The new economy and the old monetary economics

In this speech,[1] Willem H Buiter, member of the Bank's Monetary Policy Committee,[2] argues that the behaviour in recent years of the world economy, led by the United States, can, in the opinion of a number of observers, only be understood by abandoning the old conventional wisdoms and adopting a 'New Paradigm'. Prominent among the structural transformations associated with the New Paradigm are the following: increasing openness; financial innovation; lower global inflation; lower profit margins, reflecting stronger competitive pressures; buoyant stock markets defying conventional valuation methods; a lower natural rate of unemployment; and a higher trend rate of growth of productivity.

In this speech, Professor Buiter makes two distinct points. First, the New Paradigm has been over-hyped. Second, to the extent that we can see a New Paradigm in action, its implications for monetary policy have often been misunderstood.

1 Introduction

Whenever expressions like 'New Paradigm' and 'New Economy' are in the air, caution is in order. There are a few thoughtful and well-informed proponents of the view that recent and likely future 'supply-side' developments have shifted the path of future potential output, and may have invalidated the old empirical relationships between real economic performance and inflation. My MPC colleagues DeAnne Julius and Sushil Wadhwani are among these.[3] Unfortunately, the 'New Paradigm' label has been much abused by professional hype merchants and peddlers of economic snake oil.

Stripped of the razzmatazz surrounding it, the 'New Paradigm' can be summarised as follows. First, increasing and unprecedented *globalisation*, driven partly by technological change and partly by the deliberate removal of government-created barriers to the international movement of goods, services, people, financial capital, enterprises and ideas, has transformed the international and domestic competitive environments.

Second, information and communications technology (ICT), the marriage of cheap and near universally available digital computing power and telecommunications, is transforming the global economy and the way we work, shop and live. The Internet is the most visible expression of this: e-commerce, e-shopping, e-tailing and e-business are becoming as common as e-coli. B2B is the 'to be or not to be' of the trendy entrepreneur and manager. New products, new processes, new forms of organisation, and new ways of trading and exchanging information are made possible by the new information networks that are sprouting everywhere, courtesy of 'Moore's Law' and broadband technology.

Economists have to rethink the meaning of competition, which is Schumpeterian rather than Arrow-Debreu. 'Information goods', with their public good properties of non-rivalness (associated with indivisibility, high (and sunk) fixed costs or start-up costs, and low marginal costs) and non-excludability or inappropriability, are destructive of the conventional competitive paradigm.[4] More visibly than ever before, competition is seen to be a process of creative destruction, of rivalry between alternating or succeeding monopolies, not the peaceful and passive price-taking behaviour of the old textbooks. The rewards for being first with a new product or process are larger than ever before, as are the penalties for being pipped at the post—a winner-takes-all economy.

The new economy creates challenges for measurement and for the interpretation of data. The new weightless and intangible sectors make it ever more difficult to measure and value either inputs or outputs.

Third, financial innovation is transforming existing patterns of financial intermediation. The flow of funds between the ultimate wealth-owners (households and their agents) and enterprises now passes through new intermediaries, institutions, markets and financial instruments. New sources and forms of risk capital and rapid improvements in the accessibility of conventional forms of finance are creating new modalities for trading risk and transforming the allocation of existing asset portfolios. Home bias in portfolio allocation is diminishing. More households are directly active in the retail investment markets.

(1) Given to the Aberdeen Chamber of Commerce on 27 October 1999. A more detailed version of the speech is available at www.econ.cam.ac.uk/faculty/buiter/newecon.pdf
(2) And Professor of International Macroeconomics, University of Cambridge.
(3) See, for example, Julius (1999) and Wadhwani (1999).
(4) See, for example, Giordano (1999). The term 'experience goods' is due to De Long and Froomkin (1998). The formalisation of the concept goes back at least to Arrow (1962).

Globalisation, ICT and financial innovation are not independent. New developments in information technology are among the technological forces driving globalisation and financial innovation. The removal of man-made obstacles to the international flow of funds encourages FDI and hostile cross-border take-overs.

Globalisation is not new. The current wave of globalisation started in the immediate post Second World War period. A highly globalised economy existed also in the second half of the 19th century, until the First World War and the inter-war crises caused the fragmentation of the global capitalist system (see Bordo, Eichengreen and Kim (1998) and Bordo, Eichengreen and Irwin (1999)).

Technological revolutions also did not start with the 'information age'. The industrial revolution gave us, more than 200 years ago, the systematic application of science and engineering to production, distribution and exchange. The information revolution pre-dates the industrial revolution. It started with the invention of the printing press and accelerated with the arrival of the telegraph, photography, the telephone, telex, radio, television, fax and photocopier.(1) Recognisable computers are almost 50 years old.

2 The 'New Paradigm' and the real economy

The New Paradigm (globalisation and ICT) could have any or all of the following implications for the real economy of the United Kingdom.

(1) The UK economy could become more open. This could manifest itself as enhanced trade in real goods and services or in financial claims; as increased international movements of real factors of production (including labour and physical capital) and of corporate headquarters and other organisational units. Know-how and technology also become more footloose. Finally, people can move more freely across national boundaries in any or all of their capacities: as workers, consumers, shoppers, portfolio holders, tax-payers and subsidy or benefit-seekers. This threatens national tax bases and puts upward pressure on national public spending programmes. It may lead to tax or subsidy competition between national or regional governments. It also creates incentives for intergovernmental co-operation and harmonisation of tax and benefit regimes, ie for fiscal policy cartels.

(2) Global inflation could be lower.

(3) There could be a permanent reduction in profit margins or mark-ups in many sectors.

(4) Stock market valuations could be boosted to unprecedented levels.

(5) The NAIRU (the equilibrium or natural rate of unemployment) could be lower than before.

(6) The level or the underlying rate of growth of productivity could be higher than before.

2.1 Openness

As regards increased international openness, it seems likely that there is more to come. For trade in goods and services, we are unlikely to see growth of the kind seen in the 1960s and 1970s, but a more gradual increase in import and export shares in GDP is on the cards. Exports and imports as shares of UK GDP are still about 5 percentage points below their pre First World War peak.

International trade in financial claims is intense for a rather limited range of financial instruments. In years to come, we are likely to see both an extension of this range of international financial instruments and a further gradual erosion of the home bias in the portfolio allocations of UK financial institutions. Labour mobility is likely to increase, but will remain small in relation to the UK labour force. Enterprises will become more footloose, with corporate headquarters, back-office operations and R&D establishments following in the wake of manufacturing assembly plants and call centres. FDI flows, bundling finance, technical expertise and managerial skills are likely to become more significant. The traffic will be two-way. In recent years inflows of FDI into the United Kingdom have grown rapidly. Outflows have grown even more rapidly.

The greater scope for tax-payers and benefit-seekers to move to jurisdictions with lower tax rates or more relaxed enforcement, and to jurisdictions with higher benefits and easier eligibility, will put increasing strains on the public finances everywhere. Unless more effective ways are found to link the liability for tax payments in a given jurisdiction to eligibility for benefits from public spending in the same jurisdiction, the threat of mobility of tax-payers and benefit recipients will severely constrain the fiscal authorities. I expect that governments all over the world will begin to think much more systematically about ways of enhancing the excludability of their public goods and services, and of linking entitlement to public goods and services to lifetime tax contributions. Without that, people will work where taxes are lowest and retire where retirement benefits are highest. National governments will be torn between tax and benefit competition and attempts at greater co-operation and harmonisation.

2.2 Financial innovation

Financial globalisation and innovation are a mixed blessing. Properly functioning financial markets improve the global allocation of resources, by offering effective vehicles for channelling saving into domestic capital formation and

(1) The first known printed book, using block printing, came from China (AD 868). Block printing appeared in Europe during the late 1300s. Movable type using clay was invented in China during the 1000s. Koreans invented movable type in the 1300s. Europeans reinvented this particular wheel in the mid-1400s.

foreign investment and by providing the means for efficient trading of risk. Efficient risk trading means that risk ends up with the economic agents and institutions most willing and able to bear risk. The superior availability of risk capital in the United States is widely thought to have contributed significantly to the New Economy lead the United States has taken.

Unfortunately, financial markets also can and do shift the non-diversifiable risk in the economy to the imprudent, the reckless, and the fraudulent. The misalignment of the private and social costs of risk that causes such perverse risk trading occurs for legal and institutional reasons and because of asymmetric information among the parties trading risk.

ICT provides unprecedented means for collecting and processing information and for tracking economic agents and performance across space and time. It also provides unprecedented means for concealing information or for creating false audit trails. Normal human greed and widespread access to the Internet, combined with ignorance and hubris, create an unhealthy and possibly dangerous stew of speculative excess at the retail level. Day traders and Internet financial chat rooms are manifestations of this.

When risk is mispriced and misallocated, financial crises and collapses can occur. Financial crashes and associated defaults and bankruptcies are socially costly because they involve a waste of real resources as well as a reshuffling of property rights. When that happens, the aggregate non-diversifiable risk in the economy is not just distributed inefficiently, but its total quantum is increased. Risk that should be diversifiable under orderly market conditions ceases to be so.

Despite inadequate supervision and regulation, the financial innovation process that started in the final quarter of the 20th century probably improves overall economic performance during normal times. It does, however, increase the likelihood of abnormal times—panics, manias and crashes—occurring, and exacerbates the scope and severity of financial crises.

2.3 Global inflation

The long-run trend in global inflation will be determined by the weighted sum of the various national inflation objectives, adjusted for the degree of seriousness with which they are pursued. There is no evidence that the rest of the world is likely, on balance, to pursue inflation objectives and to achieve inflation outcomes that are significantly different from those pursued and achieved in the United Kingdom.

We cannot be confident that the relative prices of commodities, hard or soft, to other internationally traded goods and services will have any clear trend. Even if they did, changes in the relative price of commodities and more highly processed goods and services have no straightforward implications for global inflation. Global inflation itself has no straightforward implications for UK inflation when the United Kingdom's nominal exchange rate floats.

In the short run, global inflation is driven in part by the global output gap, just as domestic inflation is driven, in part, by the domestic output gap. Commodity price inflation is more responsive to supply constraints in the producer nations and to changes in global economic activity than inflation in more broadly based indices of internationally traded goods and services.

2.4 Stock market valuation

It should be clear that reduced margins and unusually strong stock market valuations are uncomfortable bedfellows. Equation **(2.1)** is a fairly standard representation of stock market valuation, involving only minor hand-waving. The real value of the stock market index is denoted V, the stream of real profits Θ, the risk-free real interest rate r, the growth rate of real profits g^{θ}, and the equity risk premium ρ^{q}. E_t is the expectation operator conditional on information available at time t. The term F is the fundamental valuation of the stock market.(1) B is the speculative bubble component.(2)

$$V_t = F_t + B_t$$
$$F_t = E_t \sum_{j=0}^{\infty} \left[\prod_{k=0}^{j} \left(\frac{1 + g^{\theta}_{t+k}}{(1 + r_{t+k})(1 + \rho^{q}_{t+k})} \right) \right] \Theta_t \qquad \textbf{(2.1)}$$

If μ is the mark-up of price on unit labour cost and Y is real GDP, then (ignoring profit taxes):

$$\Theta_t = \left(\frac{\mu_t}{1 + \mu_t} \right) Y_t \qquad \textbf{(2.2)}$$

I believe that recent ICT developments are making many markets more competitive and more contestable. Entry and exit in many industries is easier than before.(3) This is good news for consumers, for productivity and efficiency, and quite possibly for human happiness, but it is bad news for profits. In terms of equations **(2.1)** and **(2.2)**, the New Paradigm will boost the future path of real GDP, which is, other things being equal, good for profits, but it will depress margins, μ, which is, other things

(1) Hall (1999) argues that this fundamental valuation should include not just the physical capital stock, but also 'intangible capital' or organisational capital. His empirical investigation does not, however, consider the possibility of persistent and significant monopoly rents.
(2) Rational speculative bubbles, ie bubbles that do not violate the no-arbitrage assumption of technically efficient financial markets, would have to satisfy $E_t B_{t+1} = (1+r_t)(1+\rho^{q}_{t})B_t$.
(3) There are exceptions. If a private company manages to establish a monopoly of a product with strong network externalities which effectively becomes an industry standard, entry becomes very difficult and very large rents can be extracted.

being equal, bad for profits.(1) Valuations based on projections of earning growth, which imply that, before too long, profits will exhaust all of GDP, are not believable.(2)

Two misunderstandings distort a sensible discussion of stock market performance and the New Economy. The first is the view that the strength of stock markets globally, and especially in the United States, cannot be a bubble because the New Economy is a reality. The second is the view that the strength of stock markets during the past few years is a bubble and that therefore the New Economy is a figment of overexcited imaginations. I believe both views to be wrong. A radical restructuring of the economy *is* under way as a result of developments in ICT, globalisation and financial innovation. The United States is leading the way, but the phenomenon is spreading more widely. There also is a stock market bubble, concentrated in the fashionable e-everything sectors. Historically, spectacular stock market boom and bust episodes have often occurred during periods of rapid technological change.(3)

2.5 The nominal implications of real revolutions

The key question raised by the 'New Paradigm' for the Monetary Policy Committee is: what do the supply-side developments captured under items (1) to (6) imply for monetary policy in the United Kingdom, assuming that the MPC continues to pursue its mandate, a symmetric inflation target of 2½% per annum for RPIX? I measure the stance of monetary policy through the behaviour over time of our main policy instrument, the short risk-free nominal rate of interest.(4)

Qualitative judgments on these phenomena are not enough. The actual magnitudes matter. Unfortunately, these are highly uncertain. In addition, all six developments are *real* phenomena. One of the key insights that macroeconomists and monetary economists can bring to the New Paradigm debate is the recognition that relative price changes, distributional changes and other structural changes have no straightforward, obvious implications for inflation or for the path of interest rates that supports a given inflation target.

3 Implications of the New Paradigm for UK monetary policy

3.1 Increasing openness and UK monetary policy

Increasing openness of the United Kingdom does not have clear implications for the average level of interest rates that support the inflation target, short run or long run. Increasing openness to trade in goods and services implies that monetary policy, to the extent that it works through the exchange rate, will have a more powerful effect on the price level and a weaker effect on the real economy, because greater trade openness increases the responsiveness of domestic nominal costs and prices to the exchange rate. Increasing financial openness and integration may also make the exchange rate more volatile. There is no clear link to the average level of short nominal rates, however.

3.2 Lower global inflation and UK monetary policy

The rate of inflation of world prices, including commodity prices, translated through the nominal exchange rate, is an important component of retail price inflation in the United Kingdom. In the long run, differences between the United Kingdom's rate of inflation and the inflation rate in the rest of the world that are due to differences among national monetary policies will be reflected in nominal exchange rate depreciation. Asymmetric shocks that cause shifts in the structure of the world economy and mandate changes in the relative price and cost configurations between the United Kingdom and its trading partners will lead to systematic violations of purchasing power parity (PPP).

It is difficult to establish a clear presumption that the relative prices charged and paid by UK PLC should rise or fall steadily. I therefore consider the benchmark of a constant structure of the global real economy. The United Kingdom pursues an unchanged inflation target with a market-determined exchange rate, and the inflation rate in the rest of the world reflects global monetary policy. Under these conditions, different rates of inflation in the rest of the world should not have any implications for the level of UK nominal interest rates in the long run. This argument assumes that the world real interest rate does

(1) The growth rate of profits is approximately equal to the sum of the growth rate of real GDP and the growth rate of the mark-up.
(2) Take the United States as an example. The New York Federal Reserve has recently raised its (gu)es(s)timate of the trend growth rate of US real GDP to 3.5% per annum. Assume actual GDP will, on average, grow at the same rate as potential GDP. The share of profits in GDP has been stable (albeit subject to cyclical fluctuations) since Hannibal crossed the Alps (or since George Washington crossed the Delaware). The only realistic estimate for the long-run trend growth rate of real profits for US Inc therefore is 3.5% per annum. It is of course true that even broadly based stock market indices are not representative samples of the market capitalisation of US Inc. There is a strong bias towards larger firms; enterprises whose (relative) size is shrinking are dropped from the index and recent spectacular growth stocks are added. If earnings growth in the relatively recent past is a good guide to future earnings growth (that is, if earnings growth is positively correlated over time), the practice of dropping shrinking firms from the index and including expanding ones will permit the earnings growth of the firms included in most common stock indices to exceed the earnings growth of all firms. Sample selection bias due to truncation by relative size is no doubt present. (An interesting breakdown of the recent growth rates of operating earnings per share by economic sector for the S&P 500 can be found in Cohen and Napolitano (2000).) It is most unlikely that it can rationalise all or even most of the earnings-growth-on steroids-projections that we have seen recently.
(3) For a less bearish view, see Keating and Wilmot (1999).
(4) It is possible to rephrase these policy implications in terms of the implied behaviour of the money stock. For reasons of space, this is not done here. See Buiter (2000).

not vary, in the long run, when the world inflation rate varies.

The same conclusion also applies in the short run if the United Kingdom is perfectly integrated in the international financial system. In an internationally financially integrated economy, the domestic short nominal rate of interest is related to the foreign short nominal interest rate through expectations of future exchange rate depreciation and a currency risk premium.(1) Let i_t be the one-period short UK nominal interest rate between periods t and t+1, i^f the world short nominal rate, s the (logarithm of the) nominal spot exchange rate (defined as the price of foreign exchange in terms of sterling), $\sigma_{t+1} = s_{t+1} - s_t$ the proportional rate of depreciation of the nominal spot exchange rate, and ρ^s the foreign exchange risk premium. Then:

$$i_t = i_t^f + E_t\sigma_{t+1} + \rho_t^s \qquad \textbf{(3.1)}$$

Perfect financial integration means that the currency risk premium is independent of domestic and foreign monetary and financial policy actions. Since the risk premium is invariant to policy, it can be ignored in what follows. Without the foreign exchange risk premium, **(3.1)** implies uncovered interest parity (UIP), ie:

$$i_t = i_t^f + E_t\sigma_{t+1} \qquad \textbf{(3.2)}$$

The United Kingdom is small in the global financial markets, so I take i^f to be exogenous. The (*ex ante*) domestic short real interest rate equals the short nominal interest rate minus the expected rate of inflation. I take the rate of inflation to be the rate of inflation of the retail price index, our inflation target.(2) Let $\tilde{p}$ be the (logarithm of the) retail price index (RPI) and $\tilde{\pi}$ the rate of inflation of the RPI, ie $\tilde{\pi}_{t+1} \equiv \tilde{p}_{t+1} - \tilde{p}_t$. It follows that:

$$r_t + E_t\tilde{\pi}_{t+1} \equiv i_t \qquad \textbf{(3.3)}$$

The RPI is a weighted average of the price index of domestic value added, p, and the index of world prices, p^{*f}, translated into domestic currency. Let the share of imports in the RPI index be α. The world rate of inflation is denoted π^{*f}. Then:

$$\tilde{\pi}_t = (1-\alpha)\pi_t + \alpha(\pi_t^{*f} + \sigma_t) \qquad \textbf{(3.4)}$$

The (*ex ante*) world short real interest rate, r^f, is defined as follows:

$$r_t^f \equiv i_t^f - E_t\pi_{t+1}^{*f} \qquad \textbf{(3.5)}$$

Since the United Kingdom is too small to influence the world rate of inflation, the world real rate of interest is also taken to be exogenous.

If the fall in the expected world rate of inflation is not accompanied by any fall in the world real interest rate, it must be matched by a fall in the world nominal interest rate. In that case, the lower world inflation rate would be translated into a matching increase in the rate of depreciation of sterling, with no impact on short nominal rates in the United Kingdom or on the UK rate of RPI inflation, short run or long run. Although the real world is apt to be a bit messier, this is the obvious benchmark.

3.3 Lower profit margins and UK monetary policy

A reduction in profit margins, or in the mark-up on unit variable costs, can result either from intensification of product market competitive pressures (a reduction in the degree of monopoly power of a firm in the markets for its products) or from a weakening of a firm's competitive position in the market for its inputs—labour, raw materials etc. Such changes in firms' competitive positions correspond, at the level of the economy as a whole, to a distributional change, away from profits and towards labour income.

Consider the following simple example. The bundle of goods and services entering the RPI, denoted Q, is produced using labour, capital and imported inputs. Let W be the money wage, L employment, P^f the domestic currency price of imported inputs, N the quantity of imported inputs, ρ_K the nominal rental rate of capital and K the capital stock. Output is produced using a well-behaved, constant returns to scale production function, $Q = AF(K, L, M)$, where A is the level of total factor productivity. A monopolistically competitive firm maximises pure profits, $\tilde{P}Q - \rho_K K - WL - P^f N$. Assume that input markets are competitive. Let $\varepsilon(Q) \equiv -\dfrac{\tilde{P}(Q)}{\tilde{Q}'P(Q)}$ be the price elasticity of demand. Nominal accounting profits are denoted $\hat{\Theta}$, where $\hat{\Theta} \equiv P\Theta$ and P is the GDP deflator. It is the sum of pure profits and the rental income of capital. Using the first-order conditions for profit maximisation, $\hat{\Theta} \equiv \tilde{P}A\left(F_K K + \frac{1}{\varepsilon}(F_L L + F_N N)\right)$.

Value added for the domestic economy is the sum of accounting profits and wage income: $PY = \hat{\Theta} + WL$. This permits us to write the value-added deflator as a mark-up on unit labour cost, as follows:

$$P = (1+\mu)\frac{WL}{Y} \qquad \textbf{(3.6)}$$

The proportional mark-up on unit labour cost, denoted μ, is given by:

$$\mu = \frac{F_K\dfrac{K}{L} + \dfrac{1}{\varepsilon}\left(F_L + F_N\dfrac{N}{L}\right)}{F_L\left(\dfrac{\varepsilon-1}{\varepsilon}\right)} \qquad \textbf{(3.7)}$$

(1) For recent surveys on global financial integration, see Oxford Review of Economic Policy (1999).
(2) The distinction between RPI and RPIX does not matter for the argument under consideration.

With a profit-maximising monopolist, $\varepsilon > 1$, and the mark-up is positive and decreases with the elasticity of demand. In general, the mark-up will also depend on the input ratios. When the production function is Cobb-Douglas, $Q = AK^{\alpha} L^{\beta} N^{1-\alpha-\beta}$; $0 < \alpha, \beta, \alpha + \beta < 1$, the mark-up simplifies to **(3.8)**, which is independent of input intensities:(1)

$$\mu = \frac{1 + (\varepsilon - 1)\alpha}{(\varepsilon - 1)\beta} \qquad \textbf{(3.8)}$$

A decline in the mark-up, μ, is a reduction in the *ratio* of price to unit labour cost. There is nothing in this mark-up change *per se* that tells us anything about the behaviour of nominal prices and wages. This reduction in margins could be achieved, for a given path of nominal labour costs per unit of output, through lower prices. Theoretically, such a lower path of the price level could be achieved through a single, discrete drop in the price *level*; in practice there is likely to be a gradual approach to the new equilibrium price level path, ie there is likely to be a temporary reduction in the rate of inflation. A lower mark-up could also be achieved, for given paths of money prices and productivity, with a higher path of money wages, or with a higher price level path if it were accompanied by an even larger proportional increase in the path of money wages.

In order to determine the impact of lower structural margins on price inflation, we must simultaneously determine what happens to money wage inflation. A Keynesian approach to short-run wage and price dynamics, like the one proposed in Section 3.5 below, suggests that money wage inflation is unlikely to be positively affected by a fall in margins, when this fall in margins is the result of more intense competition in the product markets. Permanently lower margins due to more intense product market competition would produce a lower path of the price level. In the real world, this will show up as a temporary dip in the rate of inflation. This means that, in the short run, short nominal interest rates can be lower than they were before, and lower than they would have been in the absence of the fall in margins, without this endangering the inflation target.

In the medium and longer run, money wage inflation ceases to be anchored in the past. It is always influenced significantly by expected future price inflation. We cannot explain inflation with inflation. We need a further inflation anchor from outside the realm of the real economic relationships. That inflation anchor is provided by the MPC's pursuit of an unchanged inflation target. If the fall in margins is not associated with other structural changes in the economy, the path of nominal interest rates will return to where it would have been in the absence of the fall in margins.

It is not difficult to think of other changes in the transmission mechanism that could be the result of a change in margins. Redistribution from profits to wages, if wage-earners have, on average, higher propensities to spend than the recipients of profit income, would widen the output gap, putting upward pressure on inflation. Alternatively, the intensification of competitive pressures reflected in the lower structural margins could reduce 'X-inefficiency' and organisational slack in firms. This would represent an increase in total factor productivity, which would exercise temporary downward pressure on inflation.

3.4 A stock market boom and UK monetary policy

Asset prices, including the exchange rate, bond prices, land and house prices and equity prices, are not a target of monetary policy. Asset prices and asset price inflation only matter to the policy-maker because they are part of the transmission mechanism of monetary policy. If equity prices are high or rising fast because of fundamental New Economy developments, the influence of equity values on consumption and investment, and through that on inflation, is of interest to the policy-maker. The same is true if equity prices are, in part, driven by a speculative bubble. As long as the bubble persists, it will influence consumption and investment, and through that the balance between aggregate demand and aggregate supply and the rate of inflation. Since bubbles do not persist indefinitely, two questions arise. First, should the monetary authorities try to puncture the bubble? Second, should their actions while the bubble persists aim to anticipate the eventual collapse of the bubble?

Bubbles are, by definition, not driven by fundamentals. There is no reason why changes in one of the fundamentals (the rule governing the monetary instrument) would have any effect on the bubble. Policy can only influence the fundamental valuation component, *F*. It does not make sense to try and influence the fundamental valuation, *F*, to offset the bubble, *B*. First, we are by no means confident about the decomposition of the observed equity valuation into its bubble and fundamental components. Second, if and when the bubble collapses, it would be extremely difficult to 're-set' the fundamental valuation at the value it would have achieved in the absence of the bubble. Trying to influence or even puncture the bubble through 'non-fundamental' policy actions, eg open-mouth operations such as expostulations on 'irrational exuberance', is also likely to be a two-edged sword. There would seem to be no alternative but to live with the bubble.

Modifying policy in anticipation of the bubble's collapse is unlikely to be helpful. Should the monetary authority, faced with a speculative stock market boom, loosen policy in anticipation of an eventual future crash of uncertain timing and magnitude? In my view, all the authorities can do is to reveal their reaction function, ie their contingent response to a dramatic fall in equity values. This does not mean that the authorities underwrite the bubble, or provide free insurance to equity owners against the risk of a collapse. Giving the

(1) Note that ε, the price elasticity of demand, need not be a constant. Different models can produce either procyclical or countercyclical behaviour of the mark-up.

markets a free stock market put at an overvalued strike price would, if anything, feed the bubble. A bursting bubble would, at the very least, weaken consumption and investment demand. It could also create a financial crunch and liquidity squeeze, if significant amounts of private borrowing have been secured, directly or indirectly, against the overvalued stocks. The authorities can do no more than commit themselves to minimising the damage to the real economy, and to cleaning up the mess when the bubble bursts.

3.5 A fall in the NAIRU and UK monetary policy

A lower NAIRU or equilibrium rate of unemployment has no straightforward implications for the path of short nominal rates that supports an unchanged inflation target. This is because, for any given path of the actual unemployment rate, a lower NAIRU will put downward pressure on the growth rate of *expected real* wages.

A simple example of a model with this property is an open-economy adaptation of the Taylor overlapping contracts model. The Buiter-Jewitt (1981) version of the Taylor model has staggered, overlapping *real* wage contracts rather than the staggered overlapping *nominal* wage contracts of the original. We restrict the analysis to a two-period contract. Lower-case symbols denote the natural logarithm of the corresponding upper-case symbol; U is the actual unemployment rate and U^N the NAIRU or the natural rate of unemployment. Money contracts last for two periods. In each period, half the labour force negotiates a new contract. The money wage contract negotiated this period, ω_t, achieves a level of the expected average real contract wage over the life of the contract, which depends positively on the real contract wage negotiated last period and the real contract wage expected to be negotiated next period. It also depends on the average unemployment rate expected over the life of the contract. Finally, it depends on an index of the target real wage, denoted $\bar{\tau}$. One would expect the growth rate of the target real wage, $\bar{g}_t \equiv \Delta\bar{\tau}_t \equiv \bar{\tau}_t - \bar{\tau}_{t-1}$, to track the trend rate of growth of labour productivity.

$$\begin{aligned}\omega_t - \tfrac{1}{2}(\tilde{p}_t + E_t\,\tilde{p}_{t+1}) - \bar{\tau}_t \\ = \gamma\,E_t\left[\omega_{t+1} - \tfrac{1}{2}(\tilde{p}_{t+1} + \tilde{p}_{t+2}) - \bar{\tau}_{t+1}\right] \\ + (1-\gamma)\left[\omega_{t-1} - \tfrac{1}{2}(\tilde{p}_{t-1} + \tilde{p}_t) - \bar{\tau}_{t-1}\right] \\ - \tfrac{1}{2}\psi(U_t + E_tU_{t+1})\end{aligned} \qquad \textbf{(3.9)}$$

$$\psi > 0; 0 \le \gamma < 1$$

We can use **(3.9)** to solve for the current real contract wage as a function of last period's real contract wage and of current and anticipated future values of the fundamental, unemployment. There are two solutions. The sensible one is given in equation **(3.10)**:(1)

$$\begin{aligned}\omega_t - \tfrac{1}{2}(\tilde{p}_t + E_t\,\tilde{p}_{t+1}) \\ = \omega_{t-1} - \tfrac{1}{2}(\tilde{p}_{t-1} + \tilde{p}_t) \\ + \bar{g}_t - \frac{\psi}{2(1-\gamma)}\left[U_t + \sum_{i=t}^{\infty}\left(\frac{\gamma}{1-\gamma}\right)^{i-1}\frac{1}{1-\gamma}E_tU_{t+i}\right]\end{aligned} \qquad \textbf{(3.10)}$$

This solution only makes sense when $\gamma < 0.5$, ie the wage-setting process must be mainly backward-looking.(2) When the unemployment rate is expected to remain constant, the equation becomes:

$$\begin{aligned}\omega_t - \tfrac{1}{2}(\tilde{p}_t + E_t\,\tilde{p}_{t+1}) = \omega_{t-1} - \tfrac{1}{2}(\tilde{p}_{t-1} + \tilde{p}_t) \\ + \bar{g}_t - \frac{\psi}{2(1-\gamma)}U_t\end{aligned} \qquad \textbf{(3.11)}$$

The average wage paid in period t, w_t, is the average of the current and previous contract wage, $w_t = \tfrac{1}{2}(\omega_t - \omega_{t-1})$. Equation **(3.6)** can be rewritten as $p = \mu + w + l - y$.

The relationship between the RPI, the domestic value-added deflator and import prices can be written as:

$$\tilde{p} = (1-\alpha)p + \alpha(p^f + s) \qquad \textbf{(3.12)}$$

Let $g_t \equiv y_t - y_{t-1} - (l_t - l_{t-1})$ be the growth rate of labour productivity and $\rho_t \equiv s_t + p_t^{*f} - p_t$ the real exchange rate. It follows that:

$$\begin{aligned}\Delta\omega_t = \tfrac{1}{2}(E_t\tilde{\pi}_{t+1} + \tilde{\pi}_t) + \bar{g}_t \\ - \frac{\psi}{2(1-\gamma)}\left[U_t + \sum_{i=1}^{\infty}\left(\frac{\gamma}{1-\gamma}\right)^{i-1}\frac{1}{1-\gamma}E_tU_{t+i}\right]\end{aligned} \qquad \textbf{(3.13)}$$

Since $\tilde{\pi}_t = \tfrac{1}{2}\Delta\omega_t + \tfrac{1}{2}\Delta\omega_{t-1} + \Delta\mu_t - g_t + \Delta\rho_t$, this model exhibits inflation persistence and not merely price *level* persistence:

$$\begin{aligned}\tilde{\pi}_t = \tfrac{1}{4}\left[E_t\tilde{\pi}_{t+1} + \tilde{\pi}_t + E_{t-1}\tilde{\pi}_t + \tilde{\pi}_{t-1}\right] + \Delta\mu_t - g_t + \Delta\rho_t \\ + \tfrac{1}{2}\left[\bar{g}_t - \frac{\psi}{2(1-\gamma)}\left(U_t + \sum_{i=1}^{\infty}\left(\frac{\gamma}{1-\gamma}\right)^{i-1}\frac{1}{1-\gamma}E_tU_{t+i}\right)\right] \\ + \tfrac{1}{2}\left[\bar{g}_{t-1} - \frac{\psi}{2(1-\gamma)}\left(U_{t-1} + \sum_{i=1}^{\infty}\left(\frac{\gamma}{1-\gamma}\right)^{i-1}\frac{1}{1-\gamma}E_{t-1}U_{t-1+i}\right)\right]\end{aligned} \qquad \textbf{(3.14)}$$

(1) The other solution is as follows:
$$\omega_t - \tfrac{1}{2}(\tilde{p}_t + E_t\,\tilde{p}_{t+1}) - \bar{\tau}_t = \left(\frac{1-\gamma}{\gamma}\right)\left[\omega_{t-1} - \tfrac{1}{2}(\tilde{p}_{t-1} + \tilde{p}_t) - \bar{\tau}_{t-1}\right] - \frac{\psi}{2\gamma}\left[U_t + 2\sum_{i=1}^{\infty}E_tU_{t+i}\right]$$
It makes little economic sense, unless γ=1, the purely forward-looking case, which I am not considering. When $\gamma < 0.5$ (ie when the model is more backward-looking than forward-looking), the real wage growth process becomes non-stationary, and it is more non-stationary, the smaller is γ. When $\gamma > 0.5$, the autoregressive component in the real wage process is stationary, but the infinite sums for the forcing variables will explode, even when the forcing variables are constant.

(2) If $\gamma > 0.5$, the infinite sums in **(3.10)** would not converge, even if the target growth rate of real wages and the unemployment rate were constant.

From **(3.13)**, lower expected real wage growth can mean lower money wage inflation, if the expected rate of price inflation is unchanged. It can mean unchanged money wage inflation if the expected rate of price inflation falls. It is even consistent with rising money wage inflation if the expected rate of price inflation rises even more.

From equation **(3.13)**, we also see how current-period contract wage inflation depends on RPI inflation during the current period and on current expectations of next period's RPI inflation. Since the current inflation rate of average money wages is a weighted average of current and last period's contract wage inflation, $\Delta w_t = \frac{1}{2}(\Delta\omega_t + \Delta\omega_{t-1})$, the RPI inflation augmentation term in the equation for the inflation rate of average money wages is:

$$\tfrac{1}{4}\left(E_t\tilde{p}_{t+1} + \tilde{\pi}_t + E_{t-1}\tilde{\pi}_t + \tilde{\pi}_{t-1}\right) \qquad \textbf{(3.15)}$$

This 'RPI inflation augmentation term' includes both past RPI inflation and past expectations of current RPI inflation (as well as current RPI inflation and current expectations of future RPI inflation).

With the RPI inflation augmentation term in the money wage equation partly predetermined, lower expected real wage growth is likely to mean lower money wage growth in the short run. Given an unchanged mark-up and an unchanged growth rate of labour productivity, price inflation on the GDP deflator measure will also be lower in the short run than it would otherwise have been. Once the influence of inherited nominal contracts wears off, however, the lower NAIRU only has implications for the path of *real wages*, not for price inflation or money wage inflation separately. Monetary policy maps real wage growth into money wage growth and inflation in the long run.

I define the NAIRU, U^N, as the constant unemployment rate that would be consistent with a constant rate of inflation, a constant share of labour in value added (ie a constant mark-up), a constant real exchange rate, a constant growth rate of labour productivity and a constant growth rate of target real wages. This very long-run definition of the NAIRU implies that:

$$U^N \equiv \psi^{-1}(1-2\gamma)\left[\bar{g} - g\right] \qquad \textbf{(3.16)}$$

Substituting **(3.16)** into **(3.11)**, we can write the real contract wage adjustment equation, when the actual unemployment rate is constant, as follows:(1)

$$\omega_t - \tfrac{1}{2}\left(\tilde{p}_t + E_t\tilde{p}_{t+1}\right) = \omega_{t-1} - \tfrac{1}{2}\left(\tilde{p}_{t-1} + \tilde{p}_t\right) + g - \frac{\psi}{1-2\gamma}\left(U - U^N\right) \qquad \textbf{(3.17)}$$

Thus, in the short run, with current contract wage inflation in part anchored to past expectations and past actual inflation, a reduction in the natural rate of unemployment will exercise downward pressure on currently negotiated money wage settlements. Short-run nominal interest rates can be lower than they would have been otherwise. Over time, the actual unemployment rate will, partly through the automatic servomechanism of a market economy and partly through deliberate policy actions, follow the natural rate down to its new lower level. At that point, nominal interest rates will have to revert to the level where they would have been in the absence of a fall in the natural rate of unemployment, if an unchanged inflation target is to be met.

3.6 Higher trend productivity growth and UK monetary policy

An increase in the growth rate of trend productivity has no straightforward implications for inflation and for the path of nominal interest rates consistent with a given inflation target, even in the short run. The common assertion that it will reduce the rate of inflation, or that it permits lower nominal rates without endangering the inflation target, appears to be based on one of two misconceptions.

The first is a partial-equilibrium, 'cost-plus' view of price determination. For simplicity, I assume the real exchange rate is constant. The rate of inflation of the value-added deflator, $\pi_t = p_t - p_{t-1}$, is the growth rate of unit labour costs, $\Delta w - g$, plus the growth rate of margins, $\Delta\mu$.

$$\pi = \Delta w - g + \Delta\mu \qquad \textbf{(3.18)}$$

Holding constant the growth rate of money wages, a higher growth rate of productivity will reduce the growth rate of unit labour costs. If margins do not increase, this will mean lower price inflation. However, the target growth rate of real wages is unlikely to be constant when the growth rate of productivity increases. For a given path of unemployment, expected real wage growth can be expected to increase in line with the underlying growth rate of labour productivity. This need not be the case if the productivity growth reflects changes in labour market institutions and practices that weaken the bargaining strength of labour, but it is a useful benchmark.

With expected real wage growth rising in line with trend productivity growth, the effect of higher productivity growth on money wage growth depends entirely on the behaviour of expected inflation. Assume the public does not make systematic errors when it forms its inflation expectations. In that case, the behaviour of money wage inflation moves, other things being equal, one-for-one with price inflation. With price inflation moving one-for-one with wage inflation (given productivity growth and given the mark-up), there is no way we can explain what happens to price inflation and wage inflation individually. Again, we need monetary

(1) For notational simplicity, I assume that the growth rate of productivity, the target growth rate of real wages and the actual unemployment rate are all constant.

policy to translate changes in expected real wage growth into paths for price inflation and money wage inflation.

The second simple productivity-growth-to-inflation nexus is based on a misinterpretation of the most basic identity in macroeconomics, the equation of exchange. Let M be the nominal stock of money and V the income velocity of circulation of money. So:

$$MV = PY \qquad \textbf{(3.19)}$$

In growth rate form this identity can be rewritten as:

$$\pi = \Delta m + \Delta v - \Delta y \qquad \textbf{(3.20)}$$

Those who argue that higher productivity growth means lower inflation make two implicit assumptions. First, higher productivity growth means higher output growth. The correct statement would be that, other things being equal, higher productivity growth means a higher growth rate of *potential* output. To translate potential output growth into actual output growth, the proper quantum of aggregate demand needs to be in place. Second, monetary policy somehow fixes the growth rate of nominal GDP, or the growth rate of the nominal money stock, corrected for changes in velocity.

The growth rate of nominal GDP is not an instrument of monetary policy. Normally it is not a target either.(1) Simple, but descriptively realistic, monetary policy rules like the Taylor rule for the short nominal rate of interest or the McCallum rule for the growth rate of the nominal stock of base money, do not support, out of steady state, a constant growth rate of nominal GDP in the face of an increase in the growth rate of potential GDP.

According to the Taylor rule, the short nominal interest rate moves more than one-for-one with (actual and expected) inflation, and also responds positively to the output gap. Let $\tilde{\pi}^*$ be the target inflation rate, $\bar{r}$ the long-run real interest rate and $\bar{y}$ capacity output, then:

$$i_t = E_t\bar{r}_t + E_t\tilde{\pi}_{t+1} + \delta_1(\tilde{\pi}_t - \tilde{\pi}^*) + \delta_2(y_t - \bar{y}_t) \qquad \textbf{(3.21)}$$

$$\delta_1, \delta_2 \geq 0$$

The McCallum rule makes the growth rate of base money a decreasing function of the deviation of inflation from its target and of the output gap:

$$\Delta m_t = \Delta\bar{y}_t + E_t\tilde{\pi}_{t+1} - \gamma_1\left(\tilde{\pi}_t - \tilde{\pi}^*\right) - \gamma_2\left(y_t - \bar{y}_t\right) \qquad \textbf{(3.22)}$$

$$\gamma_1, \gamma_2 \geq 0$$

The transitional dynamics of the velocity of circulation of money are one of the abiding mysteries of empirical monetary economics. Common models of money demand make the money-income ratio or the money-consumption ratio a decreasing function of the opportunity cost of money. In what follows I interpret money narrowly, as non interest bearing central bank money or base money. The pecuniary opportunity cost of holding this rate of return dominated asset is the short nominal rate of interest. A representative long-run money demand function would be:

$$m - p - y \equiv -v = \eta_0 - \eta_1 i \qquad \textbf{(3.23)}$$

$$\eta_1 > 0$$

In the long run, ie along a balanced growth path, velocity is constant. Therefore, across steady states, a constant growth rate of the nominal money stock supports a one-for-one reduction in the rate of inflation when the growth rates of potential and actual output rise. If the central bank is charged with achieving an unchanged inflation target, the steady-state growth rate of the nominal money stock would rise one-for-one with the growth rates of actual and potential output.

The fact that the operational monetary policy instrument, in the United Kingdom and elsewhere, is a short nominal interest rate, the two-week repo rate in the United Kingdom, matters for the long-run response of the price *level* to shocks. When the nominal interest rate is either set exogenously, or, as in the case of the Taylor rule, is a function only of real variables, the behaviour of the nominal variables, ie the price *level* and the *levels* of the money wage and the nominal money stock paths, is different from what it would be if (the growth rate of) the nominal money stock were the instrument of policy along the lines of the McCallum rule. This is true even in the long run and even if the monetary growth rule targets and achieves the same long-run inflation rate as the nominal interest rate rule.

If there are no nominal rigidities, nominal interest rules result in price level or nominal indeterminacy.(2) While the rate of inflation, the growth rate of the nominal money stock and all other real variables are determinate, the price level sequence and the nominal money stock sequence are not. In our neo-Keynesian model, the initial value of the price level and/or the money wage is anchored in history. There is no nominal indeterminacy, but the long-run values of the price level, the money wage and the nominal money stock are 'hysteretic' or path-dependent. They depend on the initial conditions. Under a nominal interest rate rule like the Taylor rule, a real, structural change, such as a permanent lowering of margins, results in a permanently lower path of the price level, even though it will have no permanent effect on the rate of inflation. This would not be the case under a monetary rule like the McCallum rule, which would support

(1) There have been proposals that monetary policy should target nominal GDP growth, but no monetary authority has adopted such a target.
(2) This will not be the case if the nominal interest rate is made a function of some nominal variable, such as past, current or anticipated values of the nominal money stock, the price level or the money wage.

an unchanged long-run path of the price level in steady state following a permanent lowering of margins.

What can we expect to happen, in the long run, and on average, to the short nominal interest rate if the growth rate of potential output rises? Ignoring, for simplicity, term and risk premia, the expected real interest rate equals the nominal interest rate minus the expected rate of inflation. In the long run, actual, expected and target inflation will coincide and the real exchange rate is constant. With the domestic real interest rate equal to the world real interest rate, domestic nominal rates in steady state are therefore given by:

$$i = \tilde{\pi}^* + rf \qquad \textbf{(3.24)}$$

If the world real rate of interest is not changed in the long run when UK productivity growth rises, the achievement of an unchanged inflation target will still require the same long-run path of UK nominal interest rates as before.

It is easy to think of circumstances where an increase in the growth rate of UK potential output is associated with an increase in the long-run global real rate of interest. This would be the case, for instance, if, in the spirit of the New Paradigm, the increase in the growth rate of productivity were a worldwide phenomenon associated with an increase in the marginal real rate of return to capital investment. If the equity risk premium is unchanged, the global real rate of interest would also rise, and the UK real interest rate would rise with it. With an unchanged inflation target, the long-run path of the UK short nominal interest rate would have to be higher.

To get the short-run effect, assume that the long-run real interest rate is unchanged. According to the Taylor rule, the short-run response of nominal rates will depend on the short-run impact of increased productivity growth on the output gap. Productive potential is given by the real value added that would be produced if employment were at its equilibrium level. Since there is no evidence of significant intertemporal substitution in labour supply, equilibrium employment can be written as $\bar{L}(1–U^N)$, where $\bar{L}$ is the exogenous labour force. Potential output is therefore given by:

$$\bar{Y} = AF\left(K, \bar{L}\left(1 - U^N\right), N\right) - \frac{P^f}{P} N \qquad \textbf{(3.25)}$$

So-called supply-side shocks or supply-side improvements almost always have direct and indirect effects on aggregate demand as well. Even with an unchanged path of nominal interest rates, aggregate demand is likely to be boosted by the kind of structural changes that boost the trend growth rate of productive potential, which we can represent here as an increase in the growth rate of total factor productivity, *A*.

Aggregate demand is the sum of private consumption, *C*, private investment, *I*, government exhaustive spending, *G*, and net exports, *X*.

$$Y = C + I + G + X$$

Private consumption depends on permanent after-tax labour income, current after-tax labour income and real financial wealth. It may also depend on the path of current and anticipated future real interest rates. 'Confidence effects' influence investment as well as consumption. Private financial wealth is the sum of real stock market wealth, *V*, real housing wealth, the real value of the stock of base money, the real value of the public debt and the real value of net claims on the rest of the world. Private investment can be viewed as driven by (marginal) *V*, by confidence effects and by corporate cash flow, liquidity and balance sheet strength. Net exports depend negatively on domestic demand and positively on real competitiveness and on demand in the rest of the world.

Higher growth of potential output is likely to boost households' perceptions of their permanent incomes, even if their current incomes do not rise immediately. Housing wealth may increase. If any part of the productivity gains is appropriated by the owners of capital, stock market valuations will rise and household financial wealth with it. Even if the valuation of existing capital is not boosted (say because technical progress cannibalises the old capital stock and reduces profit margins), the return to investment in the appropriate new sectors could be very high. Intangibles like household and business confidence may be boosted. All this will stimulate private consumption and investment. It is not at all inconceivable that aggregate demand is, in the short and medium term, boosted by more than potential output. This would call for a higher short-run path of nominal interest rates in order to achieve an unchanged inflation target, not a lower one. In the long run, if the real interest rate and the inflation target are unchanged, higher productivity growth will have no effect on the path of nominal interest rates.

All this is a long, some might say long-winded, way of saying that inflation is, always and everywhere, in part a monetary phenomenon. It is important to remind oneself of that old truth, however, lest one gets carried away on a wave of supply-side euphoria.

Whatever the plausibility and quantitative significance of the supply-side improvements reviewed here, it is vitally important that we recognise that their implications for monetary policy, given an unchanged inflation target, are by no means straightforward. The view that a sustained reduction in the natural rate of unemployment, a sustained fall in margins or a sustained increase in the rate of growth of productivity all unambiguously imply that the path of short-term nominal interest rates can be lower than it would otherwise have been, without this posing a threat to the inflation target, is almost certainly mistaken.

4 Conclusion

Even if much of the claims made for the New Economy is hype, what remains is substantial enough to matter for the

United Kingdom's real economic performance in the medium and long term and for the conduct of monetary policy. It is encouraging that, for monetary policy purposes, the qualitative implications of the New Paradigm can be analysed using conventional tools of macroeconomic and monetary analysis. Assessing their quantitative impact remains largely guesswork. The failure of many pundits to draw the correct conclusions (even qualitatively) about the implications of the New Paradigm for the conduct of monetary policy is due less to the innate novelty and complexity of the New Paradigm than to a failure to understand basic monetary economics.

References

Arrow, K J (1962), 'The economic implications of learning by doing', *Review of Economic Studies*, June, pages 115–73.

Bordo, M D, Eichengreen, B and Irwin, D A (1999), 'Is globalisation today really different than (sic) globalisation a hundred years ago?', *NBER Working Paper*, No 7195, June.

Bordo, M D, Eichengreen, B and Kim, J (1998), 'Was there really an earlier period of international financial integration comparable to today?', *NBER Working Paper*, No 6738, September.

Buiter, W H (2000), 'Money matters; the effect of relative price changes, margin changes and productivity changes on inflation and the price level', *mimeo*, Bank of England, March.

Buiter, W H and Jewitt, I (1981), 'Staggered wage-setting with real wage relativities: variations on a theme by Taylor', *The Manchester School*, 49, pages 211–28, reprinted in Willem H. Buiter, *Macroeconomic Theory and Stabilization Policy*, Michigan University Press, 1989.

Cohen, A J and Napolitano, G (2000), *Portfolio Strategy; Investment Strategy Chartbook, Special Edition*, January, Goldman Sachs.

De Long, B and Froomkin, M (1998), *The Next Economy?*

Giordano, F (1999), 'e-conomics: information goods transforming the marketplace', *Global Strategy Research*, Credit Suisse First Boston, 15 October.

Hall, R E (1999), 'The stock market and capital accumulation', *NBER Working Paper*, No 7180, June.

Julius, D (1999), 'Back to the future of low global inflation', The Maxwell Fry Global Finance Lecture, University of Birmingham, 20 October.

Keating, G and Wilmot, J (1999), 'Boom or doom? Ten questions for the Millennium', *Fixed Income Research—Europe*, CSFB, 22 October.

Oxford Review of Economic Policy (1999), *Real interest rates*, Vol 15, No 2, Summer.

Wadhwani, S (1999), 'Currency Puzzles', Lecture given at the London School of Economics, 16 September.