$$

The reason is that, interpreted literally, the estimated relationship is dynamically unstable, a fact which becomes important if simulations are to be performed over a lengthy period. There is a small positive constant term and the long-term adjustment coefficient is slightly over unity. However, as the constant is not statistically significantly different from zero, nor the long-term adjustment coefficient from

unity, it did not seem unreasonable – for the purpose in hand – to impose values of zero and unity respectively. Without such an imposition the relationship obviously implies, literally, that inflation cannot be stopped – or even stabilised – without output declining indefinitely relative to trend.

The first simulation shows the implications of a straightforward attempt to eliminate a pre-existing inflation by a reduction in nominal GDP growth over two years to a non-inflationary rate. The simulation begins from a situation in which output is on trend with respect to both its level and rate of growth, and domestic inflation is running at 10 per cent. This situation roughly resembles that of 1979.

The results are fairly striking, with inflation falling rapidly to around 2 per cent. during the third year, and thereafter drifting on slowly down towards zero. So far as output is concerned, the effects are also dramatic. From a growth rate of 3 per cent., the rate becomes virtually zero already in the first year and an outright fall of about 1½ per cent. occurs in the second.

However, at least in terms of the *growth rate* of output, recovery does occur automatically, albeit somewhat tardily. Eventually, growth returns to the underlying 3 per cent. trend. What does not occur, though, is any recovery at all in terms of the ratio of output to trend (and, implicitly therefore, in terms of any reversal of the rise in unemployment). And this permanent output loss is severe, amounting to some 10 per cent. early in the disinflation process and rising eventually to about 13 per cent.

As the second and third simulations demonstrate, qualitatively similar results are also obtained when less rigorous disinflationary "policies" are assumed. In the former example, the zero inflation target is relaxed to allow 5 per cent. inflation. And in the latter the disinflationary thrust is reversed after two years in an attempt to counter some of the output effects of the disinflationary effort. In both cases the output effects of the assumed policies are considerably smaller than in the zero inflation case, especially in the earlier years. In the case in which the disinflationary thrust of policy is applied only temporarily, the output growth rate actually rises

above trend for two years, thus reversing some of the increase in slack. In neither case, however, is the former (presumably full employment) trend of output regained (see Note 1).

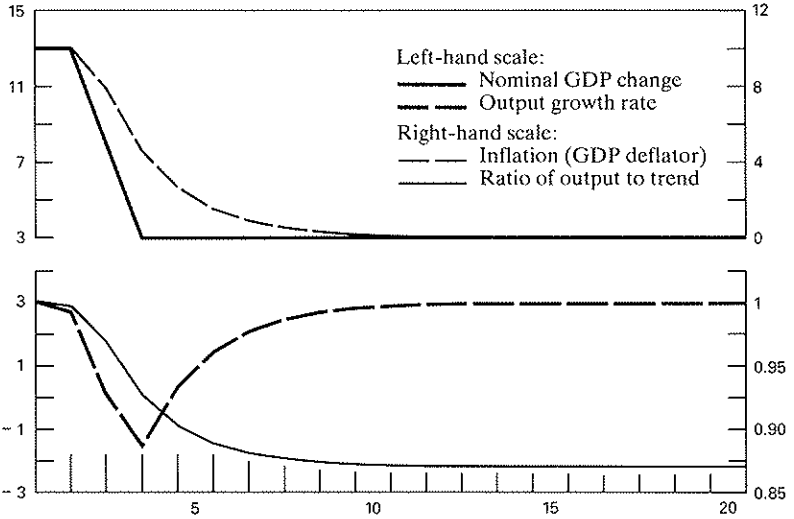
The story is basically the same when the zero inflation target is restored but the disinflationary policy is applied very gradually, as in the fourth simulation. The effect is merely to hold output growth very low (though never negative) over a more prolonged period and higher employment levels are never restored.

The remaining simulations, 5 and 6, illustrate the implications, not of disinflationary policies, but of policies targeted on output and/or employment. In the first, less ambitious, case, policy-makers set out to raise the level of output relative to trend by 5 per cent. and then maintain it there. Such a policy might be aimed, for example, at a permanent reduction in unemployment. To this end, the rate of growth of output is raised above the long-run trend of 3 per cent. for five years. As the graph shows, the result is an indefinitely accelerating rate of inflation very much along the lines postulated, for example, by the monetarist argument. The point which is of practical import currently is that, *starting from a still positive rate of inflation*, there is apparently no way of bringing about a sustainable recovery – recovery in the sense of a reduction in slack. The situation is qualitatively the same in the case of a more ambitious policy (see simulation No. 6) under which a more permanent increase in the underlying growth rate is sought. Again the attempt would – on this model – eventually have to be abandoned because of its implications for accelerating price increases.

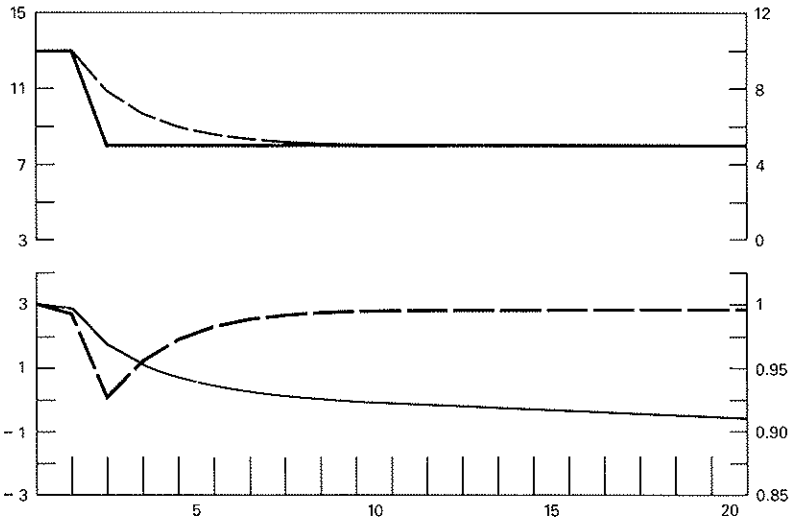
The upshot of experiments with these simpler nominal income models is thus very much in line with some current streams of thinking. Nominal demand changes are in the end powerless to achieve particular targets for real magnitudes. They are, however, capable of delivering a reduction in inflation. But the novelty of these results lies in their peculiarly pessimistic implication for the sustainable level of output. Not only do they imply a temporary output loss during the disinflationary process – something which many had already come to accept – but they also imply a large and

Simulations with the simple model

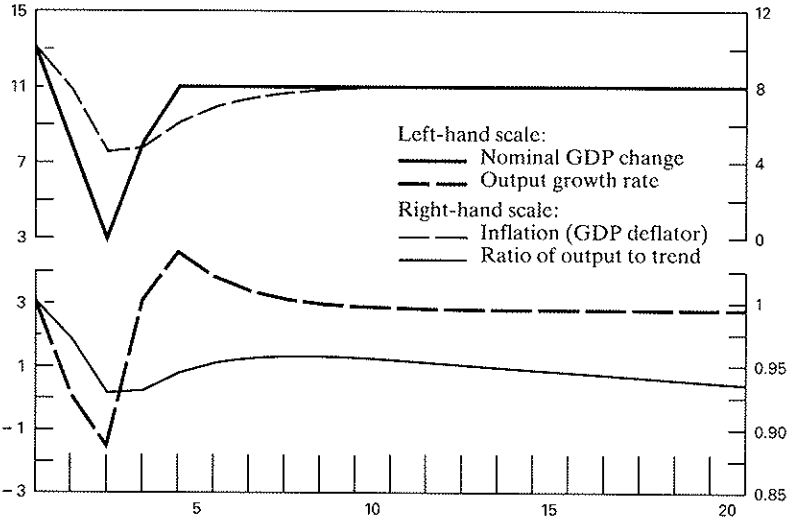
1. Zero inflation target



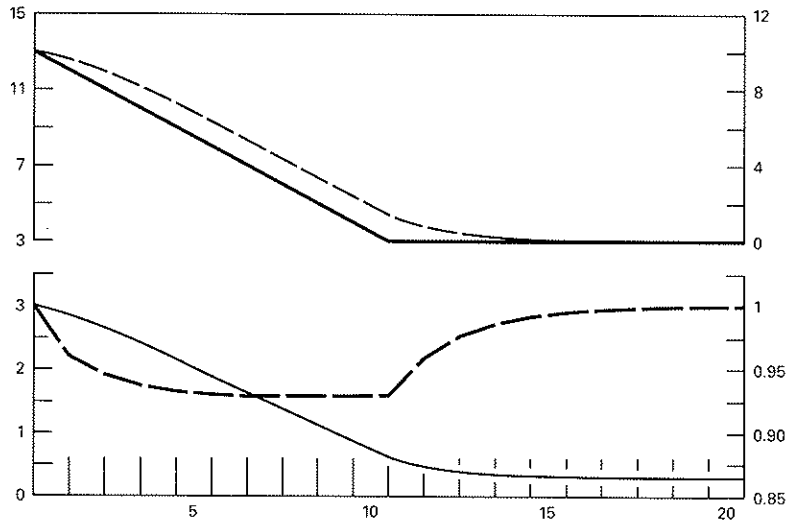
2. 5 per cent. inflation target



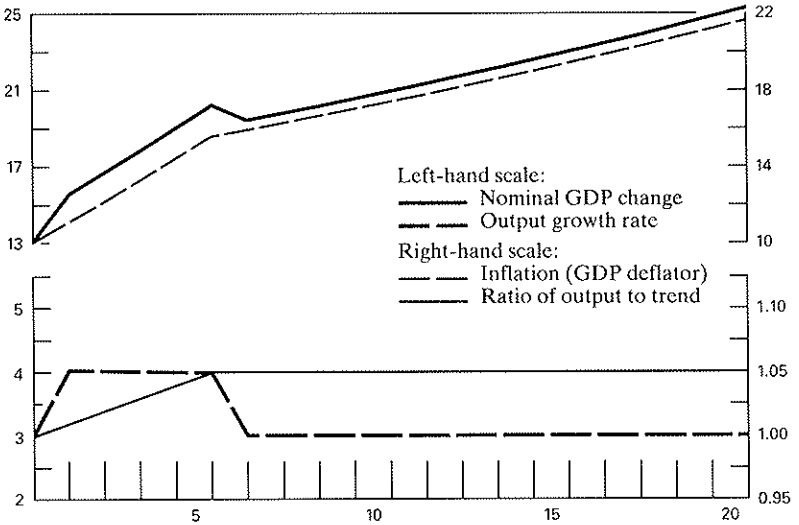
3. Temporary disinflation



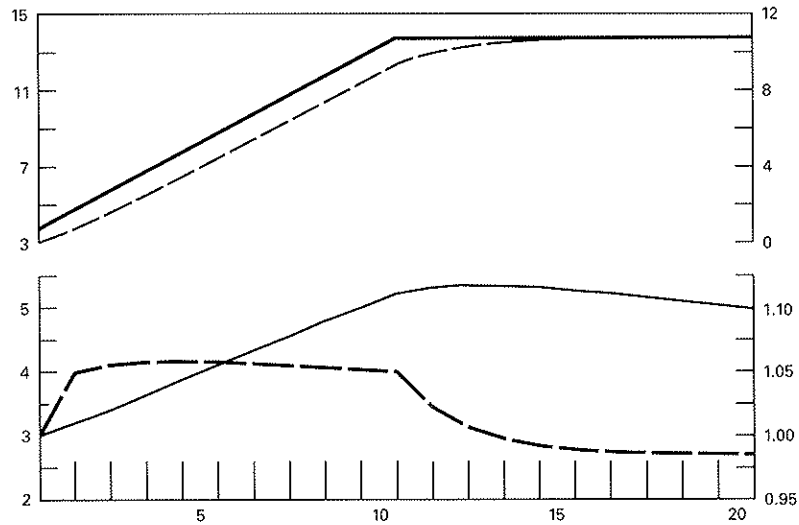
4. Gradualism



5. Real output target



6. Above-trend growth rate target



continuing loss. Put the other way round, the results suggest for the past that, relative to its underlying trend, output has been too high by a very large margin indeed.

In other words, the question raised is not so much whether the adjustment of prices to adjusted nominal income is complete – no-one could disagree that at some pressure of demand that has got to be so. Rather, the issue becomes what that demand pressure point is, and, as a corollary, what the sustainable pressure of demand is. Viewed from the perspective of a flexible/endogenous-price world, it is difficult to believe that world output has been running so far above the optimum. In turn, this might stimulate the search for other explanations. In particular, it seems intuitively plausible that if price pressures have at times increased independently of either nominal or real demand pressures, then a less pessimistic result might be obtained.

The introduction of import prices and a non-linearity into the model

As mentioned earlier, the two major candidates offering themselves as independent sources of price pressure are wage-push and import price pressures. The possible existence of the first of these is ignored in this analysis, firstly because of the obvious measurement problem. Secondly, however, given that the focus of the discussion above has been shifted towards the sustainable level of output (and hence the possibilities for recovery), it is not clear how relevant wage-push then is. The reason is that, only if such cost-push pressures abate (at any given output level) can the estimate of the sustainable/non-inflationary level of output be higher. In the absence of such a possible abatement (perhaps because of the introduction of a successful incomes policy or of other changes in wage-bargaining behaviour) it is pure semantics – in this context – to ascribe some of the inflation to cost-push rather than nominal-demand-pull factors. In this sense, it seems clearer that external

price changes might be considered as exogenous sources of price pressure. In particular, oil price shocks of the size of those experienced in the 1970s might (with luck, continued energy conservation, and no excessive boom in the world economy) not recur over the next few years. If so, such previous pressures may have lowered the implicit estimate of the currently sustainable level of output as measured in the last section. It may be recalled, too, that the purer model did not in any case fit the post-1973 period at all.

In addition, the possibility is investigated here that the relationship between nominal demand and prices may not be straightforwardly linear. The hypothesis tested is that the adjustment coefficient may itself vary with the degree of slack – that is, the ratio of output to trend. Thus, the coefficient on adjusted nominal income (the coefficient b on page 17 above) is assumed to take the form:

$$b=d+e.SLACK$$

Hence $$b(\dot{y}-\dot{y}^*)=(d+e.SLACK)(\dot{y}-\dot{y}^*)$$

In estimation, this simply implies that an extra explanatory variable ($SLACK\times(\dot{y}-\dot{y}^*)$) is included in the regression in addition to ($\dot{y}-\dot{y}^*$) itself.

The accompanying table shows the results of various estimation experiments incorporating non-linear and import price effects. As the first result demonstrates, however, simply converting the previously-estimated, lagged formulation to a non-linear form does not give good results. Neither of the adjusted income variables is apparently significant (the two variables are of course highly co-linear), though the signs of their coefficients (d and e) are plausible, suggesting greater price (rather than output) adjustment the higher the pressure of real demand.

The introduction of import prices into the analysis makes a considerable difference, however. The overall fit improves, import price changes themselves are highly significant, and the estimates of d and e move towards a greater degree of statistical significance. The "best" result – equation D – is achieved when the lag pattern for

import price effects is allowed to differ from that for adjusted nominal income.

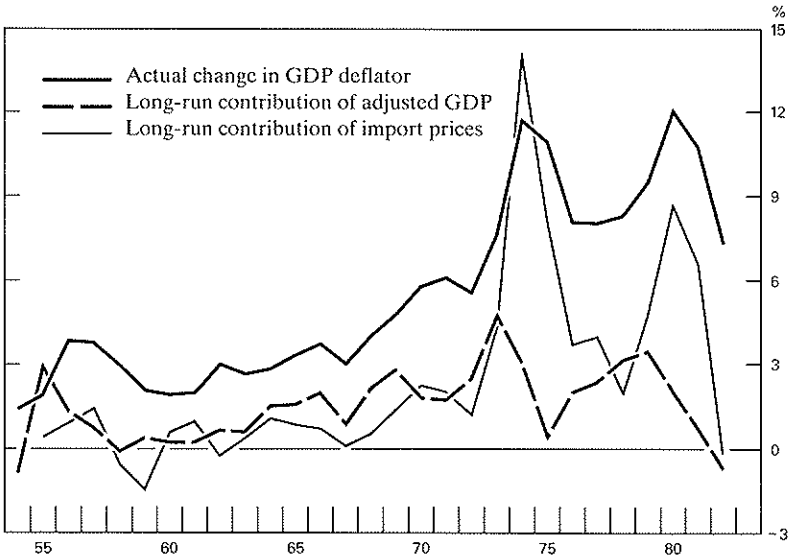
Perhaps the most outstanding result of the introduction of import price effects, however, is the drastic reduction in the coefficients on nominal income. Some reduction was, of course, to be expected, and in turn a less pessimistic assessment of sustainable output levels in the absence of external shocks. But the reduction here seems unrealistically large. For example, from equation D it is estimated that, when output is on trend, only 35 per cent. of adjusted nominal income changes passes into prices, even in the long run. And the following table, which tracks the variation of the price adjustment coefficient with slack, also seems to suggest unrealistic figures. According, again, to estimates from equation D, output would need to be 26 per cent. above trend before all nominal income change went immediately into prices. And for the long-run effect to be entirely on prices, output would still need to be held 14 per cent. above trend.

On the other hand, at the opposite end of the scale, the estimates do suggest that all adjusted nominal income change should be reflected in output changes at the kinds of demand pressure experienced recently.

Nevertheless, the corollary is that import prices are estimated to have a large effect on domestic value added prices for the industrial countries as a whole. It can be estimated from equation D that the total short-run coefficient on import prices is 0.19, and the long-run coefficient 0.48, that is, the import price coefficients are larger than those on adjusted nominal income at normal levels of output. Thus, given that at times import prices have risen much faster than adjusted income, there have been periods, especially in the 1970s, when import prices have apparently contributed significantly the greater proportion of final price increases (see graph).

This seems intuitively implausible, especially as in theory import prices do not – by definition – enter into the price deflator of GDP, that is the price of domestic value added. In this case, however, practice diverges from theory. The estimates of imports of goods and

Long-run contributions of adjusted nominal income and import prices



services at current and constant prices – from which the OECD import deflator is calculated – include intra-trade flows. Indeed, these make up well over half of total OECD "imports" as recorded. It follows that the import price index so calculated already contains the average price of that part of domestic value added traded between the OECD countries themselves. Hence the exogeneity assumption does not hold even at the level of the statistics themselves.

Accordingly, a second formulation was tried, in an attempt to incorporate only truly independent external price effects. In this an index of world commodity prices was used (including oil); the results are shown in brackets beside those for equation D. The result is certainly an "improvement" in the sense that the rôle of nominal income increases (though the standard error of the equation rises) as compared with the earlier formulation. Even so, with a long-run adjustment coefficient of not much over one-half at trend levels of output, the effect still seems on the low side.

Price response equations with response assumed to vary with the degree of slack

	Whole period (without import prices) A	Whole period (with import prices) B	1954–73 (with import prices) C	Whole period (with current and lagged import prices) D[1]	1954–73 (with current and lagged import prices) E
Assumed 3% trend output after 1973					
Coefficients:					
Constant	−0.03	0.59	0.54	0.76 (0.71)	0.67
	(0.1)	(1.8)	(1.3)	(2.4) ((2.2))	(1.6)
Adjusted nominal GDP change	−1.89	−2.25	−2.31	−3.15 (−1.87)	−1.62
	(0.6)	(1.1)	(1.0)	(1.7) ((0.9))	(0.7)
Adjusted GDP change times "slack" ratio	2.28	2.36	2.42	3.29 (2.06)	1.75
	(0.7)	(1.2)	(1.0)	(1.8) ((1.0))	(0.8)
Lagged price change	0.66	0.71	0.71	0.60 (0.62)	0.60
	(4.3)	(7.3)	(6.0)	(5.9) ((6.2))	(4.4)
Change in import prices	–	0.14	0.13	0.13 (0.035)	0.14
		(6.1)	(2.1)	(5.9) ((4.4))	(2.3)
Lagged change in import prices	–	–	–	0.06 (0.025)	0.11
				(2.4) ((3.1))	(1.6)
Short-run adjustment coefficient[2]	0.39	0.11	0.11	0.14 (0.20)	0.13
Long-run adjustment coefficient[2]	1.15	0.38	0.38	0.35 (0.53)	0.33
$\bar{R}^2$	0.88	0.95	0.86	0.96 (0.95)	0.87
Standard error	1.14	0.72	0.60	0.66 (0.71)	0.57
Durbin h statistic	0.57	−1.60	−1.35	0.26 (1.01)	−1.71

[1] Results shown in large brackets show the estimated coefficients when changes in commodity prices are substituted for the import price variable. See text. [2] Evaluated at actual output=trend output.

Price response and the degree of slack: implicit estimates from the price equations[1]

	Equation									
	A		B		C		D		E	
	S-R	L-R	S-R	L-R	S-R	L-R	S-R	L-R	S-R	L-R
Price response estimated at:[2]										
trend output	0.39	1.15	0.11	0.38	0.11	0.38	0.14	0.35	0.13	0.33
output 5% above trend	0.50	1.48	0.23	0.79	0.23	0.80	0.30	0.76	0.22	0.54
level of slack in 1982	0.25	0.72	−0.04	−0.13	−0.04	−0.11	−0.07	−0.17	0.02	0.05
Implicit ratio of output to trend at which price response=1	1.27	0.98	1.38	1.08	1.37	1.07	1.26	1.14	1.50	1.15
Implicit ratio of output to trend at which price response=0	0.83		0.95		0.95		0.96		0.93	
Memorandum item: Estimated ratio of output to trend in 1982	0.94									

[1] S-R: short-run. L-R: long-run. [2] Note that all the estimates presented in this section of the table are point estimates at some given value of the ratio of output to trend. Except for the fortuitous case in which the measured price response is already 1, the model of course implies that the pressure of demand and the price response will themselves both change (in the absence of oil-shock effects) with the passage of time, if adjusted nominal demand is changing. This is of course particularly so for those cases in which a negative response is implied.

For such reasons – and also because the prices of many imported primary commodities are in any case thought to be dependent on demand conditions within the industrial countries themselves – a final specification was tried. In this, import prices as such were dropped from the analysis. In their place a dummy variable was tried, taking the value 2 in 1974 and 1 in each of the years 1979 and 1980, with zero elsewhere. Such a variable purports to test the theory that the major external and exogenous price influences were confined entirely to the two oil shock periods and that they were equal, the first oil shock being concentrated in one year and the second being spread over two. For the rest, more normal import price effects are then assumed to be taken up in the coefficients on adjusted income in the industrial world.

Oil shocks formulation: the results

The main feature of the resulting estimates is that the rôle of nominal income is raised again to more plausible levels compared with the formulation in which all import price changes were permitted to exert an influence. As the table shows, too, when an independent lag structure is allowed to the oil shock effects, both nominal income terms return to significance. In addition, the relationship between the total income coefficient b and demand pressure becomes steeper. Thus the price response now reaches unity at an output level only 2 per cent. above trend, while it still falls to zero at 95 per cent. capacity utilisation.

Looked at over the estimation period, the price response also seems to vary in an a priori reasonable manner. The industrial world economy moves from the 1958 recession, in which the price response was low, to a period in the late 1960s and early 1970s in which the long-run price response was much higher, and occasionally came quite close to unity.

Even so, the highly significant oil shock variable may still be making an unrealistically large contribution (see graph on page 41)

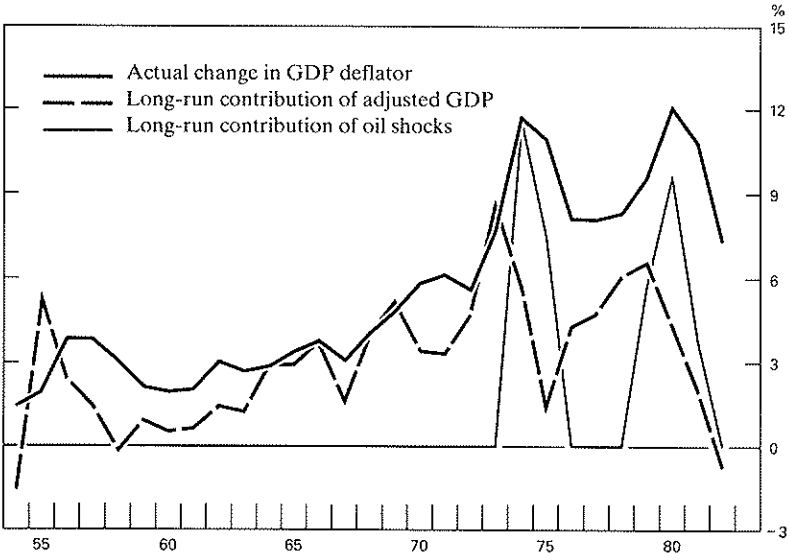
Price response equations with only the two oil shocks assumed to exert an exogenous influence*

	Equation 1	Equation 2
Constant	0.35	0.54
	(1.0)	(1.8)
Adjusted nominal GDP change	−2.16	−4.45
	(1.0)	(2.3)
Adjusted GDP change times slack ratio	2.40	4.68
	(1.1)	(2.5)
Oil shock dummy variable	1.95	2.02
	(5.0)	(6.4)
Lagged oil shock variable	–	1.33
		(3.6)
Lagged price change	0.69	0.65
	(6.3)	(7.3)
$\bar{R}^2$	0.94	0.96
Standard error	0.81	0.66
Durbin h statistic	−1.84	−0.60
Adjustment coefficients:		
1. Output on trend S-R	0.24	0.23
L-R	0.77	0.66
2. Output 5% above trend S-R	0.36	0.46
L-R	1.16	1.34
3. 1982 S-R	0.09	−0.06
L-R	0.29	−0.19
Output-to-trend ratio at which adjustment coefficient=1		
S-R	1.32	1.16
L-R	1.03	1.02
Output-to-trend ratio at which adjustment coefficient=0	0.90	0.95
Memorandum item:		
Output-to-trend ratio in 1982	0.94	

* Whole-period estimates. Adjusted GDP variable assumes 3% growth 1974–82.

to domestic price changes (even though over the estimation period as a whole its estimated contribution is less than that of import prices as previously measured). For example, the estimates suggest that each oil shock eventually contributed a total of 19 percentage points

Long-run contributions of adjusted nominal income and oil shocks



to the level of prices. (As already noted, the formulation adopted assumes that the oil shocks were equivalent in this respect. This may not necessarily have been so, but any other formulation of the dummy variable would have been equally arbitrary in the absence of additional, external evidence.)

On the other hand, such a result could be evidence (albeit perhaps exaggerated) of the strength of internal pressures such as wage-push in the face of the prospect of a decline in real incomes. At all events, the more plausible estimates of the nominal income coefficients in this formulation appear to make its simulation properties worth investigating and comparing with those presented earlier for the pure nominal income model.

Not surprisingly, the basic feature of the non-linear/oil shock formulation is a less pessimistic conclusion as to the output costs of disinflation in "normal" circumstances. As the first graph shows, in

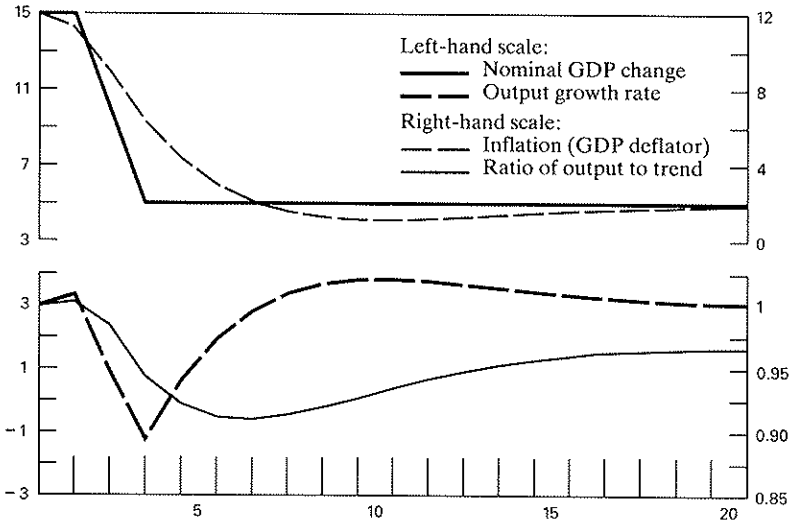
the absence of external shock, a 10-point reduction in the inflation rate (from 12 to 2 per cent.) can be achieved with much less output loss than that implied by the first simulation of the simple model (see page 30 above). The maximum decline of output below trend is less than 10 per cent. and some degree of recovery – in this strong sense – does emerge automatically, if rather slowly. In contrast, the simple model implied a permanent output loss of about 13 per cent. below trend. (2 per cent. was chosen as an acceptable minimum inflation target for the present simulation because of the presence of a more significant constant term in the estimated equation. The implication, otherwise, would be again that a zero price change target would incur larger and continuously increasing costs in terms of lost output.)

The second simulation demonstrates how the intervention of the kind of oil shock experienced in the 1970s changes the picture quite dramatically. Even an attempt at a relatively small 3-point disinflation through such a period leads to a large output loss, with growth becoming appreciably negative for two years. On the other hand, as the shock passes and as the decline in demand pressure reduces the price adjustment coefficient (i.e. increases the output effect of changes in nominal income), some measure of recovery does come about automatically, though again it takes some considerable time. It would of course be cut short should a similar external shock recur.

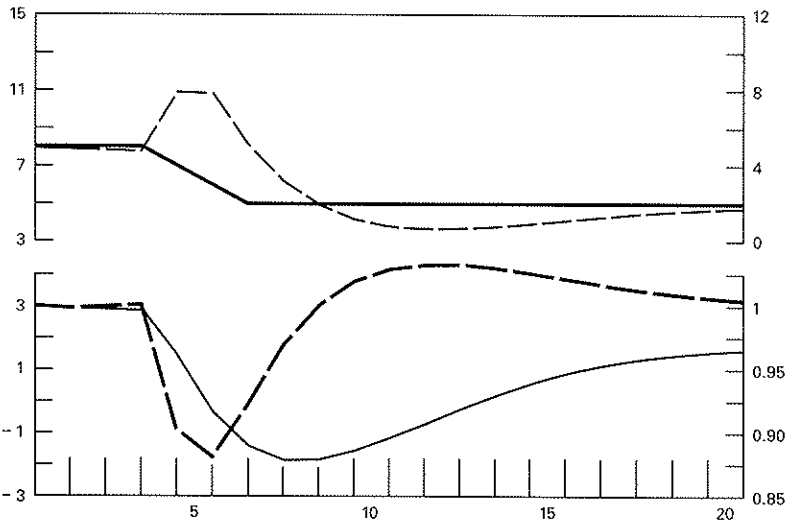
The following two simulations demonstrate the effects of complete and partial accommodation of the indirect effects of an oil shock. The shock is assumed to hit a previously low inflation world in which output was on trend. Not surprisingly, accommodation tends to reduce the output costs of a large price shock. But, equally, the inflationary implications are the more serious. Indeed, in the case of complete accommodation – i.e. the avoidance of *all* output effects – inflation is apparently pushed to a higher level over a very long period. (Such results do not, however, take account of balance-of-payments effects which might – especially for an individual country – make accommodation unfeasible.)

Simulations with the eclectic model

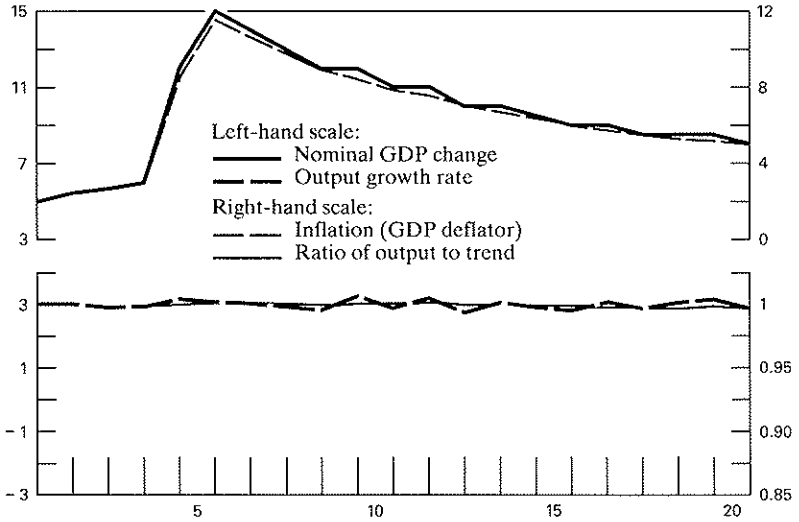
1. Disinflation: no oil shock



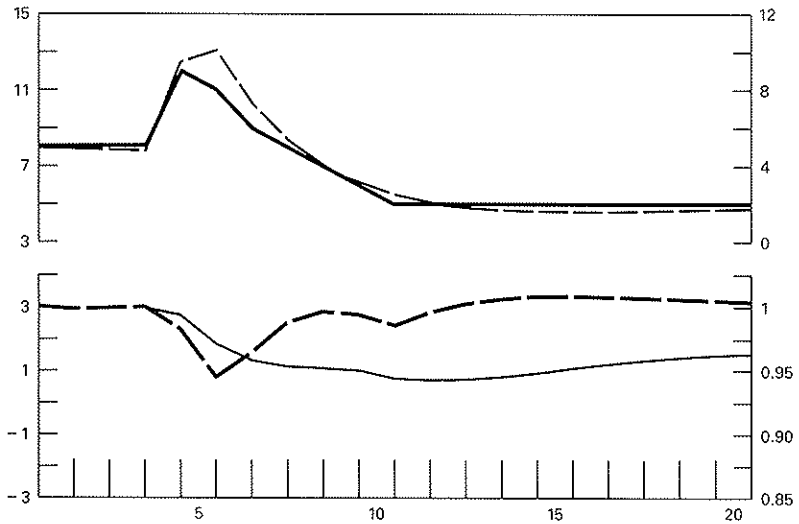
2. Disinflation through an oil shock



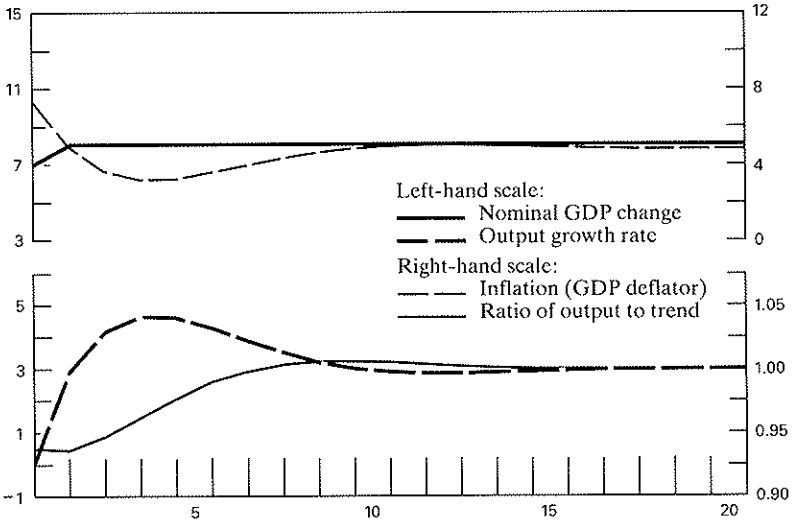
3. Accommodated oil shock



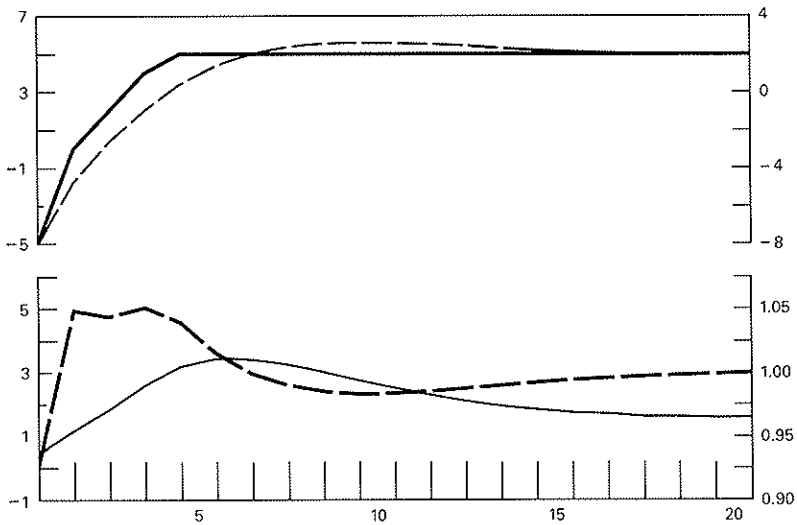
4. Partially accommodated oil shock followed by disinflation



5. Policy of mild, maintained stimulus



6. Stimulus beginning from negative inflation



Finally, two simulations investigate the possibilities for stimulating, or at least accelerating, a real recovery. The first begins from the kind of situation found in the industrial world in 1982, when nominal GDP growth was down to about 7 per cent., inflation was falling, but growth was negligible and the output level was well below trend. The "policy" adopted involves halting the deceleration of nominal growth and indeed raising it slightly to 8 per cent. and then holding it steady. The implication of course is that inflation will tend to settle at 5 per cent. eventually.

In the meantime, however, the situation is somewhat better than this. Inflation falls below its longer-run equilibrium rate largely because of the slack in the world economy. Consequently real growth is temporarily faster than trend and recovery occurs. The "cost" is the acceptance of an eventual return to rather higher inflation.

This result may be compared with the end-1983 estimates from the OECD in which nominal growth was put at 7¾ per cent. last year and 9 per cent. in 1984. As the table shows, however, the OECD was less sanguine as regards the division of this nominal growth. The model appears to give a more optimistic picture than either the OECD's forecast or the latest indications as to the likely outcome for 1983. In the various model "forecasts" shown for 1983 and 1984, real growth is higher, and price inflation lower, than seems so far to have been the case. Early in this paper (page 9 above) it was noted that one hope behind the policy of concerted disinflation was that previous behaviour (as reflected for example in the nominal income split) might change favourably in ways which could not, by definition, be captured by econometric (or other types of) analysis based solely on an examination of the past. In this context – although it is of course very early days yet – developments to date must, in the aggregate, be judged as somewhat disappointing. On the other hand, it may well be over-demanding to expect the equation to be a reliable guide when simulated in an environment of demand pressure lower than anything experienced in the sample period and at a time when world growth is heavily concentrated in

The recovery: indications and forecasts

Source		Change in nominal income	Price: nominal income split	Change in prices	Change in real output
		in percentages			
OECD Economic Outlook, December 1983	1983	7¾	71	5½	2¼
	1984	9	61	5½	3½
	1985 1st half[1]	8	69	5½	2½
Model simulation	1983	7¾	65	5	2¾
	1984	9	44	3¾	5
	1985[2]	8	41	3¾	4½

[1] At an annual rate. [2] Whole year.

one country, the United States. What is more, when the analysis is conducted at the individual country level, preliminary results suggest that for two – Japan and the United Kingdom – the 1983 outcome may, *if anything*, have been slightly better than indicated by the equation estimates. For the United States, econometric estimates and preliminary indications of the 1983 outcome seem to coincide almost exactly. Thus, for some countries in which the policy commitment to disinflation was particularly strong, the evidence from this type of analysis argues, at a minimum, for continued suspension of judgement as to the possibility of more fundamental behavioural changes (see also Note 3).

Nevertheless, we come here to the nub of the problem – the one exercising Hicks in the quotation cited at the beginning. On the evidence of the past it does not seem easy, even with an eclectic – and apparently optimistic – formulation of the nominal income theory, to combine recovery with a permanent and appreciable reduction in inflation. The only reliable way – as seen in the final simulation – that recovery can apparently be combined with minimal final inflation is if the starting point is one in which prices are already falling. As Laidler – writing about monetary targets – has remarked: "... The case for monetary growth-rate rules ... was put in terms of the capacity of such a policy prescription to *maintain* stability – it was

a prescription for *staying out* of trouble. ... There is much less unanimity ... about how to tackle the problem of restoring stability ..." (Laidler 1981). The results reported here seem to illustrate this remark rather aptly. The world economy is evidently in the same sort of situation as the tourist who, asking the local farmer for directions, received the answer that "if he wished to go there it would be better not to start from here".

In one sense, however, this result is perhaps not too surprising if one returns for a moment from the world of theory to the real one. It is generally agreed that one important set of prices – those of non-oil primary commodities – have been, and may still be, too low either to provide sufficient incentives to production in any world recovery or to provide some relief to the international debt crisis. What is more, on the basis of past experience, any recovery in demand would be very likely to bring about an increase in such prices. Indeed, such a process has already begun. From this perspective, then, the results are not perhaps quite as puzzling as they may seem. The only way out would be for the necessary rise in "real" commodity prices to come about from declining costs and prices in the industrial countries – something which seems unlikely.

Some implications of the apparent size of the oil shock effects

It has been noted at several points in the discussion so far how remarkably strong the relationship apparently is between external price shocks and the GDP split. It could be seen in the simple graph on page 21 and again in the estimated equations containing import prices as an explanatory variable. Indeed, doubts about the appropriateness of the import price index being used and the size of the coefficients found there led to the final attempt which was to try to isolate the effect of any "purely" exogenous external factor. Even so, at 19 per cent. on each occasion, the size of the eventual effect of the oil shocks on the price of *domestic value added* (GDP) seemed at first sight difficult to believe, especially as it has all to be assumed to

be indirect, oil *imports* not entering into GDP as such. In the case of the second oil shock especially, the price effect had also to be assumed to have occurred in the face of a policy stance which was avowedly set to avoid any indirect or secondary price effects, or at least to keep them to a bare minimum.

The matter is, however, slightly more complicated than this in that at least two categories of "indirectness" should probably be distinguished (see also Note 2). The first, and most straightforward, case is that of domestic non-energy costs and prices, especially wage costs, which make up the larger part of final prices. It is fairly clear that the intention of policy, especially during the second oil shock, was to be firmly non-accommodative of any secondary or "knock-on" effects in this area. And indeed, as compared with the period of the first oil shock, the acceleration in nominal income growth in 1979 and 1980 – at less than 1 per cent. – was virtually negligible (see page 19).

The second type of "indirect" effect, however, was for the most part probably not to be suppressed. This was a rise in the price of any domestically produced oil; and the same applied, perhaps in lesser degree, to the prices of other domestically produced primary sources of energy. Given varying degrees of openness in the world markets for energy raw materials there was in any case little to stop some appreciable price response here automatically. What was not necessarily automatic, however, was an accompanying increase in the overall GDP deflator. That is, the possibility was theoretically available for *non*-energy prices to fall on average such that the overall price of domestic output would not have been affected at all. The fact that this apparently did not happen, even in the face of recession, is one indication of a higher degree of price inflexibility than the purer theories are wont to assume.

But there is a further, and perhaps more significant, implication. For at 19 percentage points on each occasion, the estimated oil shock effects on the GDP deflator must be well above any reasonable estimate of the maximum possible under the second type of indirect effect just explained. For example, estimates suggest that

the contributions of the oil and natural gas industries and of oil, gas and coal combined to total area GDP might have been of the order of ½ and 1 per cent. respectively at pre-oil shock prices. (The rise in North Sea oil production may have raised these figures slightly in the meantime.) Hence, a 150–200 per cent. rise in prices (such as occurred with the *landed* international crude oil price in 1973–74), even if it had been fully matched in both domestic oil and gas prices, would have raised the industrial world's GDP price deflator by only ¾–1 per cent. in the complete absence of downward flexibility of non-oil prices. Even less realistically, a complete matching of all fossil fuel price increases would have perhaps had an effect of the order of 1½–2 per cent.

Thus, if the equation estimates are to be believed at all, they imply that other forces – possibly of the first type described above – were playing a considerable rôle (though see, again, Note 2). Not only that, but (as was clear from the graph on page 41) they were powerful enough to cause an acceleration in domestic price inflation even in the absence of much accommodating acceleration in nominal income growth. Their effect was thus seen in a sharp worsening of the split, a worsening which occurred before any deceleration in nominal growth. (Such a deceleration – when combined with a lagged price response – can, as we have seen, also have temporary adverse effects on the nominal income split.)

One conclusion would therefore seem to be that, not only are prices and costs highly inflexible downwards, they can also continue to be pushed up – even in conditions of recession – if trade unions and other groups try to avoid the real income losses inevitably attending such events as the oil price shocks. It would seem possible in fact that at least in some periods it is prices rather than output which are on some extraneously determined course.

However, as is often the case in economics, there is another – entirely different – story which can logically account for the recorded events without straying so far from the purer theoretical world of greater price flexibility and largely endogenous price movements. It involves assuming that the underlying supply potential of the world

Trend growth rates and demand pressures; assumed and implied

Years	As assumed for estimation of original equation			As implied when oil shocks assumed to have zero effect		
	Trend growth	Adjusted nominal income change	Slack (ratio of output to trend) index	"Trend" growth	Adjusted nominal income change	Slack (ratio of output to trend) index
1974	3.0	9.6	99.6	−1.7	14.3	104.3
1975	3.0	7.7	96.5	2.1	8.6	101.9
1976	3.0	10.3	98.2	9.3	4.0	97.6
1977	3.0	9.2	98.9	1.6	10.6	99.7
1978	3.0	9.6	99.8	3.0	9.7	100.6
1979	3.0	10.0	100.0	1.8	11.2	102.1
1980	3.0	10.4	98.2	0.0	13.4	103.4
1981	3.0	9.4	96.7	3.7	8.7	101.1
1982	3.0	4.1	93.7	6.1	1.1	95.1
Average 1974–82 . . .	3.0	8.9	98.0	2.8	9.1	100.6

economy dropped suddenly at times of external shock. Thus, in contrast to the evidence, say, from rising levels of unemployment, the pressure of demand (relative to actual supply) would have risen appreciably during the oil shocks. In terms of a nominal income model, *adjusted* nominal income growth would thus rise and, hence, account for the observed price movements without the need to abandon the world of the relatively pure theory, and without bringing in large and extraneous pressures to push up prices independently of nominal demand.

One method of attempting an estimate of such a new trend of potential output is to turn the model around and simulate it over the period since 1973, supplying it not with estimates of adjusted nominal income growth but with the actual price changes which occurred. Then, suppressing the oil shock dummy variable entirely, the implicit changes in adjusted income needed to generate actual inflation can be calculated. In turn, given that the history of total,

*un*adjusted GDP is also known, the implied adjustment – that is the change in equilibrium output – falls out.

The results are set out in the table. They show, in essence, what "trend" output would have had to have been in order to ensure the completely accurate fitting of the nominal-income-driven part of the price model over the period since 1973. That is, that portion of price movements formerly "explained" by the oil shock dummy variable is now assumed to be explained by new estimates of the real trend adjustment to nominal GDP, the $\dot{y}^*$ in $(\dot{y}-\dot{y}^*)$ (see page 17 above).

Quite clearly, a very different picture of the world emerges from this – admittedly somewhat unorthodox – set of calculations. The estimates show, for example, that in 1974 equilibrium output would have had to have fallen 1¾ per cent. for the actual developments in nominal GDP to have explained the recorded rise in prices. A further period of very low "trend" growth must also have occurred in 1979 and 1980. The implication is that the pressure of demand *rose* on these occasions. Indeed, taken literally, the figures for 1974–75 and 1979–80 imply demand pressures in excess of those estimated for 1973, when output was about 1¾ per cent. above trend.

The calculations also imply – not surprisingly – that, over the whole period since 1973, average demand pressure has been higher than was assumed earlier. On average, in fact, the level of output must have been somewhat above trend for the recorded rate of inflation to be explained in this way. And the underlying rate of growth, at 2.8 per cent. per annum, must have been only marginally above the recorded rate for actual output. Even so, by the end of the period, the implication is still that 1982 was a year of exceptionally low pressure of demand.

In themselves, these hypothetical "facts" are perhaps not very startling, and, for many, they may well seem quite reasonable. The difficulty, however, is that, in addition to higher demand pressures, they also imply, at times, peculiarly fast accelerations of "trend" output, especially in 1976 and again in 1982. These can hardly be accounted for by the standard supply mechanism. The latter postulates that it was the large changes in relative energy prices

which – by lowering the profitability of existing production methods – rendered part of the capital stock "economically obsolete" and thus reduced the supply of output to the market. The problem is that, while relative energy prices did fall back a little after the oil shocks, they did not return to anywhere near their pre-shock values. Thus it is difficult to see by what mechanism such sharp rebounds of supply can have taken place in the short run, especially as the facts show there to have been no boom in investment spending, or sharp upward movement in labour productivity.

Hence, the second explanation of events, avoiding the assumption of independent price movements, involves implications which are difficult to accept. In addition, however, there are other difficulties with an explanation of inflation in the 1970s based entirely on excess demand, the latter resulting from an increase in the proportion of economically obsolescent capital stock. In the first place it is unclear just how important such obsolescence should be judged. To a large extent increases in costs were in fact passed through to consumers rather than being borne entirely by profit margins in the face of given prices in the market. At the same time, in many cases, only relatively minor physical modifications would anyway be needed to the capital stock to adapt it to higher energy prices. The prime example (though not necessarily the most relevant) is perhaps that of an inadequately insulated house. A rise in energy costs does not require the demolition of the whole building. Thirdly, even where profits were reduced purely as a result of the relative price change, firms might rationally have decided nevertheless to go on producing in order to stay in business until such time as new equipment could be put in place. This might have been especially so in cases where profits did not turn into heavy outright losses, or where such losses were in any case also heavily influenced by the general climate of recession. Finally, there is the problem that, in an accounting sense at least, much of the inflation of nominal income in the 1970s came from increasing wage costs – even in the face of rising unemployment. An increase in purely structural unemployment – as implied by the capital stock

obsolescence theory – would surely have been accompanied rather by a weak price of labour and relatively strong prices of final output.

At all events, this combination of empirical implications and theoretical doubts makes it the easier to accept the notion that the oil shocks were an important independent force increasing prices through a straightforward increase in costs, rather than via an indirect, supply-reducing, mechanism. But, it must be admitted at once, the evidence and discussion presented here are partial in the extreme, especially given the importance of the theoretical issue involved.

Concluding remarks

This paper is perhaps best summarised as having a double, rather than a single theme, one strand being theoretical, the other practical and topical. In the first instance, it has sought to examine a particular – and currently popular – form of empirical analysis embodying a nominal income theory of inflation. And in the second, it has been concerned with a major real-world development, namely the process of global disinflation which effectively began in 1979. In particular, the paper addresses the current issue of the prospects for sustainable world recovery given a successful first stage of the disinflation process, that is, an appreciable reduction in inflation. These two themes have been combined by the simple device of applying the first, theoretical one to the second.

Taking the theoretical issue first, it was fairly clear immediately that the extreme – rational expectations – view of disinflation did not fit the facts. Indeed, given the depth of the international recession, it was hardly to be expected that a theory suggesting no – or only minimal – output effects of disinflation (at least in the short run) could find much support.

However, there was apparently more support for a formulation which, while maintaining nominal demand increases as the only ultimate source of inflation, provided for some lag in the price

adjustment process. What is more, estimated over the whole period 1954–82 for the industrial countries as a group, the hypothesis performed reasonably well by simple econometric criteria, as well as displaying completely "acceptable" characteristics from a nominal income-theoretic point of view. Thus, all adjusted nominal income change eventually found its way into prices, with the strong implication that there is nothing for macro-economic policy to aim at in terms of the "real" economy. Nominal policy instruments should thus be set to avoid inflation, and the real economy will then settle at some equilibrium level of unemployment and rate of growth of output which, if they are not deemed acceptable, must be dealt with by other means. In short, it was fairly easy to produce an econometric result very much in line with the broad kind of thinking which currently informs the views of many policy-makers and other observers of the economic scene.

However, one flaw in the results – and one which assumed greater significance as the analysis was pursued further – was that this basic model did not fit the post-1973 period at all. This was the more disturbing in that this was the period of the greatest inflation. It was also the period for which many have asserted that past and current policy excesses had been most to blame for worsening economic performance.

Short of abandoning the nominal income theory of inflation altogether, there appeared to be two major avenues of escape from this difficulty. The first was to assume that, at least at times, the rate of change of domestic prices can be affected by exogenous factors such as import price shocks. The second was to reduce the assumed equilibrium level of output at times after 1973 in such a way that the increase in adjusted nominal GDP is raised sharply and can then "explain" the observed path of prices. This is tantamount to postulating a drop in output *supply*, implicitly entailing the assumption of considerable excess nominal demand during the periods of greatest inflation. Though, of course, apparently clashing with the observed rise in unemployment at the same time, such a possibility cannot be logically counted out in theory. However, it is

not clear that this theoretical supply response mechanism *has* been at work on this occasion, while in any case the erratic path of equilibrium output implied seemed a priori very difficult to justify.

Thus it is not easy to avoid the conclusion that both the domestic inflation rate, and even the nominal income split, can be affected by exogenous forces. And, while it is too much to consider all import price changes as exogenous to nominal demand in the industrial countries, at least some part of the two oil shocks may well have been so. Hence, it was not surprising to find a highly significant fit for equations which incorporated an oil shock dummy variable. In such formulations, it was also found that the nominal income-prices coefficient varied positively with the real pressure of demand in the world economy.

What was perhaps surprising, however, was the size of the estimated oil shock effects on purely *domestic* prices, amounting to an eventual total of about 19 per cent. during each oil shock. One interpretation of this result would be that it is eloquent testimony both to the downward inflexibility of non-energy prices and to the forces of wage push in the face of a threatened cut in real incomes. In turn, this leads to the thought that if such forces as the latter can exist at times of external shock, then why not – perhaps on a lesser scale – at other times?

Be that as it may, one implication of the exercise, on the theoretical plane, is the rather disturbing ease with which simple results can be obtained to support very different hypotheses, depending on the formulation imposed on the data. Thus, apparently plausible results were obtained from a fairly pure nominal income specification (albeit not for the 1974–82 sub-period), while more eclectic formulations also worked well. In terms of fit, in fact, the latter performed better, though the use of dummy variables is notoriously open to abuse. (It is always possible for the researcher to put in a dummy variable at points where the equation residuals would otherwise be large.)

Turning to more practical questions and issues, one should of course admit, first, that having cast some doubt on the nominal

income theory, it is not then logically possible to draw very strong conclusions from its use – even in modified form – in analysing the process of disinflation. Nevertheless, the results of some of the simulation experiments were perhaps suggestive.

In the first place, there was apparently little doubt that, whatever formulation was used, the relatively pure or the more eclectic, inflation could be reduced to very low levels by the pursuit of a sufficiently stringent nominal demand "policy". In the latter case, however, this was importantly dependent on the absence of further external shocks.

Secondly, whatever the ultimate benefits of eliminating inflation, no such disinflation policy could be pursued without substantial costs in terms of lost output (and, implicitly, higher unemployment), at least in the short run. In the eclectic formulation, these costs depended very importantly on whether or not disinflation was being pursued at a time of external shock and whether the shock itself came at a time of high demand pressure. If so, the costs were the greater. On the other hand, if disinflation was simply postponed and the external shock accommodated, a deep recession could be avoided, though at the expense of a much more prolonged period of inflation. In the absence of external shock, however, the eclectic formulation generally implied less severe output costs from disinflation than did the purer alternative.

So far as longer-term implications are concerned, all formulations for the OECD area as a whole had somewhat disappointing implications. This of course is the question that is of interest currently: having passed through a period of disinflation, what are the prospects for continuing sustainable (that is, non-inflationary) recovery? The basic message of these simulations seemed to be that the continued pursuit of a low inflation target would not necessarily prevent recovery in terms of a return of the output *growth rate* towards its assumed 3 per cent. trend. But what did appear to be ruled out – to a greater or lesser extent – was much automatic taking-up of *slack*. Only if the world economy were already in a situation in which prices were actually falling, could

nominal income growth be safely accelerated back up to its minimum inflation rate, and, with it, a temporary period of output growth above trend be encouraged. In other words, the results illustrated rather aptly the statement of Sir John Hicks noted at the beginning of this paper.

This result was not quite so stark under the assumption of exogenous price pressures, however. Some degree of recovery seemed possible then, which, although it was accompanied by some inflation, did not apparently require an ever-accelerating rate of price increase. Indeed, given the recent and prospective likely rates of increase in nominal demand and the low initial level of demand pressure, this formulation provides a somewhat more optimistic "forecast" than the most recent projections of the OECD Secretariat. One implication of this, however, is that, for the first year of the recovery, there is thus no evidence that the behaviour of the OECD price/output split has yet changed fundamentally as compared with the past – though of course this still cannot be ruled out for future years. It could be the case that as, and if, recovery continues, relatively restrained price behaviour might also continue, in contrast to the historical record in which upturns tended to generate accelerating price increases. All that can be said is that, so far, and merely using the analysis presented in this paper, a major change in price behaviour has yet to appear in the aggregate. There is thus some conflict here with the anecdotal evidence from some countries – some of which is fairly convincing – that some significant changes, especially in wage behaviour, have occurred. And indeed, some preliminary results of a country-by-country approach were reported which suggested that price/output performance in the recovery so far may be related to the degree of disinflationary resolve shown earlier.

However, the temptation should probably be resisted to draw too tight and literal a set of conclusions from such a drastically simplified form of analysis. Such analysis does not, in any case, say anything about whether an adequate rate of nominal growth will itself continue to be provided. At the moment such growth appears –

on average – to be quite strong. However, to the extent that it is being significantly fed by the US budget deficit, it may not be sustainable. And, of course, further exogenous shocks, while perhaps not likely, are not ruled out by the model as such.

Rather, the more important – and more modest – conclusion of the analysis seems to be the potential significance of exogenous influences on prices. The analysis does not prove that they exist. But it does suggest that they may and that, if so, they can exert strong effects on prices which, if not accommodated, lead to severe output losses. In turn, this points to the kinds of common-sense factors which could well help to bolster the sustainability of any upturn. Most obviously, the risk of further oil shocks needs to be minimised by continued energy conservation and oil substitution. But the finger also points to wage costs as being potentially very important. In other words, the more that the split can be favourably influenced by forces which do not rely on the creation of slack, the more secure does recovery become. Otherwise, one tends to be pushed back to the world of the less eclectic models in which the implicit, sustainable, level of output was found to be very low. In short, the successful conclusion of the disinflation process cannot yet be confidently predicted, though the first stage has clearly been effective and the second – recovery – is for the present under way. It may be naive and elementary – though none the less true – to conclude that the more that can be done, directly, to improve the split the greater the chances of ultimate success.

Notes

Note 1

Indeed, as growth never quite returns to 3 per cent. per annum, the ratio of output to trend tends to slip downwards indefinitely, in contrast to the case in which nominal GDP is assumed to rise at a completely inflation-free 3 per cent. The reason is to be found in the precise way in which the variables are defined for the analysis. In particular, it is the additive (as opposed to multiplicative) way in which the adjusted nominal income change variable (say ADNG) is defined that brings about this result:

$$ADNG = DNG - 3$$

where DNG equals the total change in nominal income.

In the formulation as used for the simulations, the maintenance of a constant rate of growth of adjusted nominal income will sooner or later result in an inflation rate of exactly the same magnitude (i.e. a long-run adjustment coefficient of 1 was imposed). Hence, the long-run steady-state rate of inflation will always be ADNG, which in turn is related to the overall nominal income change as above.

The real growth rate, however, will be not the *difference* between ADNG and DNG, but

$$\left[\frac{100+DNG}{100+(DNG-3)} - 1\right] \times 100$$

For the zero inflation case, DNG is 3 and, hence, so is the growth rate. But for price (and adjusted nominal income) changes greater than zero, the equilibrium growth rate is increasingly below 3. For example, for ADNG=5 in the long run, the real growth rate will be 2.86 per cent. per annum. For ADNG=8, the rate is 2.78 per cent.

The point is, merely, that this is something of an arithmetic accident, which would not occur if the variables were all defined multiplicatively as has to be the case between actual changes in nominal and real growth rates and the rate of inflation.

Thus ADNG could have been defined as:

$$ADNG = \left[\frac{100+DNG}{103} - 1\right] \times 100$$

In this case, as further simulation experiments confirmed, the rate of inflation always tends to ADNG as previously, and in addition, the growth rate also always tends to return to 3 per cent. per annum whatever the rate of inflation.

The results of an analysis formulated in this way remain, however, qualitatively the same as those reported in the main text. A permanent reduction in inflation can only be achieved by a permanent fall in output relative to its previous trend, the fall being the greater the higher the initial inflation. The fall is not, however, indefinite.

Perhaps slightly more significantly, the real output target simulation – No. 5 – gives a less pessimistic result under the assumption of a multiplicative variable. Specifically, the ratio of output to trend can apparently be raised in such a formulation at the expense of a move to a permanently higher – but then *constant* – inflation rate. In other words, the implication of *ever-accelerating* inflation is not inescapably associated with this formulation as it apparently is with the other. For the case where the aim is to raise the *growth rate* permanently – as in simulation 6 – the results are, however, qualitatively the same.

The practical import of all this is probably relatively minor. It is merely a reminder that apparently insignificant changes in specification can sometimes have unexpected implications. For the record, when the basic equation is re-estimated using an adjusted nominal variable calculated on the multiplicative basis, the result is insignificantly different from that reported on page 26:

$$\dot{p} = \underset{(0.3)}{0.14} + \underset{(4.3)}{0.45}\ ADNG_t + \underset{(5.9)}{0.57}\ \dot{p}_{t-1}$$

$\bar{R}^2=0.88$, standard error=1.13, Durbin h statistic=0.89, t statistics shown in brackets. At 1.044, however, the estimated long-run coefficient is higher than previously estimated and the equation, *as estimated*, is thus less suitable for simulation for the reasons explained on page 27 of the text.

Note 2

There is a third category which does not, however, fit too easily with the nominal income view of the world. It stems from the supposed negative demand effect of the oil shocks as the oil-producing countries effectively "saved" a large proportion of their increased revenues, with no prompt spending offset elsewhere. To the extent that this apparently took the form of a decline in *real* (as well as nominal) demand, output – and therefore productivity (in the short run at least) – were depressed, with adverse implications for unit costs and prices. In short, the oil-shock-induced recessions, especially that of 1974–75, may have had an independent short-run effect on the nominal income split. The same might also have occurred again in 1982, the reason then being, in part, the sharp cutback in real import demand on the part of certain heavily indebted LDCs. Admission of the validity of both these cases, however, involves a further break with the assumptions of the pure nominal income model. It may, however, be part of the explanation for the size of the coefficients found on the oil shock dummy variables (see the discussion on page 48). If so, it implies another possible influence on the split not allowed for in the pure model, though it is an influence which might be partly subsumed under the heading of price inflexibility. The operative mechanism, namely short-run productivity variations, might of course also come into play in other cases where nominal income instability leads to (albeit short-run) output fluctuations.

Note 3

The strongest evidence in support of a change in price and cost behaviour comes from Japan, though it seems to pre-date somewhat the general implementation of disinflationary policies. Thus, if the oil shock dummy variable is split into two – that is, the two oil shocks are accorded their own proxy – there is evidence of very different price behaviour in 1979–80 as against 1974. Indeed, the raw data already tell a most compelling story before econometric manipulation: the GDP deflator rose some 20–21 per cent. in 1974, while in 1979 and 1980 the rises were only 2½ and 2¾ per cent. respectively.

For the record, a typical result for Japan from the nominal income model is as follows (t-values in brackets):

$$\dot{p}_t = \underset{(2.2)}{1.0} + \underset{(10.4)}{0.55}\,ADNG_t + \underset{(7.7)}{4.83}\,SHOCK\,1 - \underset{(0.8)}{0.63}\,SHOCK\,2 + \underset{(2.9)}{0.16}\,\dot{p}_{t-1}$$

$\bar{R}^2 = 0.922$, standard error = 1.1, Durbin h statistic = −1.06

where $\dot{p}$ = change in GDP deflator

ADNG = change in adjusted nominal income

SHOCK 1 = 2 in 1974, zero in all other periods

SHOCK 2 = 1 in both 1979 and 1980, zero in all other periods.

The equation shows that the first oil shock had a large and significant effect on domestic prices while the second apparently had none. Indeed, the coefficient is actually negative, though statistically insignificant.

References

Laidler D.: "Monetarism: An interpretation and an assessment", *Economic Journal,* March 1981.

Hicks J.: Keynes Centenary Essay in *The Economist,* 18th June 1983.

Brittan S.: "How to end the 'Monetarist' controversy", Hobart Paper No. 90, Institute of Economic Affairs, 1981.

Gordon R.J.: "Output fluctuations and gradual price adjustment", *Journal of Economic Literature,* June 1981.

Coe D. and Holtham G.: "Rising income – the 'split' between output and inflation", *OECD Observer* No. 123, July 1983.