The Effects of Monetary Policy on the Real Sector: What Do We Know? *

Introduction

During the 1970s OECD countries have been subjected to large adverse supply shocks, high inflation rates, rising budget deficits and an upsurge in unemployment. At the same time, radical changes occurred in exchange markets following the collapse in the Bretton Woods system. In the 1980s there has been a substantial improvement in inflation performance; however, trend growth has remained generally low and unemployment stubbornly high, especially in Europe, while large external imbalances have emerged among major OECD economies. The present decade has also witnessed a surge in financial market liberalization and innovation, which has led to greater capital mobility and higher volatility of domestic financial conditions.

These developments have had important implications for the formulation and conduct of monetary policy. In the mid-1970s, increased emphasis was put on monetary aggregates, culminating in the widespread adoption of target-oriented monetary policies in response to rising inflation. In more recent years, however, as the money-income relationship broke down, monetary authorities were forced to adopt a more eclectic approach. The role of monetary targeting was downgraded, while greater emphasis was placed on stabilizing exchange rates in the context of coordinated policymak-

---

* Mr. Chouraqui is Head of the Monetary and Fiscal Policy Division of the OECD Economics and Statistics Department. Prof. Driscoll (Middlesex Polytechnic, London) and Mr. Strauss-Kahn (Bank of France) were members of this Division during the preparation of this paper. The authors wish to thank Isabelle Wanner for her valuable assistance in preparing the supporting statistical material. The views expressed therein reflect their own opinions and do not necessarily represent those of the OECD or of the governments of its Member countries.

ing, and on reducing uncertainty in financial markets (notably after the stock market crash of October 1987). Since the general thrust of such changes has been in the direction of strengthening the influence of market mechanisms in the allocation of resources, the burden of monetary policy transmission has increasingly fallen on market determined financial prices such as interest rates and exchange rates. The ability of central banks to influence these variables thus has an important bearing on the overall effectiveness of monetary policy.

Against this background, the purpose of this article is to assess the current state of understanding about the effects of monetary policy on domestic real sector variables — expenditure components, output, employment and the price level — in the light of the recent experience of the seven major OECD countries (the United States, Japan, Germany, France, the United Kingdom, Italy and Canada) and three selected smaller open economies (Australia, the Netherlands and Sweden).[1] The analysis begins with the distinction between the competing frameworks for monetary analysis — market-clearing *versus* price level inertia — which predict a different impact of monetary policy on the real sector. It then continues with a review of the evidence based on a set of models representative of these frameworks.

1. The competing analytical frameworks

The current large array of competing frameworks for the analysis of monetary policy can usefully be divided into two main groups. The first covers those based on non-clearing goods and labour markets — essentially the neo-Keynesian and monetarist approaches. The second covers those based on the market clearing, or new classical, approach to macroeconomic modelling.

A) The traditional non-clearing markets approach

Neo-Keynesian and monetarist frameworks have often been seen as representing extreme alternative descriptions of the way

[1] For views on the role of monetary policy in major OECD countries up to the early 1970s, see OECD (1975).

economies work. In fact, both adhere to the traditional "short-run" non-clearing markets approach, based on the "stylised fact" of inertia in the adjustment of wages and prices. But given differences in a number of other assumptions, they come to different conclusions about the conduct and effects of monetary policy.

Neo-Keynesian thinking on the role of monetary policy is usually taken to be epitomised by the standard Hicksian IS-LM model. In the simplest versions of this model, prices are taken to be given, expenditure and money demand are interest rate sensitive and well determined with identifiable parameters, while output is perfectly elastic. Thus, monetary policy induced changes in aggregate demand affect output and have no effect on prices. In modern versions of the neo-Keynesian model prices are not assumed to be constant but to adjust gradually, and output is assumed to depend upon the productive potential of the economy. The nearer to the capacity limit of the economy the more that aggregate demand raises prices and the less it affects output. This trade-off between output and prices, known as the "Phillips curve" in its original labour market price-quantity formulation, is assumed to be sufficiently robust to be exploited for stabilizing employment and output, at least in the short run.

Another striking feature of the neo-Keynesian approach is the assumed mechanism by which inflation is generated. Prices are viewed as being determined by a simple mark-up on costs. One implication of this is that aggregate demand pressure will have little or no direct impact on prices and will have more powerful effects on supply. A second implication is that inflation is largely determined by the attempts of labour to alter the distribution of income in its favour. With a full employment goal, monetary policy will have to accommodate any change in wage rates and prices. Within this framework monetary policy has little role in containing inflation. The control of inflation has instead to be based on measures to stem wage demands, such as income policies, wage indexation, wage-price guideposts and "social contracts". Inflation in the Keynesian world is largely a social phenomenon. Failure to recognise this, and instead to try to achieve rapid disinflation via monetary deflation, would accordingly result in high real costs for little or no short-run gain, especially if wage settlements are not very sensitive to rising unemployment. In open economies under a floating exchange rate regime, monetary policy could be expected

to influence inflation via the response of the exchange rate and, hence, import prices. In general floating exchange rates would be expected to worsen the output-inflation trade-off and, thereby, reduce the potential gains to discretionary stabilisation policy.

Monetarist thought has diverged from neo-Keynesian ideas on a number of issues. Perhaps the most important point of divergence concerns the confidence with which a well-determined model of the economy can be identified. While generally rejecting the possibility of generating such a model, and, therefore, discounting completely the simulation results of large-scale Keynesian models, monetarists have placed substantial emphasis on the power of the same econometric techniques to identify a well-determined structural money demand function and a "reduced form" relationship between money and nominal income. At the same time they have been noted for maintaining that such a relationship suffers from "long and variable lags", which prevent the efficient use of active monetary stabilization policy. It would not be too much of an exaggeration to characterise monetarist thought on the business cycle as viewing this feature of non-market-clearing economies not only as a disequilibrium phenomenon but also as a largely monetary phenomenon. According to this view the excessive swings in economic activity could largely be avoided by formulating monetary policy in terms of a simple rule for the growth of an appropriate monetary aggregate.

A second important point of divergence concerns the long-run effects of monetary policy on output and employment, which monetarists assume to be nil. Formerly opinion divided on the existence of a stable long-run trade-off between inflation and output implied by the Phillips curve. Such a trade-off is rejected by monetarists on the grounds that it seems to imply an implausible degree of money illusion. While being prepared to accept that inflation might not be fully anticipated in the short run, they cannot support the idea that such errors will remain persistently large in the long run. The monetarists' alternative view of the Phillips curve is that it is a short-run phenomenon caused by expectational errors. So if inflation suddenly accelerates, this may lead to an increase in output and employment because labour costs (real wages) decline given temporarily fixed nominal wages. This situation will only last, however, as long as it takes to adjust nominal wages to the new level of expected inflation. Output and employment will then

return to their former levels. In these circumstances the only way in which higher output and employment can be maintained will be to accelerate the rate of increase in inflation in order to stay ahead of expectations. This implies an ever deteriorating trade-off, a given level of "excess employment" requiring more and more inflation in the long run. Such a situation is, of course, not sustainable. Actual inflation will then coincide with expected inflation and the economy will revert to its *natural* long-run equilibrium output growth and employment rate.

This monetarist interpretation offers a considerably more pessimistic prognosis of the scope for trading output against inflation; it depends on the speed with which wage rates respond to inflation and is at best temporary. It also offers a bleak outlook for attempts to achieve rapid disinflation via monetary deflation. If nominal wage rates do not adjust quickly, disinflation will be accompanied by high output and employment costs. This has led monetarists to advocate a gradualist approach in which the money supply growth rate is decelerated very slowly in the hope of reducing the adverse output and employment consequences.

According to this interpretation, an exploitable temporary trade-off between output and inflation may exist, however, as long as expectations, formation is slow to adjust to changing circumstances, because it is confined to an adaptive process that uses past values of inflation alone, or because there are persistent nominal rigidities (for example long-term nominal wage contracts). Under adaptive expectations when price increases accelerate, this will give rise to systematically biased forecasts of inflation which, if interpreted as involving a favourable change in relative prices (real wages appear higher than expected), may cause a positive supply response. If expectations formation is, on the other hand, forward-looking and is based on all relevant available information, including aspects of the process by which inflation is generated, no exploitable trade-off will exist. For example, assuming that monetary policy is the sole determinant of the price level and such policy can be observed then the price level will be known also. No errors will occur in expectations, and movements in nominal wage rate will not be mistaken for movements in real wages. Perfect foresight is, however, not a requirement for the elimination of an exploitable trade-off based on expectations errors. In general all that is required is that price forecasts be based on the

efficient use of all available information — that is be *rational* — and that there be an absence of asymmetries in information. The monetary authorities, for example, should not have superior information to the private sector about the inflation process. Even in the absence of expectations errors, however, price and wage inertia may give rise to an exploitable short-run trade-off.

The concept of rational, or at least forward-looking, expectations and the absence of a favourable long-run inflation-output trade-off is now widely accepted by both monetarists and neo-Keynesians. But despite this convergence of views, differences still persist about the long-run effectiveness of monetary policy. Monetarists have tended to characterise the equilibrium or long-run state of the economy as being a "natural", unique reflection of market structure largely impervious to monetary policy induced shifts in aggregate demand. Under these circumstances there can be no lasting gains to activist monetary policy. Some neo-Keynesians have, on the other hand, advanced the possibility of eliminating low output growth and high unemployment, which they believe to be responsive to aggregate demand, up to the capacity limits of the economy. Modern neo-Keynesian analysis of underemployment equilibrium is based on the concept of "hysteresis" — the tendency for the equilibrium rate of unemployment to be strongly dependent on the actual rate (see Linbeck and Snower, 1987). The implication of this is that there is no unique "natural" or equilibrium level of output or unemployment. According to this view the immediate and short-run effects of monetary policy on real economic activity can remain more or less permanent, with no automatic tendency to revert to some other long-run trend, even when the price level has fully adjusted. According to neo-Keynesians the existence of hysteresis and some real activity effectiveness of monetary policy would justify, if not fine tuning, some "gross tuning" to reduce high unemployment.

B) The new equilibrium business cycle approach

Keynesian and monetarist frameworks are predicated on the assumption that in the short run the economy may be driven into disequilibrium, a situation seen as undesirable and which should be avoided or corrected. Since the early 1970s a radical alternative to this view has emerged. The key proposition of this new approach, known as "new classical economics" (due to the inspiration it draws from classical equilibrium analysis) is that prices always adjust sufficiently to maintain continuous market clearing. This approach does not, however, reject the idea of a business cycle. Indeed, in a continuous market-clearing framework, the cycle is an equilibrium phenomenon which may not be undesirable and, even if it was the case, may not be correctable. Rational expectations is also an important feature of the new classical approach, though less hinges on this assumption alone than its presence in conjunction with the assumption of market clearing.

Such an approach has far reaching implications for the effects of monetary policy and its potential as a tool of stabilization policy. New classical economists have typically dismissed the idea of using monetary policy to stabilize output and employment. In their analytical framework, real variables can only deviate from full information values because of random (non-systematic) variations in the price level induced by monetary policy. The essential prediction of this framework is that only the *unanticipated component of monetary policy will have any real effects*. The price level, on the other hand, will depend upon both the unanticipated and anticipated components. One implication of this (known as the "Lucas effect"), is that a monetary policy which is "noisy" or highly variable will tend to cause price level variability, which will swamp relative price changes. This may lead to a tendency to interpret all price changes as reflecting changes in the general price level, thus hampering the efficient working of the price mechanism and inducing a lower level of economic activity.

In addition, the view is also held by some that high rates of money growth, even if these are not particularly volatile and are fully anticipated, cause instability in the price level and relative prices. The reason for this is given by the conjecture that high inflation, associated with high money growth, causes the price level to have a higher variance and relative prices to be more dispersed. This is sometimes referred to as the *Friedman effect* (see Friedman, 1977). Such a connection between the rate of inflation and relative price dispersion arises from the different speeds at which individual prices adjust. A pure inflation, one where the price level changes but relative prices remain unchanged, may not be possible because markets are segmented, behaviour is slower to

adjust in some sectors, or because price controls vary from industry to industry. If high and unstable monetary growth leads to a situation in which prices do not contain the same degree of reliable information as they do under more stable conditions, the allocative efficiency of the economy may suffer and output and employment may decline. This negative effect of high money growth may be offset by the *Mundell-Tobin effect* (see Mundell, 1963 and Tobin, 1965). Given the short-run fixity of the capital stock and the absence of interest payments on money, increased inflation will lower the expected return on money and cause a portfolio switch away from real money balances to capital goods. If the output of capital goods can be increased future equilibrium output will be higher. The slope of the long-run Phillips curve will depend on the relative strength of the Friedman effect on the one hand — tending to make it positive, worsening the output inflation trade-off — and the Mundell-Tobin effect on the other — tending to make it negative and improving the long-run trade-off.

In the equilibrium business cycle approach the full information equilibrium, or "natural", values of variables are taken to be the "best" (Pareto optimal) that can be achieved. Given that the full information equilibrium is the "best" position for the economy, unanticipated policy is undesirable (see Barro, 1980). Viewed in this way the new classical framework provides, from a different perspective, an alternative rationalization for simple, credible announced monetary targets to that offered by traditional monetarists. As far as disinflation is concerned it gives the comfortable prediction that monetary policy can achieve a rapid and costless reduction in inflation if the policy is well understood and is believed.

The qualification that policy must be believed or be "credible" to have desirable effects — inflation control with no output or employment costs — has recently become the focus of much attention in the theoretical literature on monetary policy. It has been shown that in a world where expectations are forward-looking and monetary authorities have the power to temporarily raise output or lower unemployment, either by creating more money or by exploiting rigidities in wages and prices, a policy of maintaining low inflation may be "time-inconsistent" and, therefore, not credible (see Barro and Gordon, 1983). The problem of time-inconsistency arises when the monetary authorities attach some

weight to lower unemployment and higher output which they may be tempted to strive for when inflation is low and, therefore, not seen to be an immediate problem. If private sector agents realise that a policy of low inflation is not compatible with the short-run incentives facing the monetary authorities, the best they can do to avoid a fall in real earnings is to set wages and prices assuming that the authorities will pursue their short-run inclination to inflate. Knowing that the private sector will behave in this way, the authorities could choose not to inflate, but in this case real wages will prove too to be high and employment and output will suffer. In such circumstances the authorities would probably prefer to allow private sector expectations to be realised by monetary expansion.

A number of schemes have been advanced to avoid this inflation bias. One involves the adoption of a commodity standard like gold. A second involves precommitting the monetary authorities in some way, for example by a legal or constitutional devise forbidding inflationary monetary expansion. But even without this, it has been suggested that low inflation could still be maintained if the monetary authorities have a reputation for low inflation, which they value at least as much as any temporary output gain from expansionary monetary policy (Backus and Driffill, 1985). However, establishing and maintaining a favourable reputation, especially for authorities identified as permissive of high inflation in the past, is difficult and may imply a protracted period of low growth and high unemployment. Reputation may also be lost quickly if discretionary measures designed to boost output growth are adopted by monetary authorities.

There are reasons for believing, however, that discretionary monetary policy may play no more than a minor role in explaining variations in real economic activity and may not be able to account for the strength of the correlation between money and real growth. From an *a priori* point of view, the assumption that significant informational gaps would persist, motivated by maximising behaviour, seems as arbitrary and *ad hoc* as the assumption that prices do not adjust instantaneously because of unspecified costs of adjustment. In practice, there exists a good deal of information that might help to avoid confusion between relative price and absolute price level changes (see King, 1981). Many goods are traded throughout the economy and the prices at

which they are sold in different localities are easily established. Also there is readily available information on such global price variables as the exchange rate and interest rates. Moreover, in some countries preliminary monetary statistics are available with a very short lag.

If monetary disturbances are rejected as a source of the business cycle two questions remain to be answered: (i) why are the money supply and real activity correlated? and (ii) what is the cause of variations in real activity? One explanation, ironically already often advanced by some Keynesians, for the existence of a significant correlation between money and real activity is that reverse causation is responsible, the money supply responding positively to money demand which is determined by changes in the level of real activity (King and Plosser, 1984). But if the observed correlation has indeed been derived from data in which money is endogenous, it leaves open the question of what would happen if monetary policy ceased to accommodate output changes; would output be affected or would the effects be confined to prices? One emerging approach to macroeconomic analysis known as the *real equilibrium theory of the business cycle* posits that exogenous monetary policy would have no real effects and that the business cycle is an exclusively real phenomenon (see Kydland and Prescott, 1982 and Long and Plosser, 1983). In this framework monetary policy could not even be destabilizing (random action has no real consequences) and it does not matter whether monetary policy announcements are credible or not. The source of the serial correlation observed between output and employment are real shocks. Viewed in this light, the business cycle, as well as being independent of nominal monetary policy, is a desirable response of the economy to supply shocks. An important implication of this framework is that the monetary authorities have no incentive to bring about inflation, monetary policy cannot be time-inconsistent and there is no reputation problem.

The challenge offered by the equilibrium business cycle approach has received considerable attention in recent years. This is not surprising in view of the important consequences that such an approach implies for the conduct of monetary policy. In particular, the high costs commonly attributed to disinflationary monetary policy and which are used to justify a gradualist policy towards inflation control are seen, from this analysis, as exaggerated.

2. An overview of the empirical evidence

The discussion in this part begins with a review of evidence based on models which are in the spirit of the traditional non-clearing markets approach to monetary analysis. This is followed by a review of the evidence on the relevance of equilibrium business cycle models.

A) The effects of monetary policy under slowly adjusting prices

The following analysis is based mainly on evidence from some thirty large scale models, a list of which is given in Table 1. Although these models differ in numerous ways many of them share a broad basic structure. Nominal wages and prices exhibit inertia so that employment and output respond to changes in aggregate demand. Aggregate supply is essentially demand determined in the short run and prices are set as a mark-up on variable costs. These costs include import prices and wage costs. Import prices are determined by, among other things, the exchange rate. Wages are determined by some version of the expectations augmented Phillips curve, price expectations and excess demand being the main factors driving wages. Price expectations are typically adaptive and not model consistent. In this framework monetary policy directly affects aggregate demand and thereby output and employment. Monetary policy affects prices by influencing costs; it influences import prices via the exchange rate and wage costs via its impact on excess demand, often equated with the unemployment rate. One implication of this is that monetary disinflation is achieved by an unavoidable reduction in real economic activity. In addition to the evidence from large scale models, the properties of which essentially reflect the strong prior beliefs of the model builders, the results of a number of single equation studies are also considered here together with some empirical work undertaken by the OECD Secretariat.

1. The effects on real expenditure

The empirical assessment of the role of monetary policy in goods markets has tended to concentrate on its impact on the main

TABLE 1

LIST OF NATIONAL AND INTERNATIONAL MODELS

Country	Models	Abbreviation (version)		Frequency*	Authority responsible
United States	INTERLINK	OECD	(85)	S	OECD
	MCM	MCM	(82)	Q	Intl. Finance Div., Board of Governors
	"	MCM	(84)	Q	of the Federal Reserve System
	DRI annual	DRI	(82)	A	Data Resources Incorporated
	Chase	CHA	(82)	Q	Chase Econometrics
	Wharton	WHAR	(82)	A	Wharton School
	MPS	MPS	(85)	Q	Federal Reserve System
Japan	INTERLINK	OECD	(85)	S	OECD
	World model	WLD	(82)	Q	Economic Planning Agency
	" (revised)	WLD	(84)	Q	Economic Planning Agency
Germany	INTERLINK	OECD	(85)	S	OECD
	Bundesbank	BBK	(82)	Q	Bundesbank
	" (revised)	BBK	(84)	Q	Bundesbank
France	INTERLINK	OECD	(85)	S	OECD
	Metric	MET	(81)	Q	INSEE
	Copain	COP	(81)	A	Direction de la Prévision
	Metric (revised)	MET	(83)	Q	INSEE
	OFCE	OFCE	(85)	Q	Observatoire Français de Conjoncture Economique
	Bq. France (provis.)	BDF	(86)	Q	Banque de France
United Kingdom	INTERLINK	OECD	(85)	S	OECD
	HM Treasury	HMT	(82)	Q	H.M. Treasury
	" " (revised)	MT	(84)	Q	H.M. Treasury
	Bank of England	BKE	(84)	Q	Bank of England
	National Institute	NIESR	(84)	Q	Nat. Inst. of Economic and Social Research
	LBS model	LBS	(84)	Q	London Business School
	Liverpool	LIV	(84)	A	Liverpool University
Italy	INTERLINK	OECD	(85)	S	OECD
	Bk. Italy (provis.)	BKI	(86)	Q	Bank of Italy
Canada	INTERLINK	OECD	(85)	S	OECD
	RDXF	RDXF	(82)	Q	Bank of Canada
	Candide	CAND	(82)	A	Conseil Economique
	QFS	QFS	(82)	Q	Ministère des Finances
	SAM	SAM	(82)	Q	Bank of Canada
	SAM (revised)	SAM	(85)	Q	Bank of Canada
	RDXF (revised)	RDXF	(84)	Q	Bank of Canada
Australia	RBII	RBA	(84)	A	Reserve Bank of Australia
	AMPS	AMPS	(86)	Q	Economic Planning Advisory Council
Netherlands	FREIA	FREIA	(82)	A	Central Planning Bureau
	MORKMON	MKM	(85)	Q	Bank of Netherlands

* S = semestrial; Q = quarterly

component of private expenditure — business and residential investment, consumption, imports, exports and inventories. The evidence on the role of financial variables (such as interest rates, money balances, exchange rates, financial net worth, credit availability, etc.) and non-financial variables (such as inflation, real income, etc.) in the determination of these categories of private spending is discussed in detail in an earlier version of this paper (see Chouraqui *et al.*, 1988). Therefore only the main features of that discussion are outlined here.

Monetary variables usually have some direct role in explaining expenditure but they are not generally the major proximate determinants. Of the financial variables affecting expenditures, interest rates appear most frequently in the models considered, especially in equations explaining business and residential investment. Exchange rates, where these are allowed to vary, are important determinants of trade flows, and hence the current account of the balance of payments; they are, however, rarely used to explain directly other categories of expenditure. The same is true for other financial variables, such as money balances (real and nominal), financial net worth and credit availability, the inclusion of which in models is rarely successful. In fact the main determinant of all categories of expenditure turns out to be the overall level of aggregate demand. It is, therefore, predominantly via its impact on aggregate demand as a whole that monetary policy influences the different categories of expenditure, its small initial impact on each being magnified by multiplier and accelerator mechanisms. Moreover, the relative importance of financial and non-financial variables and the magnitude of the impact and duration of monetary policy effects differ between categories of expenditure, and between models for the same type of expenditure.

One feature of recent evidence which differs from studies of earlier vintage is the presence of significant interest rate effects. This could imply a number of things. It could signal a higher degree of responsiveness of expenditure to interest rates; but it could also merely reflect the fact that the effects of interest rates have become more transparent now that they are allowed to vary more freely. According to this last argument, if interest rates are not flexible then their measured effect on expenditure will tend to be biased towards zero because other variables will tend to account for more of the variation in spending. At the limit, if the rate of interest were fixed over the whole of the estimation period it would show no effect on

the level of expenditure even if borrowing costs were an important consideration in spending decisions. Alternatively, the new found importance of the rate of interest could reflect differences in the statistical tests used and the availability of longer runs of data in more recent empirical work.

There are two major reasons, however, for thinking that the effects of interest rates may have become more significant in the wake of financial market deregulation and recent developments in the macroeconomic environment. *First*, the very high levels that interest rates, and in particular real rates, reached in the early 1980s may have passed thresholds beyond which "consciousness" of borrowing costs is awakened. Whether or not this sensitivity will persist when real interest rates have fallen to more normal levels is uncertain. But this would be more likely to be the case if deregulation has permanently raised interest rates to higher "normal" levels, which it may well have done if the perception that credit rationing was important in the past is correct. Also the volatility that has been experienced in financial market yields may have increased the risk premium included in interest rates. *Second*, the development of freer and more competitive financial markets may have raised the average interest elasticity of private sector expenditure. This may have happened because interest rates changes spread more quickly, affecting a larger number of transactions and borrowers, or because financial assets have become more substitutable as a result of reduced market segmentation (the changes in interest rates thus altering the return on all financial assets *vis-à-vis* physical assets). *Finally*, the growth in variable rate loan contracts and short-term lending implies that interest rate adjustments will have a larger impact on overall borrowing costs, because they will affect outstanding loans as well as new loan contracts. This effect is likely to be especially important in the United States. In the case of rising interest rates, the impact will depend upon the extent to which borrowers are approaching the limits of their capacity to service the interest payments on existing loans.

The factors acting to raise the interest rate responsiveness of expenditures may, however, be offset by other influences. The increased availability of variable rate financing and hedging instruments may reduce the impact of a large rise in interest rates because the fear of being locked into high borrowing costs is lessened. This is especially likely if a tightening of monetary policy is expected to be only temporary. Moreover, the higher volatility in interest rates

and prices that has been experienced recently, if this has reinforced uncertainty about future inflation, may mean that a larger increase in interest rates is needed in order to achieve a particular increase in expected real credit costs. In addition, if nominal interest rates adjust rapidly to reflect changes in inflation expectations, shifts in monetary policy may have less impact on real rates and, therefore, less influence on expenditure.

Another reason why interest changes may have, in particular, a reduced impact on physical investment is related to the phenomenon of "short-termism" in financial markets — *i.e.* the tendency to give excessive weight to immediate and short-term returns to financial investment. The idea that financial markets are myopic is not new; it dates back at least to Keynes and is a popular notion among industralists in some countries (see Keynes, 1936 and Knight, 1981). Although this problem has not been studied extensively, there is some evidence of financial market myopia (see Nickell and Wadhwani, 1987). What is less clear, and this is something that empirical researchers have not addressed, is whether short-termism is becoming a more important problem in the present context. There are those who see short-termism as being bound up with the structure of the economic and financial system and, therefore, view it as a feature of financial markets that has been present for some time.[2] On the other hand, some consider that the development of sophisticated financial markets, dealing with spot and short-term futures and options contracts, may have permanently shifted flows of funds away from physical investment. Also the more competitive environment that fund managers have to operate in nowadays may necessitate adopting a very short investment horizon. Furthermore, the worldwide boom in stock markets since the early 1980s may have shifted funds into assets which are easily traded on secondary markets. In this environment, companies not large enough to attract equity finance may thus not be able to easily obtain loans for physical investment whatever the rate of interest.

[2] See MAYER (1987) who tries to account for differences in the investment performances between the United States and the United Kingdom on the one hand with Japan on the other, in terms of the structure of their financial systems. The comparatively better investment rate in Japan is attributed to the close involvement between Japanese banks and the corporate sector. He argues that despite being competitive (and perhaps even because of this) the financial systems in the United States and the United Kingdom have not been efficient providers of funds to industry.

Thus, overall, it is not possibile to say *a priori* if interest rates now have a more important effect on expenditure than in the past. The limited evidence that is available on this issue is also far from being decisive, though some recent studies have reported results in support of increased interest rate elasticities.[3]

2. *The effects on inflation*

The existence of some long-run causal relationship between money and the price level is rarely challenged. The question of whether it is the price level which adjusts to exogenous changes in the money stock or whether instead money accommodates exogenous pressures on the price level continues to be disputed. Long-run money neutrality implies that exogenous money growth will ultimately be fully reflected in the aggregate price level. This assumption which seems to be a plausible first order approximation is, however, difficult to establish empirically. Much of the evidence that is advanced in support of a long-run money-inflation link is in fact anecdotal in nature (for example, descriptions of hyperinflation episodes) and as such has been criticized as lacking rigour. Other approaches, which are designed to overcome this limitation, have been adopted recently. One of these involves measuring the association between money growth and inflation on a cross-country basis over a long period, the idea behind this being that problems of "noise" in high frequency data will be avoided by using only one observation (the average value over a given period of time) for each country. Such an approach and other time series analyses, which are also designed to extract the long-run "signal" in the data, generally support the proposition that money growth has a permanent effect on the price level, under the assumption of an exogenous money supply (see Lucas, 1980). None of these tests, however, are capable of settling the question of causality between money and inflation.

Most macroeconomic models which incorporate non-clearing markets predict that the relationship between money growth and prices will be weaker in the short-to-medium run than over the long

[3] See AKHTAR (1983) and AKHTAR and HARRIS (1987) for attempts to measure the changing role of interest rates in expenditure. The results reported in both of these papers point to an increase in the sensitivity of expenditure to interest rates.

run. Additionally the widely-held view that the speed of price adjustment is variable would tend to suggest that the relationship will also be unreliable. On the whole, the evidence seems to bear out the idea that a strong and reliable short-run money-growth-inflation relationship is difficult to establish (see Chouraqui *et. al.*, 1988, for a discussion of some evidence for major OECD economies). This may explain why monetary aggregates are generally absent from equations explaining prices and price expectations in large-scale structural models. Nevertheless, in these models monetary policy typically has important effects on prices, via its influence on cost variables such as import prices, capital and inventory costs and wages. In other words, prices are determined as a mark-up on such costs.

An important channel by which monetary policy affects the domestic price level in most models is via its influence on the exchange rate and, hence, import prices, which depends on the extent of the adjustments made by traders to their cost-price margins. Although the usual range of estimates is between 0.2 and 0.3, these vary considerably over the choice of index, the country in question and the particular study. In some models the cost of capital also enters directly in price equations, for example via the cost of mortgage finance or borrowing costs in general, and occasionally via credit availability. In a few models the price-cost mark-up process incorporates inventory costs and hence the rate of interest, as the opportunity cost of holding real assets. These effects of interest rates on prices are especially prominent in models of the French economy. The more open the industrial sector to foreign competitiveness, however, the weaker the mark-up of prices on unit costs such as inventory costs.

To gain further insight into the role of monetary policy in the inflationary process as described in structural models, it is necessary to examine the determination of wage inflation. This is usually encapsulated in some version of the "expectations augmented Phillips curve", according to which nominal wage inflation depends on inflation expectations and demand pressure that is usually reflected in the rate of unemployment. As expectations are often assumed to be formed adaptively and, therefore, to be independent of the current stance of monetary policy, any influence that monetary variables exert on wage inflation must come via their impact on excess demand and the degree of nominal wage indexation to the price level. On the whole, indexation is more rapid in Europe and Japan than in North America. In Europe full indexation generally occurs within 2 to 4

quarters following a price level increase, while in the United States and Canada full indexation often takes from 8 to 12 quarters. This difference partly reflects the fact that adjustments of nominal wages for cost-of-living changes generally occur *ex post*, coupled with the fact that wage contracts in North America have a longer duration — typically 2 to 3 years — than those in Europe and Japan where the usual bargaining cycle is one year. Though the notion of indexation tends to suggest that price level changes lead wage changes, it should be noted that in most national models, if prices can affect wages they do so as part of the adjustment process of wages in response to excess demand pressures.

3. *Monetary policy and the price-output split*

As already noted, if prices exhibit significant inertia, any impact that monetary policy has on aggregate demand will, in the short to medium run at least, be distributed over both the level of output and the price level. The extent to which these are affected is of considerable importance in assessing the role of monetary policy. If changes in aggregate demand are dominated by changes in the price level this may mean that significant output gains can only be achieved by expansionary policy at the cost of a substantial increase in inflation but that, at the same time, rapid disinflation can be brought about at little cost in terms of output. As far as the costs of disinflation are concerned these may be considerable if aggregate demand changes are mainly reflected in output.

One way of measuring the overall impact of monetary policy on prices and output is through a dynamic simulation of models involving all potential monetary policy transmission mechanisms. The following discussion compares the simulation results from the main disaggregated models listed in Table 1 for the countries under review.[4] As instruments for assessing the impact of monetary policy in the current environment these models have, however, a number of limitations. The weight unavoidably given to earlier periods, through the use of long runs of data, stretching back to the 1960s, may be misleading and it is difficult for large models to be

[4] See CHAN-LEE and KATO (1984) for a comparative analysis of some of these models in their pre-1982-83 versions.

adapted quickly to incorporate recent developments. Moreover, it bears repeating that the overall structure of these models is essentially imposed on the basis of the prior beliefs of the model builders; besides they often contain a mixture of statistically estimated parameters and imposed judgemental parameters. These models should, therefore, be seen as reflecting particular lines of thought rather than as the outcome of an exhaustive testing procedure.

Monetary policy simulations of large-scale models are typically conducted in terms of an exogenous change to a key short-term nominal interest rate. Simulations conducted in terms of a measure of the money stock are comparatively rare. Arguably short-term interest rates are closer to the instruments that monetary authorities actually control directly. Nevertheless, there are problems with using nominal interest rates to measure the stance of monetary policy over anything but the very short run. The reason for this is that a permanent change in the rate of interest requires an accelerating rate of change in money growth. Ideally, therefore, simulations should be conducted in terms of the ultimate instruments of monetary policy with models incorporating well-specified links between such instruments and other variables in the transmission process. Unfortunately these links are not quantitatively well understood and are not included in existing models.

Three types of simulation results are surveyed here, which are reported in Tables 2, 3, and 4 respectively: those conducted in terms of a once-and-for-all decrease in the stock of money; those based on a permanent reduction in the rate of money growth; and those involving a permanent increase in the level of nominal interest rates. It should be noted that these simulation results are not the product of exactly the same experiment and that they are not, therefore, fully comparable. Simulations have been performed using different baseline assumptions regarding the "neutral" stance of monetary policy and the settings of other policy variables such as fiscal deficits, which may be an important factor in explaining the striking dispersion that appears in the results. Nevertheless the following features are worth noting:

i) According to all simulation results, a tightening of monetary policy has a restrictive impact on nominal income, the magnitude of which is greater under a floating exchange rate regime than it is

under fixed exchange rates. This finding supports the view that the exchange rate, when floating, is an important channel for the transmission of monetary policy. The way in which this operates is easy to envisage: the exchange rate appreciates in response to tight monetary policy, lowering import prices. In the absence of purchasing power parity, partly due to slow price adjustment, the real exchange rate also rises and output falls because of the worsening of competitiveness (terms of trade *improve*). Under fixed exchange rates monetary policy changes may be offset by capital flows as reported by simulation results showing that, in such a case, the response of money growth to interest rate changes is generally smaller than under flexible rates. This difference is, however, often small, suggesting that effective sterilization of capital flows may have occurred or that exchange rate regimes may not be well specified in the simulations.

ii) Although both output and prices usually fall in the face of a restrictive monetary policy, a few models exhibit stagflationary outcomes. Some interest rate simulations in France, the United Kingdom and the Netherlands, under fixed exchange rates, generate a decline in output but a rise in the price level when policy is tightened. This outcome could be the result of the effects of monetary policy tightening on nominal financial costs, which are passed on to prices, thereby eroding households' purchasing power. According to a recent (end-1986) experimental version of the OECD INTERLINK model, where prices largely depend on a mark-up on the user cost of capital and hence on long-term interest rates, this stagflationary effect may occur in most countries except the United States.[5] The mirror image of this, an anti-stagflationary outcome (lower inflation and higher output), is generally not found even in the medium run (last year of the simulation, typically the 5th or the 7th year). This does not encourage the view that monetary disinflation will quickly (or within the sorts of periods covered by simulations) succeed in establishing the conditions for higher output growth.

iii) The short-run split of nominal income between output and

[5] The different behaviour of the United States might be due to the higher share of raw materials in the U.S. economy and the greater importance of demand in determining the prices of these products (*cf.* SYLOS LABINI, 1982).

TABLE 2

EFFECTS OF A ONCE-AND-FOR-ALL 1 PER CENT REDUCTION IN THE MONEY STOCK*

Country	Model	Short-term(a)		Medium-term(b)		Memorandum items: Year of peak effect on		Exchange rate	Interest rate	
		GDP	Prices	GDP	Prices	GDP	Prices	(a)	Short-term(a)	Medium-term(b)
1. *Floating exchange rates*										
United States	MCM 82	−0.5	−0.1	−0.2	−0.5	2	L	0.7	0.6	0.4
Canada	CAND 82	−0.1	−0.4	−0.1	−0.4	L	L	1.1	0.7	0.8
	RDXF 84	−0.3	−0.1	0	−0.8	2	L	1.0	0.3	0
Australia	RBA 82	−0.5	0	−0.2	−0.1	3	2	1.2	0.5	1.4
	RBII 84	−0.3	−0.8	−1.2	4.9	L	L	0.9	0.1	0.4
2. *Fixed exchange rates*										
United States	MCM 82	−0.3	0	−0.2	−0.3	2	L	..	0.7	0.6
Canada	RDXF 84	−0.1	0	0	0	2	L	..	0.4	0.3
Australia	RBA 82	−0.4	0	−0.6	0	2	2	..	0.5	0.9
	RBII 84	−0.2	−0.7	−0.8	−4.1	L	1	..	0.1	0.5

* A once-and-for-all shock is applied by lowering the path of a chosen money aggregate relative to its base. All results have been normalized to represent a 1 per cent shock by taking the ratio of each variables deviation from the baseline over that of money stock. For simpler comparisons with other tables, a minus sign corresponds to a decrease (in output or prices) after a money stock reduction.

.. = Not available or inapplicable.

L = Last year reported.

a) Short-term = average of first three years.

b) Medium-term = last year of simulation (5th to 7th year).

Source: National models (see list in Table 1).

TABLE 3

EFFECTS OF A CONTINUOUS 1 PER CENT REDUCTION IN THE RATE OF MONEY GROWTH*

Country	Model	Short-term(a)		Medium-term(b)		Memorandum items: Ratio of growth rates (medium-run)	
		GDP	Prices	GDP	Prices	GDP	Prices
1. *Floating exchange rates*							
United States	DRI 82	−0.4	−0.3	0.0	−0.4	0.0	−0.5
	CHA 82	−0.2	−0.1	−0.1	−0.1	0.0	−0.2
	WHAR 82	−0.4	0.0	−0.1	−0.3	0.0	−0.7
	MPS 85	−0.7	−0.3	−0.3	−0.8	+0.3	−1.8
Canada	SAM 85(c)	−0.2	−0.4	0.0	−1.0	0.0	−1.0
	RDXF 85	−0.2	−0.1	−0.1	−0.4	0.0	−0.7
Australia	RBII 84	−0.6	−1.6	−2.4	−9.8		
2. *Fixed exchange rates*							
United States	MPS 85	−0.7	−0.2	−0.4	−0.7	+0.3	−1.7
Canada	RDXF 85	−0.1	0.0	−0.1	−0.1	0.0	−0.2
Australia	RBII 84	0.4	−1.4	−1.6	−8.2		

* A 1 per cent continuous shock is applied by lowering the growth rate of a chosen aggregate by 1 per cent each year relative to its baseline, with the previous years difference added to the current year. Figures correspond to the ratio of output (or price level) deviations over money stock deviations. To compare results easily with other tables, a minus sign corresponds to a decrease (in output or prices) after a money growth reduction.

a), b), see Table 2.

c) The shock on short-term interest rate is maintained for *3 years only*. The "medium" run outcome corresponds to the 15th to the 20th year of simulation.

Source: National models (see list in Table 1).

TABLE 4

EFFECTS OF AN INTEREST RATE SHOCK ON OUTPUT (GDP) AND PRICES*

A. UNDER A FLOATING EXCHANGE RATE REGIME

Country	Model	Short-term (a) GDP	Short-term (a) Prices	Medium-term (b) GDP	Medium-term (b) Prices	Year of peak effect on GDP	Year of peak effect on Prices	Effect on: money Short-term	Effect on: money Medium-term	Effect on exchange rate Short-term	Effect on exchange rate Medium-term
United States	MCM 82	–0.8	–0.3	–0.1	– 1.6	2	L	–1.9	+ 2.6	+1.3	+ 1.4
	MPS 1 85	–2.1	–0.9	–5.9	– 7.8	L	L	–3.3	–13.2	+4.4	+15.8
	MPS 2 85(d)	–0.4	–0.3	–0.6	– 1.7	L	L	–1.6	– 3.1	+1.4	+ 2.3
	OECD 85	–0.3	–0.2	–0.6	– 1.1	L	L	–1.1	..	+1.0	+ 1.7
Japan	WLD 82	–1.0	–0.5	–1.5	– 1.1	L	L	–4.3	– 6.6	+4.5	+ 5.1
	WLD 84	–0.2	–0.4	–0.4	0	L	2	–3.0	– 3.9	+1.2	– 0.2
	OECD 85	–0.7	–0.5	–1.3	– 2.3	L	L	–1.8	..	+1.4	+ 4.0
Germany	BBk 82	–0.2	–0.2	+0.1	– 0.3	3	L	–0.2	+ 0.6	+1.1	+ 1.1
	BBk 84	–0.6	–0.1	–0.4	– 0.4	3	L	–1.9	– 1.9	+0.5	+ 0.7
	OECD 85	–0.1	–0.1	–0.4	– 1.0	L	L	–0.9	..	..	+ 2.7
France	MET 81	–0.4	–0.1	–0.3	– 1.5	3	L	–0.4	..	+1.4	..
	Idem for 1% rise in BR	–2.0	–0.6	–1.5	– 7.5	3	L	–2.1	+ 3.8	+7.2	..
	OEDC 85	–0.4	–0.3	–1.1	– 1.5	L	L	–1.1	..	+1.1	+ 2.9
United Kingdom	HMT 82	–0.3	–0.6	–0.2	– 2.0	3	L	–1.1	+ 0.6	+2.7	+ 2.2
	HMT 84	–0.5	–0.7	..	..	2	..	–1.0	..	+2.6	..
	BKE 84	0	–0.1	..	..	L	L	–0.4	..	+0.2	..
	NIESR 7 84	–0.2	–0.8	–1.4	– 8.8	L	L	–3.0	..	+4.1	..
	LBS 5 84	–0.4	–1.3	0	– 2.0	L	L	0	..	+2.7	..
	LIV 84	–0.6	–0.6	0	– 1.5	L	L	–0.6	..	–0.6	..
	OECD 85	–0.1	–0.3	–0.2	– 1.3	L	L	–3.8	..	+1.1	+ 3.0
Italy	BKI 85	–0.2	–0.5	–0.7	– 0.8	L	L	–0.7	– 0.5	–0.9	– 2.5
	OECD 85	–0.2	–0.6	–0.2	– 2.7	2	L	–3.0	..	+3.5	+ 3.7
Canada	RDXF 82	–0.5	–0.5	–0.5	– 3.1	3	L	–2.2	– 6.8	+1.6	+ 4.3
	CAND 82	–0.1	–0.3	–0.4	– 0.4	L	L	–1.7	– 1.6	+1.1	+ 0.9
	QFS 82	–0.4	–0.5	–0.3	– 2.6	3	L	–2.6	– 5.1	+0.3	+ 0.1
	SAM 82	–0.2	–1.7	+0.1	– 8.5	L	L	–5.0	..	+1.0	..
	RDXF 84	–0.8	–0.4	–0.5	– 3.5	3	L	–3.0	– 6.7	+2.0	+ 4.7
	RDXF 85	–1.0	–0.4	–1.1	– 4.0	3	L	–3.3	– 8.1	+2.4	+ 5.5
	SAM 85(c)	–1.2	–3.7	0	0	..	..	–8.4	..	+5.1	..
	OEDC 85	–0.5	–1.2	–1.0	– 5.8	L	L	–3.1	..	+1.5	+ 6.5
Australia	RBII 84	–0.8	–0.4	–0.9	– 1.0	L	5	–2.7	– 4.0	+1.9	+ 2.6
Netherlands	FREIA 82	–0.3	–4.8	–0.5	–10.0	L	L	–0.6	– 3.5	+9.5	+10.9
	FREIA 82(c)	–0.1	–1.1	–0.1	– 2.3	L	L	0	..	+2.2	..
	MKM 85	–1.1	–0.3	–0.9	+ 0.1	2	2	0	– 0.2	+0.2	+ 0.3

B. UNDER A FLOATING-EXCHANGE RATE REGIME

	Model	Short-term(a) GDP	Short-term(a) Prices	Medium-term(b) GDP	Medium-term(b) Prices	Year of peak effect on GDP	Year of peak effect on Prices	Effect on: money Short-term	Effect on: money Medium-term
United States	MCM 82	–0.5	–0.1	–0.7	–0.7	2	L	–1.5	–2.0
	MPS 1 85	–2.1	–0.6	–4.2	–5.5	L	L	–2.9	–9.8
	MPS 2 85(d)	–0.3	–0.1	–0.3	–1.0	L	L	–1.4	–2.2
	OEDC 85	–0.3	–0.1	–0.8	–0.6	L	L	–1.2	–2.3
Japan	WLD 82	–0.4	–0.1	–0.6	–0.1	3	L	–3.3	–4.7
	WLD 84	–0.1	–0.1	–0.3	+0.1	L	2	–2.0	–3.6
	OECD 85	–0.5	–0.3	–0.5	–1.0	3	L	–1.5	–5.2
Germany	BBk 84	–0.4	–0.1	–0.4	–0.5	3	L	–1.9	–1.8
	OECD 85	–0.1	0	–0.2	–0.1	3	2	–0.8	–2.6
France	MET 81	–0.3	0	–0.2	0	2	..	–0.7	..
	Idem for 1% rise in BR	–1.0	–0.1	–0.7	0	2	..	–2.8	..
	COP 81	–0.3	+0.3	–0.5	0	L	..	–0.8	..
	Idem for 1% rise in BR	–0.5	+0.6	–0.6	0	L	..	–1.1	..
	MET 83	–0.1	+0.1	–0.2	+0.2	L	3	..	..
	Idem for 1% rise in BR	–0.4	+0.2	–0.6	+0.6	L	3	..	..
	BDF	–0.1	–0.1	+0.3	–0.6	2	L	..	..
	OECD 85	–0.4	–0.1	–0.9	–0.6	L	L	–1.3	–4.2
United Kingdom	HMT 82	–0.1	+0.1	–0.1	+0.3	L	L	–0.7	–0.7
	HMT 84	–0.4	+0.3	..	..	L	L	–0.5	..
	BKE 84	0	–0.1	..	..	L	L	–0.4	..
	NIESR 7 84	0	+0.1	..	..	L	L	–2.2	..
	LBS 5 84	–0.2	+0.1	0	0	–	–	–0.7	..
	OECD 85	–0.1	–0.1	–0.1	–0.3	L	L	–2.0	–7.5
Italy	BKI 85	–0.2	–0.4	–0.5	–0.1	L	2	–0.6	–0.1
	OECD 85	–0.3	–0.2	–0.4	–0.7	2	L	–4.0	–6.7
Canada	RDXF 84	–0.8	0	–0.5	–0.1	2	L	–3.4	–8.1
	OECD 85	–0.4	–0.2	–0.4	–0.6	1	L	–2.0	–7.8
Australia	RBII 84	–0.4	–0.1	–1.7	–1.8	L	L	–1.6	–2.1
Netherlands	FREIA 82	–0.1	0	–0.5	+0.4	L	L	–1.7	–1.3
	FREIA 82(c)	0	0	–0.1	+0.1	–	–	–0.4	..

* Results as a percentage deviation from the baseline; shock standardised as a 1 percentage point rise in the representative short-term interest rate (IRS), with long-term rates (IRL) generally endogenous.

BR is the base rate considered as representive of the short-term interest rate (IRS) instead of the money market rate in some comparative studies of simulations; see CHAN-LEE and KATO (1984).

For notes a), b) and c) see Tables 2 and 3.

d) This version of MPS assumes that long-term interest rates are fixed.

Source: OECD INTERLINK and national models (see list in Table 1).

the price level is frequently in favour of output in the short run (measured as the average of the first three years of the simulation); this is especially true under fixed exchange rates. The split turns out in favour of prices in Canada, only under floating exchange rates, and in the United Kingdom, under both exchange rate regimes. Over the medium run, the price-output split is less clear-cut and depends on the nature of the monetary shocks. Three types of shock can be distinguished:

– *First*, in the case of a once-and-for-all reduction in the level of the money stock, the initial increase in interest rates should in principle vanish as prices adjust and as the level of real money balances returns to baseline. In such a case, for money neutrality to hold in the medium run, the output effect should disappear or tend to disappear by the last year of simulation. In the few available simulations expressed in terms of a shock to the quantity of money, changes in interest rates and in output persist into the medium run. In terms of the price-output split, however, these responses are generally smaller than in the short run. This trend suggests that in the longer run, money neutrality may hold in these models.

– *Second*, in the case of a permanent reduction in the rate of money growth, the initial liquidity effect should be more than compensated by an opposite inflation expectations effect in the short-to-medium run. In the longer run, for neutrality of money to hold, the change in the pace of money creation should only affect the rate of inflation but not the rate of real growth. There are only a few simulations available involving a change in money growth. In the majority of these the effect on output relative to prices more or less disappears over the medium term. Only in the MPS model for the United States is the rate of real growth in the last year of simulations significantly affected by the change in the rate of money creation. In this case, however, the last year of simulation is only the fifth and under floating exchange rates the output deviation from baseline in terms of level tends to vanish since the rate of growth for the last year is reverting. As for price effects, the ratios of price changes over money changes, either in terms of levels or rates of growth, do not equal unity in the last year of simulation (except for the Canadian model SAM), but they tend to approach this value in some models (such as MPS for the United States or RDXF for Canada).

– *Third*, in the case of an exogenous permanent increase in short-term nominal interest rates, most model exhibit a persistent change in real output, which is often larger than in the short run. Indeed, most simulations generate the largest output changes in or around the last year of simulation. The responses of prices to interest rate changes also increases over time, especially under floating exchange rates. With a few exceptions, the peak effects in terms of prices corresponds to the last year of simulation and exceeds the effect on output. This increase in the dominance of the response of prices to interest rates is not sufficient to confirm longer-term money neutrality. Implied elasticities with respect to money calculated from data provided for the last year of the simulation period often remain positive and price elasticities seldom become close to unity. Nothing definitive, however, can be said about the question of medium-term neutrality in the case of monetary policy simulations couched in terms of a permanent change in the rate of interest. To maintain a permanent increase in the nominal rate of interest, money growth must decrease considerably over time with very strong and persistent real and nominal effects.

Japan is typically the country with the strongest real effects relative to price effects, both in the short and medium run. The reverse case is the United Kingdom, where price effects generally dominate output effects especially under flexible exchange rates. The price-output split for other countries lies between these extremes, with Germany closer to Japan (although magnitudes of real effects are lower) and Italy closer to the United Kingdom. As for the United States and Canada, the major impression is of a wide divergence in simulation results across the different models.

Overall then, the assumption of non-market clearing prices included in the structure of these models largely explains in the short-to-medium-run non-neutrality of monetary policy. *The impression that emerges is that the costs of disinflationary monetary policy in output terms are significant and far from temporary.* Nevertheless, as will be argued further below, the real effects of monetary policy are not generally sufficiently predictable to make real economic activity a feasible short-run target for monetary authorities.

A striking feature of the simulation results reviewed here is the dispersion in the magnitude of effects across countries and sometimes across models for the same country — dispersion which is even greater if the more common interest rate simulations are considered. This stems mainly from differences in the size of parameters and in simula-

tion conditions. In most cases, however, the overall process described by models run along the following lines. Under fixed exchange rates and some imperfection in capital mobility and substitutability, a rise in the interest rate (initially nominal and real) induced by a slowing of money creation inhibits the growth of the main aggregate demand components, especially business and residential investment. The slowing of economic activity and, hence, the reduction in the rate of growth of real income strengthen the direct restrictive effects on consumption. In addition to the rising cost of holding money, this slackening of the economy reduces the demand for liquidity and prevents a persistent disequilibrium. At the same time, the easing on the goods and, therefore, labour markets helps to slow the rise in prices, wages and inflationary expectations, which are usually modelled as an adaptive process. The resulting increase in the real interest rate (the increase in the nominal rate assumed constant) reinforces the deflationary mechanism, but income effects associated with increased real interest transfers partially offset these movements. This is a feature of most models, especially in France and the United Kingdom. Wealth effects are small and their impact on output and price is ambiguous. Finally, the slowing of activity, and thereby of imports, together with possible enhanced competitiveness and increased exports, usually bring about a general improvement on current account.

Under floating exchange rates, this adjustment process is reinforced. In addition to the mechanisms already cited, the exchange rate appreciates in most cases under the impetus of the initial current account and/or capital account improvement, with revisions in expectations playing a variable role. This exchange rate appreciation (especially large in the United Kingdom, Canada and Italy) strengthens the deflationary momentum to a greater or lesser degree, depending in particular on its interaction with the wage-price spiral (stronger in the Netherlands and Italy for instance) and its effects on the trade or capital account. However, the current account may worsen as, for example, in the United Kingdom and Italy, mainly because of the J-curve effects.

B) The effects of monetary policy under rapidly adjusting prices

This section begins with an examination of the evidence concerning the assumptions of market clearing and rational expectations underlying monetary policy neutrality. It then continues with a review of the evidence on the role of monetary policy in the business cycle as well as on the real effects of monetary instability.

1. Market clearing and rational expectations

a) Market clearing evidence

From an empirical standpoint not enough formal empirical evidence has been advanced concerning the existence of non-market clearing prices to draw any firm conclusions.[6] The orthodox view that prices do not adjust sufficiently rapidly to maintain market clearing is usually based on casual observation of particular markets and the existence of rationing in such markets. The assumption of price inertia is often justified by reference to the existence of controls and regulations, monopolistic pricing behaviour (by firms or trade unions), staggered nominal wage contracts, indexation, desynchronisation and decentralisation of microeconomic decisions, etc. (see Bailey *et al.*, 1987). For example, unemployment is seen frequently as a sign that wages are inflexible in the face of excess labour supply. The prices of many retail goods are also seen as being unresponsive to changes in demand and supply conditions and as changing far less frequently than asset prices or interest rates in financial markets. Apart from this casual empiricism, one of the main pieces of evidence used to justify the non-market clearing assumption is the behaviour of the aggregate price level. Indeed, the apparent dependence of the current price level on its own past values is often interpreted as evidence that prices adjust slowly.

Supporters of the market clearing approach have reacted to this type of evidence by claiming either that it is irrilevant or that it is open to interpretations which are consistent with the existence of market clearing prices. It could be argued, for example, that changes in measured unemployment do not reflect temporary disequilibria but are instead a symptom of the microeconomic conditions in the labour market which influence the long-run or "natu-

[6] CARLTON (1986) reports micro-based evidence for significant price rigidity and rationing in the United States over the period 1957-66.

ral" rate of unemployment. Indeed a good deal of the empirical evidence on the causes of the growth in unemployment in the 1980s supports the view that this has been mainly due to the rise in the natural rate of unemployment. While the prices of many goods and services do not exhibit the same frequency of adjustment as some market determined interest rates or market determined exchange rates, they do nevertheless adjust. The important question is whether price adjustment takes significantly longer to achieve market clearing than the relevant policy response period, rather than whether prices in goods markets adjust more slowly than those in financial markets.

On the question of the implications of the dependence of the current price level on its own past values, this, it is argued, could reflect the movement of prices from one equilibrium to another or it could, instead, reflect the persistence of the causes of changes in prices (*e.g.* permanence of fiscal deficits expected to be monetized). What is needed in order to identify the correct interpretation of price level inertia is a careful comparison of the performance of models which can be constructed using either gradual price adjustment or gradual quantity adjustment. Nevertheless, the limited amount of work that has been done on this issue has on the whole produced results which support gradual price adjustment (see Bailey *et al.*, 1987).

As noted above, this market clearing *versus* non-market clearing debate has important implications for the analysis of the effects of monetary policy. Market clearing implies that monetary policy will, in the absence of money illusion, only have effects on the real economy, in the sense of causing real variables to deviate from their equilibrium values if it is unanticipated, or if its effects on the price level are unanticipated. If monetary policy has this characteristic the economy is said to be *structurally neutral* with respect to monetary policy. In contrast non-market clearing implies structural non-neutrality. If markets fail to clear within the policy response period, anticipated and unanticipated monetary policy will have real effects.

b) Rational expectations evidence

The way expectations are formed is also important for the assessment of the impact of monetary policy. If expectations are non-rational because they are not based on an optimal use of all the available information, this may give rise to systematic biases which could be exploited in order to stabilize real aggregates. Non-rational expectations formation could result in the anticipated component of monetary policy having a substantial and identifiable deterministic effect. In contrast, if expectations are rational and markets always clear, there can be no scope for monetary stabilization policy even if monetary policy actually affects real variables, because these effects will be purely random. Preferences for one interpretation or the other are typically justified on *a priori* grounds. This is probably because of the paucity of evidence on expectations and the difficulty of establishing whether or not expectations are being formed rationally. Expectations are rational if they are consistent with the way that the economy works in practice. As this cannot be exactly replicated by an econometric model, model consistent expectations should not, therefore, be equated automatically with rational expectations.

Nevertheless, there are statistical properties which might be reasonably envisaged from observed expectations if they are rational. In particular, they should be *unbiased* and *efficient* predictors of the actual values of the corresponding variables, in the sense that *on average* they coincide with actual observation of the variable concerned and that they reflect all the relevant available information. Evidence from survey data on expectations does not generally support the idea that expectations are formed rationally (see Holden, Peel and Thompson, 1985). Of course these survey data may not be fully reliable, and the tests performed are based on asymptotic properties. It is possible for time series data on expectations to appear to be biased and inefficient over considerable spans of time even though expectations are truly rational. This may happen, for example, if the private sector perceive that the authorities are temporarily following policies which are not consistent with the incentives they face. Under these circumstances the authorities will be expected, sooner or later, to abandon such policies in favour of time consistent ones.

Faced with the lack of any clear support for rational expectations, the model builder has to consider whether to use an alternative non-rational expectations formation scheme. Unfortu-

nately most of the alternatives such as static or adaptive expectations appear even less attractive. The approach that is adopted increasingly is to impose rational expectations, where this is feasible, as the default assumption. This approach at least has the advantage of being rooted in more reasonable forward-looking behaviour, thus highlighting the importance of the interaction between the behaviour of the authorities and the private sector.

c) *Implications for the price-output split*

In empirical terms, rational expectations and structural neutrality (RESN) implies that, in equations designed to explain real variables, such as employment or output, deviations of these variables from natural (or equilibrium) values will only occur as a result of unanticipated monetary policy and random non-policy influences. In such equations there should be no role for the *anticipated* component of monetary policy. In other words, if monetary policy is currently observable, it amounts to being fully anticipated and should prove to be of no significance for real economic activity. Even in this case, however, there may be confusion about the extent to which movements in policy stance represent autonomous changes in policy or endogenous reactions to current real variables. In general, therefore, only exogenous anticipated monetary policy should be neutral under RESN.

The proposition that it is only the unanticipated component of monetary policy (*i.e.* the difference between the actual and anticipated policy) which matters can be assessed by examining separately the size of the real effects of the actual and unanticipated monetary policy variables in equations for output and employment. This proposition cannot be rejected if the effects of actual and anticipated monetary policy are significantly different from each other. Rational expectations implies that unanticipated policy will vary unsystematically in the sense that it cannot be predicted from its past values or from other information. The immediate implication of this is that systematic and, therefore, predictable monetary policy will have no real effects. Where there is full current information about monetary policy, no role should be found for currently observed actual monetary policy in equations explaining real economic activity.

2. *Money and the business cycle*

a) *Anticipated and unanticipated monetary policy*

To test the rational expectations market-clearing approach, Barro (1977) employed the distinction between anticipated and unanticipated monetary policy and advanced a method by which monetary policy could be dichotomised into these components. Barro's measurement of the effects of unanticipated money growth involved the estimation of an equation for an index of the unemployment rate containing a measure of unanticipated money growth. Unanticipated money growth was measured as the residual of an equation explaining money growth policy. The money growth components were obtained prior to the estimation of an equation which had as its dependent variable unemployment being a proxy for real economic activity.[7] The results were supportive of the irrelevance of anticipated money growth. Thus, only unanticipated monetary policy would affect unemployment.[8]

Given the seminal nature of Barro's analysis, there has been a large number of replicative studies motivated by the desire to test its robustness. The main findings of these studies are listed in Table 5. On the whole, they suggest that Barro's results are not robust to changes in either the data period or to small changes in

---

[7] The two equation model used in Barro's work is as a follows:

$$\log (U/1 - U) = a_0 + a_1 DMR_{t-1} + a_2 DMR_{t-2} + a_3 MIL + a_4 MINW_t + V_t \quad (1)$$

$$DM = b_0 + b_1 DM_{t-1} + b_2 DM_{t-2} + b_3 FEDV_t + b_4 UN_{t-1} + DMR_t \quad (2)$$

Where
U= unemployment rate;
DMR= unanticipated money growth;
DM= money growth;
MIL= proxy for militaty conscription;
MINW= proxy for minimum wage rate;
FEDV= proxy for real government expenditure relative to normal;
V_t= random error.

The inclusion of $FEDV_t$ and UN_t are meant to reflect changes in money-financed deficit spending and counter-cyclical monetary policy. The model was estimated with annual U.S. data for the period 1941-1973. Equation 1 was estimated in three forms: firstly, in the form given in 1; secondly, with the total money growth, DM, substituted for DMR; and thirdly, with DM and DMR included at the same time.

[8] The approach followed by Barro raises a number of important methodological issues: the evaluation of monetary policy and the specification of the equation representing monetary policy expectations; the identification of alternative structural approaches; the Lucas and Goodhart critiques; the avoidance of "observational equivalence"; and the method of estimation. These issues are discussed in detail in DRISCOLL (1985).

the specification of the money growth equation. While it is always possible to dispute particular specification choices, the finding that the results are data-period sensitive is particularly damaging.

Further research, focusing mainly on the United States, has extended Barro's analysis to the examination of the effects of monetary policy on other real variables such as output, real wages and real interest rates. These new studies encompass different measures of money, different money growth forecasting equations, as well as different data periodicities. Although the results are somewhat mixed, most of the studies, especially those of most recent vintage, have been unsupportive of the proposal that only unanticipated monetary policy matters. From a methodological standpoint, two main features of these studies are worth noting:

— *First*, in a number of cases the outcome of results has been shown to depend on the form of the money growth equation. This equation has usually been estimated over the whole data sample. As future information is clearly not available to rational individuals, its use may lead to predictions which are too accurate, even for rational people. One solution has been to generate an anticipated money growth series from the one-step-ahead predictions from a rolling regression. Although this procedure avoids the problem of using information that would not be available at the time forecasts were being made, it may imply a small sample bias in the estimates; this may be no less important than the bias from overfitting the forecasting equation.

— *Second*, most studies have been content to model the natural or equilibrium value of real variables as a simple time trend. However, the appropriateness of this approach has, as noted above, been questioned recently. Different assumptions about the permanent components of real variables leave residual components to be explained. But the choice of the trend component (whether deterministic or stochastic) for real variables does not, on the strength of existing evidence, appear to be able to account for the conflicting results that are the main characteristic of the current body of empirical work.

Finally, it must be noted that one strong implicit assumption in all the work initiated by Barro is that information about money growth is only available with a lag of at least one quarter or, in some cases, one year. This assumption has been criticised (King, 1981) as being totally unrealistic, at least in the case of the United States, where preliminary money stock figures have been available with a lag of only 8 days since 1965. Moreover, it has been demonstrated, (for example Boschen and Grossman, 1982) that significant positive correlations exist between contemporaneous monetary data and real variables and that these correlations cannot be accounted for by data revisions, which might proxy *unperceived* monetary policy. These findings represent a strong rejection of the rational expectations market-clearing hypothesis, partly because they do not rely on estimating latent variables such as anticipated and unanticipated money growth.

TABLE 5

TIME SERIES TESTS OF THE ROLE OF ANTICIPATED AND UNANTICIPATED MONETARY POLICY IN OUTPUT AND EMPLOYMENT

Country	Both anticipated and unanticipated policy significant	Anticipated policy not significant. Unanticipated policy significant	Neither unanticipated nor anticipated policy significant
United States	Small (1979), Froyen (1979), Mishkin (1982a, 1982b), Boschen and Grossman (1982), Pesaran (1982), Makin (1982), Merrick (1983), Canarella and Gaston (1983), Cairns and Lombra (1984), McGee and Stasiak (1985), Driscoll *et al.* (1983), Sheehey (1984), Frydman and Rappoport (1987).	Barro (1977, 1978), Sheffrin (1978), Leiderman (1980), Barro and Rush (1980), Barro and Hercowitz (1980), Fitzgerald and Pollio (1983), Neftci and Satgent (1978), Attfield and Duck (1983), Lilien (1982), Rush (1986).	Haraf (1983), Wasserfallen (1984a, 1984b), King and Plosser (1984), Sims (1980), Litterman and Weiss (1985), King and Plosser (1984).
Japan	Piggott (1978), Seo and Takahashi (1981), Hamada and Hayashi (1985), Taniuchi (1980), Gochoco (1986), Fitzgerald and Pollio (1983).	Parkin (1984).	
Germany	Bailey *et al.* (1987).	Demery *et al.* (1984).	Wasserfallen (1984a, 1984b).
France	Fitzgerald and Pollio (1983), Bailey *et al.* (1987).		Bordes *et al.* (1982), Wasserfallen (1984a).
United Kingdom	Symons (1984), Garner (1982), Driscoll *et al.* (1983), Fitzgerald and Pollio (1983), Bean (1984), Alogoskoufis and Pissarides (1983), Bailey *et al.* (1987).	Attfield *et al.* (1981a, 1981b), Attfield and Duck (1983).	Wasserfallen (1984a), Demery (1984).
Italy	Fitzgerald and Pollio (1983), Bailey *et al.* (1987).	Smaghi and Tardini (1983).	Wasserfallen (1984a).
Canada	Darrat (1985).	Wogin (1980).	

b) Real versus monetary interpretations of the business cycle

A number of studies already reviewed failed to find any significant effect of either unanticipated or anticipated monetary policy on real variables. One interpretation of these findings is that variation in real variables is caused by real not monetary factors and that the business cycle is, therefore, a *real* phenomenon. Such an interpretation would leave no role for nominal monetary policy in the stabilization of real activity. Furthermore even *random* monetary policy would have no effect; monetary policy could not destabilize the real economy. Most studies reporting such results use a random walk model of the natural rate of unemployment.

This evidence is in sharp contrast with most of the results of other empirical work, which supports the idea that monetary policy, even if only its unanticipated component, is responsible for variations in real variables. Certainly the existence of a significant correlation between monetary variables and real activity is well established. It is possible for such correlations to be consistent, however, with models of real activity which give no causal role to nominal monetary variables.[9]

Overall, the most recent evidence on real *versus* monetary causes of the business cycle, taken at face value, suggests that the business cycle may be caused essentially by real factors. Whether such a view will survive further close examination is an open question. Certainly the notion that the business cycle is essentially a monetary phenomenon is under attack as more theoretical and empirical work is produced on the role of real factors in explaining the variation in real activity. Recent studies have reported evidence on the importance of real factors. For the United States Lilien (1982) found that, over the period 1948-80, half of the variation in unemployment could be explained by the *dispersion of employment demand*. In addition, Hamilton (1980) has demonstrated the importance of supply shocks in influencing variations in U.S. output. These two studies are relevant because they attempt to model the effects of specific real factors rather than simply inferring their importance by default; the finding that monetary policy is neutral is frequently taken as signalling the importance of real factors without any attempt being made to suggest which real factors are decisive and in what way.

[9] KING and PLOSSER (1984), for example, have developed a prototype real business cycle model, about which they have reported supporting evidence. This predicts a close correlation between real activity and components of monetary variables, while denying the latter any *causal* role, that is that real activity is *determined* by monetary variables. In this model bank deposits, or *inside* money, are regarded as a *produced input* into the goods and services production process. The quantity of inside money is determined, in this framework, by the needs of industry and commerce and responds passively to demand. Outside money, equated with the monetary base is, on the other hand, exogenous, its quantity being determined independently of the needs of trade. This real business cycle model predicts that inside money will be correlated with real activity and that outside money will not. On the other hand the model predicts that the monetary base will be the main determinant of inflation.

3. *The importance of monetary instability*

Investigations into the role of monetary instability have usually focused on one of the links in the supposed causal chain running from money to output. The main links usually identified are those between: i) monetary instability and price variability; ii) inflation and price variability; iii) price variability and price uncertainty; and iv) price variability or price uncertainty and output. Studies which address the question of the effect of monetary instability on real output, often take for granted the existence of well-defined first link in the causal chain. However, this relationship is rarely checked. One approach to assessing its empirical relevance is to regress measures of inflation variability on measures of the rate of money growth or its instability. The results of such an exercise, for some OECD countries are reported in Table 6. There is evidence of some relationship in the majority of these countries. Support appears strongest in Japan, Italy and Australia. In the United Kingdom and Canada, inflation variability appears to be related to the variability of a broad measure of money. In Germany and France, the evidence is on the whole less supportive of the importance of money growth instability. No link could be found for the United States.

Available empirical evidence on the second and third links is mixed (see Chouraqui *et al.*, 1988 for details). Most cross-country studies report a close association between the level and variability of inflation, a conclusion which is not generally supported by multi-country or single-country studies. More consistent support is found for a link between the level of variability of inflation and relative price dispersion. The relationship between price variability and price uncertainty has, on the other hand, received little attention.

TABLE 6

THE RELATIONSHIP BETWEEN THE VARIANCE OF MONEY GROWTH AND THE VARIANCE OF INFLATION

A test of significance using the F-statistics

	8 period moving variance							
Lags (a)	None		2 quarters		4 quarters		6 quarters	
	M1	M2	M1	M2	M1	M2	M1	M2
United States	..	..	..	..	..	..	..	S
Japan	..	S*	S*	S*	S*	S*	S*	S*
Germany	..	..	..	..	S*	..	..	..
France	S	..	S	..	S	..	S*	..
United Kingdom	S	..	..	..	..	S	..	S*
Italy	S	S*	S*	S*	S*	S	S*	..
Canada	..	S	..	S*	..	S*	..	S
Australia	S*	S*	S*	S*	S*	S*	S*	S

	16 period moving variance							
Lags (a)	None		4 quarters		8 quarters		12 quarters	
	M1	M2	M1	M2	M1	M2	M1	M2
United States	..	..	S	..	..	..	..	..
Japan	S*	S*	S*	S*	S*	S*	..	..
Germany	..	..	..	..	..	S*	..	S*
France	..	..	S	..	..	..	..	..
United Kingdom	..	S*	S*	S*	S*	S*	..	S*
Italy	S*	S*	S*	S*	S*	S*	..	S
Canada	S	S*	..	S	..	..	..	..
Australia	S*	S*	S*	S*	S*	S*	..	..

S = Significant at the 5 per cent level (S*, and at the 1 per cent level).
.. = Not significant at the 5 per cent level.
(a) The moving variance of inflation is regressed on the moving variance of money growth either contemporaneously (no lag) or lagged (from 1 to 6 quarters).

This is in one way surprising since the real effects of price variability are typically seen as arising from the impact that it has on the confidence with which relative price movements can be identified. However, research on this question is inevitably limited by the absence of an agreed measure of price uncertainty. Despite this some attempts to test for a relationship between price variability and proxies for price uncertainty have been made.[10] Most of these studies report a significant correlation, subject of course to the validity of the proxies for uncertainty that have been used.

[10] FROYEN and WAUD (1984b) for instance, constructed proxies for price uncertainty based on the error variance of the anticipated prediction of the energy price index and the import price index. CUKIERMAN and WATCHEL (1979) have used the variance across respondents in inflation expectations survey data. They found support for a positive relationship between inflation uncertainty and the variance of inflation and/or the level of inflation (in the United States, the United Kingdom and Canada).

Most of the evidence on the final link supports the view that price variability or price uncertainty have a depressing effect on economic activity. This is often interpreted as justifying policies aimed at low and stable rates of money growth. At the limit, according to this view, a perfectly constant low rate of growth of the money supply may at worst have no beneficial effects but an unstable money supply could lower output. This contention, however, ignores the possible consequences for financial markets of suppressing money growth instability. One consequence might be greater volatility of interest rates, which might, in turn, create uncertainty about relative returns on alternative investments and lower capital accumulation and hence, output. Though the consequences of interest rate volatility has not been studied extensively, the available evidence supports the view that it has a negative effect on economic activity.[11]

Conclusions

Measurement of the effects of monetary policy on the real sector of the economy is hindered by the lack of a universally accepted analytical framework. As shown in the above analysis, the evidence on models which combined market clearing and rational expectations is, on the whole, less relevant in current circumstances than that based on models assuming slow price adjustment. Market clearing and rational expectations have indeed little or no empirical foundation, the weight of evidence providing more support for a macroeconomic framework in which prices adjust gradually. Furthermore, monetary shocks (unanticipated changes in money growth) do not appear to be wholly responsible for the business cycle; real as opposed to monetary factors may have a more important role to play in generating business cycles.

[11] EVANS (1984), in particular, addressed this issue for the United States. He found that interest rate volatility due to a greater short-run stability in money stock had a strong and significant negative effect on output.

However, if the structural reforms that many governments have been pursuing succeed in increasing the competitiveness and flexibility of markets, including the labour market, the market clearing framework might emerge as a closer approximation of reality than the currently more orthodox sticky-price approach, at least over the medium term. In fact, the introduction of such a framework into the debate on monetary policy has already had some important effects. In particular, it has focussed attention on the evolution of the equilibrium in the economy and raised questions about how this might be influenced by monetary policy. It has also highlighted the potentially important role of expectations in the transmission process of monetary policy. Finally, it has mostly been within this framework that the damaging effects of instability in monetary policy on output and employment have been analysed. Therefore, although the sticky price model still remains the main tool of monetary policy analysis, there may be much to be gained from paying more attention to equilibrium properties of economies, the role of expectations and the effects of monetary policy instability — areas not yet well understood.

The evidence on the real sector effects of monetary policy, based mainly on large-scale models, which are in the spirit of the non-clearing markets framework, does not generally support the view that the price level or output can be closely controlled in the short run. The diversity in the size of the reported multipliers and the widely varying structure of the models, the parameters of which are often subject to large revisions, mean that the short-run response of real sector variables to changes in financial conditions cannot be known with any degree of confidence. As regards *output*, the empirical evidence presented in this survey tends to suggest that the effects of monetary policy are uncertain, both in terms of their initial impact and in terms of their duration. Nevertheless, neo-Keynesian econometric models tend to show the largest effects (positive in sign) in the first or second year, with the influence of monetary policy tailing-off into the medium term, but typically remaining significant. As for *inflation*, it is clear that, among the countries considered, typically no strong and reliable short-run relationships exist between money growth and inflation. However, generally, those OECD countries with higher average rates of money growth tend to have higher average rates of inflation, reflecting a medium- to long-term relationship. This might suggest that sustained changes in the rate of money growth will have a lasting effect on the rate of inflation.

In addition to the diversity of empirical results on the macroeconomic effects of monetary policy, there are other reasons why policymakers would be justified in feeling uncertain about the outcomes of their actions. Uppermost is the perception that the structure of the economy is subject to change: casual observation of time series reveals substantial shifts in such variables as savings ratios, money velocity, etc., over the last decade or so. The changing economic and financial environment is likely to have played an important role in this respect. Another consideration is that, in the present more deregulated financial market context, the relationships between macroeconomic variables are likely to depend, to an important extent, on market sentiment and expectations. This perception has been underlined by the overriding weight now given by commentators and central banks to the importance of market "confidence" — a factor which is seen as likely to swamp the traditional wealth effects of financial asset price changes. This means that the effects of adjustments in particular policy instruments may differ depending on whether market participants anticipate these adjustments or not and whether they expect policy changes to be permament or only temporary. Consequently, in assessing the effects of monetary policy, it is important to take into account the conditions — notably the state of expectations — in which it is being conducted and the effects that monetary policy might have on these conditions.

This suggests that attempts to use monetary policy for "fine tuning" economic activity run the risk of having perverse effects on price and output developments. By creating uncertainty about the general direction of policy, such active short-run monetary policy may also destabilize private sector expectations. However, it does not mean that monetary authorities should not react at all to events. Monetary policy has to be aimed at sustaining the integrity of the financial system and of preventing "excessive volatility" in financial markets, which may have adverse effects on investor and consumer confidence. In this context it was clearly appropriate for central banks to provide liquidity to financial systems after the October 1987 stock market crash, as well as to intervene in foreign exchange markets to bring about an orderly adjustment in exchange rates from the autumn of 1985. The pursuit of such market stabilization should, however, involve no more than temporary opera-

tions until policies can be put in place which deal with the fundamental cause of financial disturbances.

There is in fact nothing in the available empirical evidence that would suggest that, in order to preserve price stability, monetary authorities should abandon the medium-term approach to policy that has been practised in OECD countries in the 1980s. In particular, monetary policy should not be designed to take on the prime responsibility for correcting the cyclical instability of output and employment; it should be orientated towards the less ambitious objective of price stability over the medium term. Indeed, the provision of a stable nominal framework, on which the private sector can rely in forming expectations, is perhaps the best contribution that monetary policy can make to limiting costly adjustments in economic activity. However, the task of conducting monetary policy in a way that will lead to price stability may not be trivial. The uncertainty that manifestly exists about the measurement of the stance of policy means that monetary authorities need to be pragmatic and to monitor all potentially informative variables (including real sector variables). This pragmatism implies some flexibility both in pursuing intermediate monetary targets and in the setting of monetary instruments. If such short-run flexibility is to be effective it, nevertheless, remains crucial for monetary authorities to maintain public confidence in the credibility of their medium-term goal of price stability. Other things being equal, monetary policy effects are likely to be most predictable in an environment where the authorities are able to convince market participants that they are pursuing a credible medium-term strategy which they fully intend to stick to.

Paris

J.C. CHOURAQUI - M. J. DRISCOLL - M.O. STRAUSS-KAHN

REFERENCES

AKHTAR, M. (1983), "Financial Innovations and their Implications for Monetary Policy: An International Perspective", *BIS Economic Paper* No. 9, December.

AKHTAR, M. and E. HARRIS (1987), "Monetary Policy Influence on the Economy - An Empirical Analysis", *Federal Reserve Bank of New York Quarterly Review*, Winter, Vol. 11, No. 4, pp. 19-30.

ALOGOSKOUFIS, G. and C.A. PISSARIDES (1983), "A Test of Price Sluggishness in the Simple Rational Expectations Model: U.K. 1950-1980", *Economic Journal*, Vol. 93, pp. 616-28.

ATTFIELD, C., D. DEMERY and N.W. DUCK (1981a), "Unanticipated Monetary Growth, Output and the Price Level in the U.K. 1946-1977", *European Economic Review*, Vol. 16, pp. 367-85.

ATTFIELD, C., D. DEMERY and N.W. DUCK (1981b), "A Quarterly Model of Unanticipated Monetary Growth, Output and the Price Level in the U.K.: 1963-1978", *Journal of Monetary Economics*, pp. 331-350.

ATTFIELD, C., and N.W. DUCK (1983), "The Influence of Unanticipated Money Growth on Real Output: some Cross-country Estimates", *Journal of Money, Credit and Banking*, Vol. 15, No. 4, pp. 442-454.

BACKUS, D. and J. DRIFFIL, "Relation Expectations and Policy Credibility Following a Change of Regime", *Review of Economic Studies*, Vol. 52, pp. 211-221

BAILEY, R.W., C. BORDES, M. DRISCOLL and M.O. STRAUSS-KAHN (1987), "Monnaie, demande globale et inertie des rythmes d'inflation dans les principaux pays européens", *Economie Appliquée*, Vol. 40, No. 3, pp. 483-538.

BARRO, R. (1977), "Unanticipated Money Growth and Unemployment in the United States", *American Economic Review*, Vol. 67, pp. 101-15.

BARRO, R. (1978), "Unanticipated Money, Output and the Price Level in the United States", *Journal of Political Economy*, Vol. 86, pp. 549-580.

BARRO, R. (1980), "A Capital Market in an Equilibrium Business Cycle Model", *Econometrica*, Vol. 48, pp. 1393-417.

BARRO, R. and Z. HERCOWITZ (1980), "Money Stock Revisions and Unanticipated Money Growth", *Journal of Monetary Economics*, Vol. 6, pp. 257-267.

BARRO, R. and M. RUSH (1980), "Unanticipated Money and Economic Activity", in Stanley Fisher (ed.), *Rational Expectations and Economic Policy*, NBER: Chicago, pp. 23-48.

BARRO, R. and D. GORDON (1983), "Rules, Discretion and Reputation in a Model of Monetary Policy", *Journal of Monetary Economics*, Vol. 12, pp. 101-121.

BEAN, C.R. (1984), "A Little Bit more Evidence on the Natural Rate Hypothesis from the U.K.", *European Economic Review*, 25, pp. 279-292.

BORDES, C., M.J. DRISCOLL, J.L. FORD and A.W. MULLINEUX (1988), "Tests econométriques de l'hypothèse de rationalité et de l'hypothèse de neutralité structurelle: le cas de la France, *Revue d'Economie Politique*, pp. 363-381.

BOSCHEN, J.F. and H.I. GROSSMAN (1982), "Tests of Equilibrium Macroeconomics Using Contemporaneous Monetary Data", *Journal of Monetary Economics*, Vol. 10, pp. 309-333.

CANARELLA, G. and N. GARSTON, (1983), "Monetary and Public Debt Shocks: Tests and Efficient Estimates", *Journal of Money, Credit and Banking*, Vol. 15, No. 2, pp. 199-211.

CARLTON, D. (1986), "The Rigidity of Prices", *American Economic Review*, 76, pp. 637-657.

CARNS, F., and R. LOMBRA (1984), "Rational Expectations and Short-run Neutrality: A Re-examination of the Role of Anticipated Money Growth", *Review of Economics and Statistics*, pp. 639-643.

CHAN-LEE, J., and H. KATO (1984), "A Comparison of Simulation Properties of National Econometric Models", OECD *Economic Studies*, No. 2.

CHOURAQUI, J.C., M. DRISCOLL and M.O. STRAUSS-KAHN (1988), "The Effects of Monetary Policy on the Real Sector: An Overview of Empirical Evidence for Selected OECD Economies", *OECD Economics and Statistics Department Working Paper*, No. 51.

CUKIERMAN, A. and P. WACHTEL (1979), "Differential Inflationary Expectations and the Variability of the Rate of Inflation: Theory and Evidence", *American Economic Review*, Vol. 69, No. 4, September, pp. 595-609.

DARRAT, A.F. (1985), "Unanticipated Inflation and Real Output: the Canadian Evidence", *Canadian Journal of Economics*, Vol. 18, pp. 146-155.

DEMERY, D. (1984), "Aggregate Demand, Rational Expectations and Real Output: Some New Evidence for the U.K. 1963.2-1982.2", *Economic Journal*, Vol. 94, pp. 847-862.

DEMERY, D., N.W. DUCK and S.W. MUSGRAVE (1984), "Unanticipated Money Growth, Output and Unemployment in West Germany", *Weltwirtschaftliches Archiv*, Vol. 120, No. 2, pp. 244-255.

DRISCOLL, M.J. (1985), "The Effects of Monetary Policy: an Overview of Theory and Evidence", mimeo, OECD Department of Economics and Statistics.

DRISCOLL, M.J., J.L. FORD, A.W. MULLINEUX and S. SEN (1983), "Money, Output, Rational Expectations and Neutrality: Some Econometric Results for the U.K.", *Economica*, Vol. 50, pp. 259-268.

DRISCOLL, M.J., J.L. FORD, A.W. MULLINEUX and S. SEN (1984), "Testing of the Rational Expectations and Structural Neutrality Hypothesis", *Journal of Macroeconomics*, Summer 1983, Vol. 5, No. 3, pp. 353-360.

EVANS, P. (1984), "The Effects on Output of Money Growth and Interest Rate Volatility in the United States", *Journal of Political Economy*, Vol. 92, pp. 204-222.

FITZGERALD, M.D. and G. POLLIO (1983), "Money, Activity and Prices: Some Inter-country Evidence", *European Economic Review*, Vol. 23, pp. 279-314.

FRIEDMAN, M. (1977), "Inflation and Unemployment", *Journal of Political Economy*, Vol. 85, pp. 451-472

FROYEN, R.T. (1979), "Systematic Monetary Policy and Short-run Real Income Determination", *Journal of Economics and Business*, Vol. 32, pp. 14-22.

FROYEN, R.T. and R. WAUD (1984), "An Examination of Aggregate Price Uncertainty in Four Countries and Some Implications for Real Output", *NBER Working Paper*, No. 1460.

FRYDMAN, R. and P. RAPPOPORT (1987), "Is the Distinction Between Anticipated and Unanticipated Money Growth Relevant in Explaining Aggregate Output?", *American Economic Review*, Vol. 77, No. 4, pp. 693-703.

GARNER, C.A. (1982), "Tests of Monetary Neutrality for the United Kingdom", *Quarterly Review of Economics and Business*, Vol. 22, No. 3, pp. 81-95.

GOCHOCO, M.S. (1986), "Tests of the Money Neutrality and Rationality Hypotheses: The Case of Japan 1973-1985", *Journal of Money, Credit and Banking*, Vol. 8, No. 4, pp. 458-466.

HAMADA, K. and F. HAYASHI (1985), "Monetary Policy in Postwar Japan" in A. Ando, H. Eguchi, R. Farmer (eds.), *Monetary Policy in Our Times*.

HAMILTON, J. (1980), "Oil and the Macroeconomy since World War II", *Journal of Political Economy*, Vol. 91, pp. 228-248.

HARAF, W.S. (1983), "Tests of a Rational Expectations-Structural Neutrality Model with Persistent Effects of Monetary Disturbances, *Journal of Monetary Economics*, Vol. 11, pp. 103-116.

HOLDEN, K., D. PEEL and J. THOMPSON (1985), *Expectations: Theory and Evidence*, Macmillan, London.

KEYNES, J.M. (1936), *The General Theory of Employment, Interest and Money*, Macmillan, London.

KING, R. (1981), "Monetary Information and Monetary Neutrality", *Journal of Monetary Economics*, Vol. 7, pp. 195-206.

KING, R. and C.F. PLOSSER (1984), "Money, Credit and Prices in a Real Business Cycle", *American Economic Review*, Vol. 74, No. 3, pp. 363-380.

KNIGHT, A. (1981), "Wilson Revisited: Industrialists and Financiers", Policy Studies Institute, *Discussion Paper*, No. 5, London.

KYDLAND, F. and E. PRESCOTT (1982), "Time to Build and Aggregate Fluctuations", *Econometrica*, Vol. 50, pp. 1345-70.

LEIDERMAN, L. (1980), "Macroeconomic Testing of the Rational Expectations and Structural Neutrality Hypothesis for the United States", *Journal of Monetary Economics*, 6, pp. 67-82.

LILIEN, D. (1982), "Sectoral Shifts and Cyclical Unemployment", *Journal of Political Economy*, Vol. 90, pp. 777-93.

LINBECK, A. and D. SNOWER (1987), "Efficiency Wages versus Insiders and Outsiders", *European Economic Review*, Vol. 3, Nos. 1/2, pp. 407-416.

LITTERMAN, R.B. and L. WEISS (1985), "Money , Real Interest Rates and Output: A Reinterpretation of Postwar U.S. Data", *Econometrica*, Vol. 53, No. 1, pp. 129-156.

LONG, J. and C. PLOSSER (1983), "Real Business Cycles", *Journal of Political Economy*, Vol. 91, pp. 777-793.

LUCAS, R. (1975), "An Equilibrium Model of the Business Cycle", *Journal of Political Economy*, Vol. 77, pp. 721-54 & pp. 1113-1129.

LUCAS, R. (1980), "Two Illustrations of the Quantity Theory of Money", *American Economic Review*, Vol. 70, pp. 1005-1014.

MAAREK, G. (1980), "Quelques relations statistiques simples entre la monnaie, les prix et l'activité", *Cahiers Economiques et Monétaires*, No. 11, Banque de France, pp. 87-100.

MAKIN, J.H. (1982), "Anticipated Money, Inflation Uncertainty and Real Economic Activity", *Review of Economic Studies*, Vol. 64, pp. 126-134.

MAYER, C. (1987), "New Issues in Corporate Finance", mimeo, London City University Business School.

MCGEE, R.T. and R.T. STASIAK (1985), "Does Anticipated Monetary Policy Matter?", *Journal of Money, Credit and Banking*, Vol. 17, No. 1, pp. 16-27.

MERRICK, J.J. (1983), "Financial Market Efficiency, the Decomposition of 'Anticipated' versus 'Unanticipated' Money Growth and Further Tests of the Relation Between Money and Real Output", *Journal of Money, Credit and Banking*, Vol. 15, No. 2, pp. 222-232.

MISHKIN, F. (1982a), "Does Anticipated Monetary Policy Matter? An Econometric Investigation", *Journal of Political Economy*, Vol. 90, pp. 22-51.

MISHKIN, F. (1982b), "Does Anticipated Aggregate Demand Policy Matter?", *American Economic Review*, Vol. 72, pp. 788-802.

MUNDELL, R. (1963), "Inflation and Real Interest", *Journal of Political Economy*, Vol. 71, pp. 280-283.

NEFTCI, S.N. and T.J. SARGENT (1978), "A Little Bit of Evidence on the Natural Rate Hypothesis from the U.S.", *Journal of Monetary Economics*, 4, pp. 315-320.

NICKELL, S. and S. WADHWANI (1987), "Myopia, the 'Dividend Puzzle', and Share Prices", *Discussion Paper*, No. 272, Centre for Labour Economics, London School of Economics.

OECD (1975), *The Role of Monetary Policy in Demand Management*, OECD Monetary Studies Series, Paris.

PARKIN, M. (1984), "Discriminating between Keynesian and Classical Theories of the Business Cycle: Japan 1967-1982", *Bank of Japan Monetary and Economic Studies*, Vol. 2, pp. 23-60.

PESARAN, M.H. (1982), "A Critique of the Proposed Tests of the Natural Rate - Rational Expectations Hypothesis", *Economic Journal*, Vol. 92, pp. 529-54.

PIGGOT, C. (1987), "Rational Expectations and Counter-cyclical Monetary Policy: the Japanese Experience", *Federal Reserve Bank of San Francisco Review*, Summer.

RUSH, M. (1986), "Unexpected Money and Unemployment, 1920-1983", *Journal of Money, Credit and Banking*, Vol. 18, No. 3, pp. 259-274.

SEO, J. and W. TAKAHASHI (1981), "Unanticipated Money and Real Output - An Examination of the Macro Rational Expectations Hypothesis for Japan", *The Bank of Japan Monetary and Economic Studies Department Discussion Paper Series*, No. 10.

SHEEHEY, E.J. (1984), "The Neutrality of Money in the Short Run: Some Tests", *Journal of Money, Credit and Banking*, Vol. 16, No. 2, pp. 237-241.

SHEFFRIN, S.M. (1978), "Discriminating between Rational Expectations Models: Some Evidence", *Economic Letters*, Vol. 1, pp. 205-210.

SIMS, C.A. (1980), "Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered", *American Economic Review*, Vol. 70, pp. 250-257.

SMAGHI, L.B. and P. TARDINI (1983), "The Effectiveness of Monetary Policy: an Empirical Investigation for Italy (1966-1981)", *Giornale degli Economisti e Annali di Economia*, No. 9-10, pp. 679-690.

SMALL, D.H. (1979), "Unanticipated Monetary Growth and Unemployment in the United States: A Comment", *American Economic Review*, 69, pp. 996-1003.

SYLOS LABINI, P. (1982), "Rigid Prices, Flexible Prices and Inflation", in this *Review*, March, pp. 37-68.

SYMONS, J.S.V. (1984), "Money and the Real Interest Rate in the U.K.", *Manchester School*, pp. 250-265.

TANIUCHI, M. (1982), "Prior Monetary Expectations and Output Determination - A Study of the Japanese Economy", Ph. D. Thesis, Brown University (unpublished).

TOBIN, J. (1965), "Money and Economic Growth", *Econometrica*, Vol. 33, pp. 671-684.

WASSERFALLEN, W. (1984a), "Trends, Random Walks and the Phillips-Curve: Evidence from Six Countries", mimeo, Volkswirtschaftliches Institut.

WASSERFALLEN, W. (1984b), "Internationally Integrated Capital Markets and the Effects of Monetary Policy on Real Interest Rates and Real Exchange Rates" mimeo, Volkswirtschaftliches Institut.

WOGIN, G. (1980), "Unemployment and Monetary Policy under Rational Expectations: Some Canadian Evidence", *Journal of Monetary Economics*, 6, pp. 59-68.