Economic cycles in the United States and in the euro area: determinants, scale and linkages

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Introduction

This article analyses the business cycles recorded in the US and in the euro area over recent decades on the basis of the estimated results of a general equilibrium model. The analysis is in line with the recent economic literature on cyclical movements which ascribes those movements to various types of exogenous shocks, such as changes in productivity, the labour supply, consumer preferences or economic policy. This type of decomposition of the cyclical movements in the main macroeconomic aggregates is discussed on the basis of the models estimated for the US and the euro area. The results broadly correspond with those published elsewhere in the literature. Such an analysis can be conducted for the average of the period under review, but is even more informative if it is carried out for specific periods to identify the key factors triggering the principal recessions or recoveries. If it is applied to the most recent period, such an analysis can provide useful information not only for the policy to be pursued, but also for prediction exercises.

Apart from the origin of the cyclical movements, the downward trend in the volatility of the economic aggregates is also discussed. The reduction in the standard deviation of growth, or in other words, the amplitude of the cycle for most economic aggregates, is clearly discernible in the developed economies, especially since the mid 1980s, and has recently been the subject of much attention in the economic literature. However, it is hard to investigate precisely whether that lower volatility is due to random circumstances in the form of relatively small exogenous shocks, or to more efficient to monetary and fiscal stabilisation policies or to a change in the economic structure (e.g. a shift in favour of the services sector, more efficient stock management, or better access to financial instruments).

Finally, this article examines the close connection between the cycles in the various economies, particularly that of the US and the euro area: has globalisation of the real and financial economy also led to greater synchronisation? As well as offering a possible interpretation of these trends, the article also explores the policy implications.

1. Economic theory and general equilibrium models

In recent decades, research on economic cycles has intensified. Traditionally, the analysis of the business cycle was primarily statistical and descriptive, but the approach nowadays is far more theoretical.

The modern theory of the economic cycle assumes that the economic system is inherently stable. The cycles are generated by exogenous shocks, but after each shock the internal dynamics of the system will constantly tend to revert to the system's equilibrium growth path. This approach is in line with current economic theory which assumes rational behaviour on the part of the individual economic agents: households maximise their well-being and companies optimise shareholder value. In the process, both households and businesses form rational expectations regarding future changes in budget restrictions and technological constraints, which means that they use all

available information to predict future developments as accurately as possible. Within this theoretical framework, the individual decisions will be automatically coordinated by market pricing. The result is a stable economic model in which the cycles are driven by external shocks in regard to preferences, technological progress or government interventions.

This approach to the economic cycle is fundamentally different from the traditional, mainly Keynesian view of the economy. The traditional approach was more critical as regards the stability and dynamic efficiency of the market economy. According to that approach, the uncoordinated behaviour of consumers and investors regularly disrupted the balance in the form of either under-consumption or excess accumulation of capital goods, triggering a recession. The cause of the cycles was therefore attributed to the internal dynamics of the market economy. However, this analysis remained mostly descriptive and lacked any genuine empirical testing of the underlying model. In the modern literature, this approach is viewed as a dissenting opinion which deviates somewhat from the mainstream models, with rational expectations and markets which are almost perfectly efficient.

In the recent models, great progress has been made in combining theoretical insights with the empirical regularities. The general equilibrium models succeed in describing the rational decisions of the various economic agents in a consistent system of equations. That system explains the consumption behaviour and the labour supply of households as well as the investment, employment and pricing behaviour of businesses. It also describes the behaviour of the monetary and fiscal authorities via systematic rules. All those decisions are influenced by both past decisions – the "delayed" effects due to all kinds of adjustment costs or information lags – and expectations about future movements in exogenous and endogenous variables. Yet these systems are relatively easy to solve and can also be estimated empirically.

The Bank uses a general equilibrium model of this type as a research instrument for analysis and research on the economy and the optimum monetary policy (Smets and Wouters 2003). This article begins with a summary of the main findings on the subject. The same model was estimated for the euro area and for the US. On the basis of this exercise, it is possible to identify and quantify the causes of the economic cycles in the two economies, in the form of the underlying exogenous shocks. Naturally, such an exercise is always based on a whole series of assumptions. Other models or model specifications may produce different conclusions regarding the role of the various shocks.

1.1 Theoretical assumptions underlying general equilibrium models

The main characteristics of these models can be summarised as follows:

- The goods and labour market are modelled as markets with imperfect or monopolistic competition. This means that the goods offered and labour performed are imperfect substitutes and that the parties offering them can to some extent determine their price themselves, in contrast to a perfect competition situation in which the price for the individual sellers is fixed and is equal to the market price. In the case of imperfect competition, the price will therefore be determined as a mark-up on top of the marginal production costs. The size of the mark-up will depend on the price elasticity of demand: if the elasticity is very large, i.e. if there is very little difference between the various goods, and variations in price give rise to large substitution effects, the mark-up will be very small. Greater differentiation or lower price elasticity, on the other hand, will lead to a larger mark-up. Obviously, positive mark-ups in prices and wages result in less economic activity than in a competitive economy with no mark-ups. In these models, the mark-up is an exogenously determined structural characteristic of the economy. The degree of monopolistic competition determines the equilibrium level of economic activity.
- In these models, price and wage fixing is also subject to nominal rigidity in one form or another. Prices and wages are not revised in each period to the optimum level in line with changes in costs or demand. In those circumstances, a rational price setter will take account of the fact that his price will remain unchanged for a number of periods. The price will then be determined as a mark-up on a weighted average of present and future marginal costs. The same will happen to wage fixing. Empirical estimates based on macroeconomic data show that prices and wages are typically fixed for relatively long periods.
- Apart from some form of nominal rigidity, these models also feature real rigidities. These mechanisms explain in the first instance why the various components of demand respond only slowly to the various types of economic shocks. Consumption demand is characterised by habit formation households will be slow to adapt their consumption in line with a change in income level. Changes in the level of investment are typically associated with adjustment costs: if the profitability of the capital stock increases, businesses will only slowly step up their investments. This can be explained both by the simple fact that it takes time to carry out business investment, and by the argument that major investments also entail time-consuming additional

training and implementation costs which may be at the expense of the existing activity.
- Another mechanism causing some real rigidity is the variable use of the existing production capacity. This means that, if demand increases, production can increase without any significant rise in marginal costs. In the short term, variations in the degree of existing capacity utilisation may inhibit the sensitivity of the marginal costs, and hence prices, to fluctuations in output.
- Finally, the model is closed with a systematic behaviour response by the monetary and fiscal authorities. The monetary policy response typically takes the form of a reaction to inflation – more specifically, the deviation between the inflation rate and the central bank's inflation target – and a reaction to the output gap. Later on, this article will examine in some detail the specific concept of the output gap used in these models.
- One of the important weaknesses of the model used here is that the economies are seen as closed economies and the fiscal policy is not modelled as yet, or only in a very primitive way as an exogenous process with no response to developments elsewhere in the economy.

On the basis of these fairly simple theoretical insights, the behaviour of households and businesses is derived as totally rational, resulting in a mathematical system of equations. There are two features which typify the difference between these general equilibrium models and the traditional macroeconomic models:
- In the modern general equilibrium models, both long-term and short-term relationships between the different economic variables are derived from optimising behaviour. This implies that the models are totally consistent from a theoretical pont of view. Both demand and supply and price and wage formation are at all times fully coordinated and based on the same information about current and future trends in the exogenous processes.
- General equilibrium models are typically viewed as a system of equations that can be estimated simultaneously. This implies that the rational behaviour and the expectations regarding the future movement in the different variables are based on predictions consistent with the model.

An example may make this clear. When the total exogenous productivity of the factors of production increases, the supply of goods offered by businesses will increase while prices fall, but on the other hand the expected wealth of households will increase, bolstering consumption and at the same time leading to higher wage demands. Such consistency between the response of the various sectors to an exogenous shock is not guaranteed in the traditional models which are built up sector by sector or equation by equation.

According to this same principle, all macroeconomic variables will respond systematically to the various exogenous shocks affecting the economy during the economic cycle. All variables will therefore supply information identifying the various shocks. By regarding the system of equations as a whole when estimating the model, one can make optimum use of all information available on the different variables. This "full-information" estimation procedure is theoretically a major advantage, but it also has its risks: if particular sectors or equations are incorrectly specified, this may distort all the results of the estimation.

The Bayesian estimation method may offer a solution here, as it is based on a "prior" assumption regarding the various parameters of the model. That prior information may originate from other estimation results in the literature, be based on data from other countries, other periods or other types of data, e.g. microeconomic studies. The more robust and accurate this prior information, the greater the weight that can be assigned to it in the estimation procedure. The information in the economic time series on which the model estimation is based is then used to supplement the prior information and in that way to arrive at a "posterior" distribution for the various model parameters. In contrast to the classic estimation methods aimed at estimating the "real" parameters as efficiently as possible, the Bayesian method aims at estimating the whole distribution and thus the probability of the various parameters. This estimation method therefore results in a full description of the parameter distribution, which is very useful for determining the margin of uncertainty in prediction exercises or all other deductions based on the model.

1.2 Empirical implementation of the general equilibrium models

This standard general equilibrium model was estimated for the US and for the euro area, taking seven macroeconomic variables into account: GDP, consumption, investment, employment, wages, inflation in the price deflator of GDP and the short-term interest rate. In this exercise, which intends to compare the two economies, the model was estimated for the two economies over the same base period: 1974.1-2002.4. The estimation concerns both the behaviour parameters of households, firms and public authorities and the parameters which describe the exogenous processes: the variance and persistence of the exogenous shocks. Together, these parameters determine the entire behaviour of the economic system and make it

possible, for example, to ascribe the total variance of the system to the various underlying exogenous shocks.

Ten exogenous shocks were identified in the course of the estimation. Six of them were modelled as persistent processes which typically have a fairly protracted influence on the economy:

- shocks in the total factor productivity (TFP) of the economy;
- productivity shocks specific to capital goods;
- shocks in the labour supply of households: these shocks specifically take the form of a more or less persistent shift in the relative value placed on labour effort in the utility function of the households, so that the households are inclined to do more or less work at a particular wage rate. Changes in the participation rate, standard of education, etc. and institutional reforms on the labour market will also be covered by this shock in so far as they influence the economy primarily via the labour supply;
- shocks in the intertemporal preferences of households: such shocks typically lead to a temporary postponement of household spending but without any change in households' overall budgets or wealth;
- shocks in exogenous demand and/or government spending;
- shocks in the monetary policy inflation target: this shock determines the long-term level of inflation and hence the nominal interest rate.

In addition, there are four shocks which were modelled as being relatively short-lived:

- temporary changes in the mark-up for price-setting;
- temporary changes in the mark-up for wage-setting;
- temporary changes in the cost of financing investment;
- temporary changes in the interest rate: these are interest rate changes which are not generated endogenously by the response of monetary authorities to fluctuations in inflation or output.

Each of these shocks has its specific influence on the seven macroeconomic variables used for the historical estimation. The effect of the shocks on the economic system is typically reflected in the impulse-response functions of the shock on the different variables. The impulse-response effects for some of the shocks are shown in chart 1.

An average positive shock affecting total factor productivity causes an increase in output and in the various components of demand, while inflation falls. Employment declines, primarily in the short term, since demand and production respond only slowly to the positive wealth effects of this shock. The short-term interest rate falls owing to the decline in inflation, but also because – in the short term – output lags behind the expansion in production capacity. Other supply shocks with comparable effects are the shock to the labour supply and the shock affecting the specific technology of capital goods.

A positive shock affecting the intertemporal preferences of households encourages the propensity to consume in the short term and is a typical example of a demand shock. Such a shock causes a rise in output and prices with an increase in the short-term interest rate, causing a crowding out in investment spending. Another demand shock is the shock affecting exogenous expenditure (e.g. in government spending) which has the effect of crowding out the two private demand components.

A shock affecting the price mark-up has a positive impact on inflation in the short term but produces a negative wealth effect, causing a fall in demand and hence in output. Monetary policy responds relatively weakly to such a temporary surge in inflation, since the curbing of short-term inflation has to be weighed against the negative output gap. The impulse-response function of this shock shows a strong similarity with the effects of an oil price shock.

Finally, the impulse-response function for a monetary shock affecting the short-term interest rate is explained. An interest rate hike has negative repercussions on the demand components – and even more so on investment, which is relatively sensitive to interest rates – and also leads to a fall in inflation, which is fairly persistent on account of price and wage rigidities.

Without going into the estimation results in detail, it must be said the results for the US are very similar to those for the euro area, both for the behaviour parameters of firms and households and the parameters which determine the systematic behaviour of monetary policy, and for the variance and persistence of the different structural shocks. The fact that the results for the systematic monetary policy of the two economies are comparable is particularly surprising since there was no single European monetary policy during the period considered, and the estimations were therefore based on a highly abstract representation of the real situation. Yet the congruity of the results for the two economies is not so surprising in view of the other results in the literature, which also indicate a close similarity. On the basis of a descriptive comparison of the economic cycle in the euro area and the US, Mojon and Agresti (2001) also deduced that the cyclical behaviour of the two economies was very similar: the variance and the correlation of a whole series of macroeconomic variables tally very closely. Studies focusing on specific behavioural

CHART 1A IMPULSE-RESPONSE FUNCTION FOR A SHOCK AFFECTING TOTAL FACTOR PRODUCTIVITY

(Deviation relative to base, in percentage points)

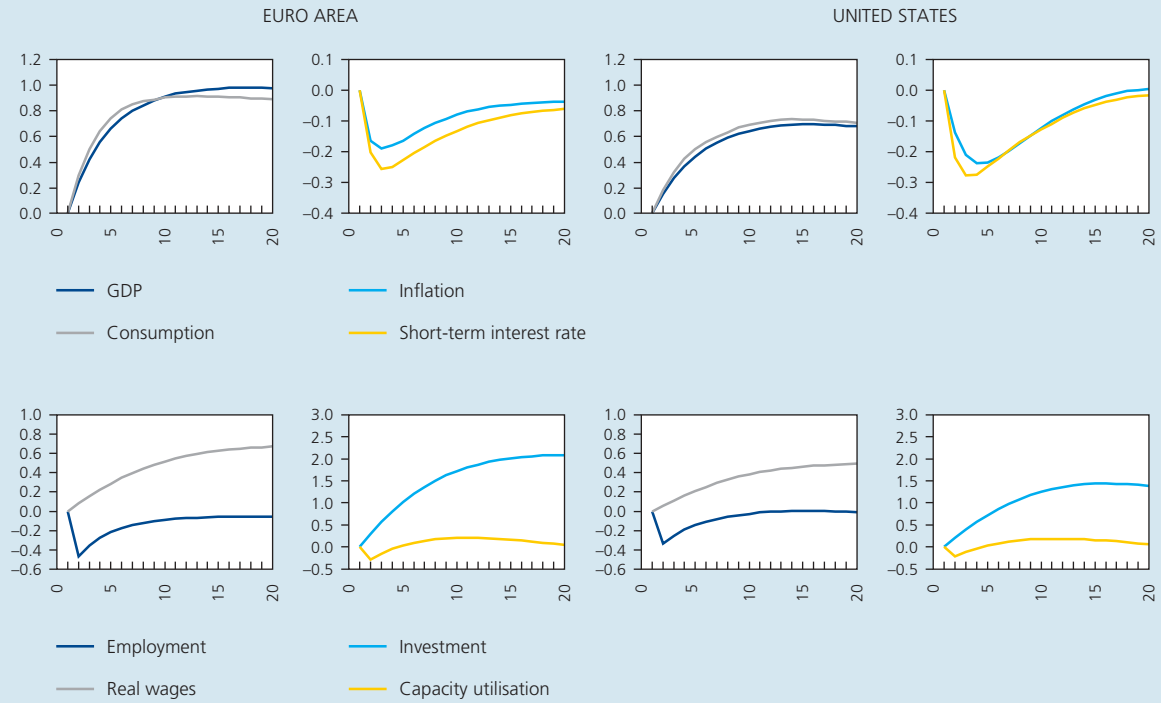


CHART 1B IMPULSE-RESPONSE FUNCTION FOR A SHOCK AFFECTING CONSUMPTION PREFERENCES

(Deviation relative to base, in percentage points)

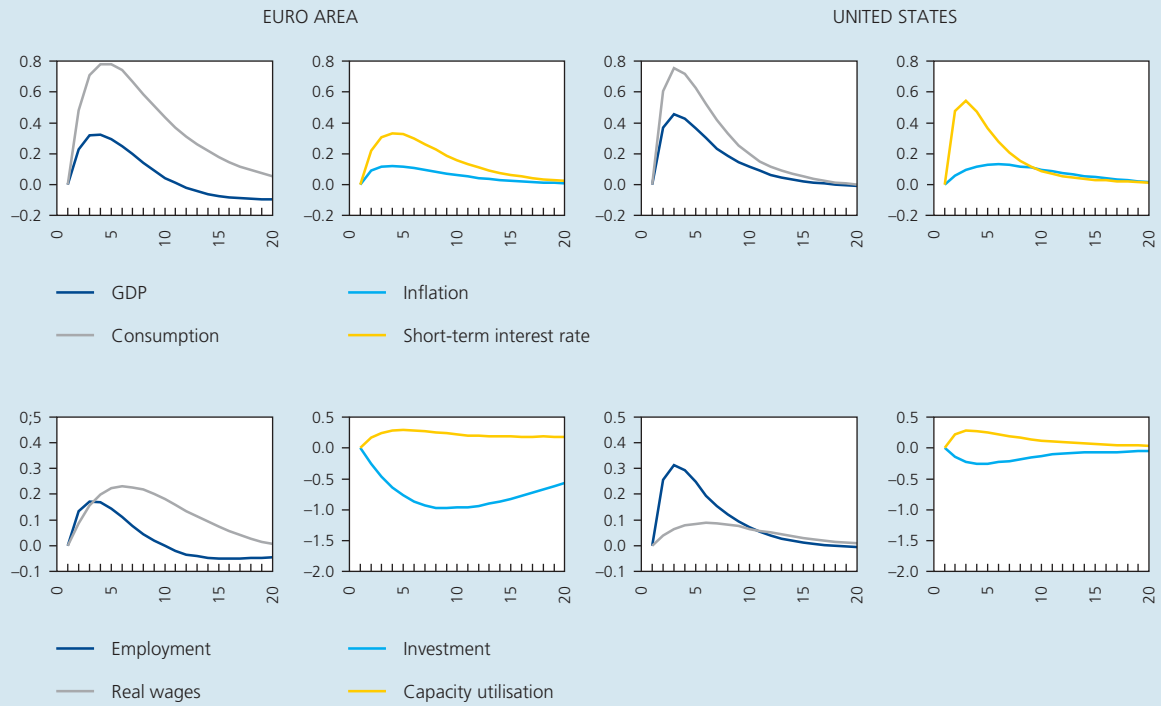


CHART 1C IMPULSE-RESPONSE FUNCTION FOR A SHOCK AFFECTING THE PRICE MARK-UP

(Deviation relative to base, in percentage points)

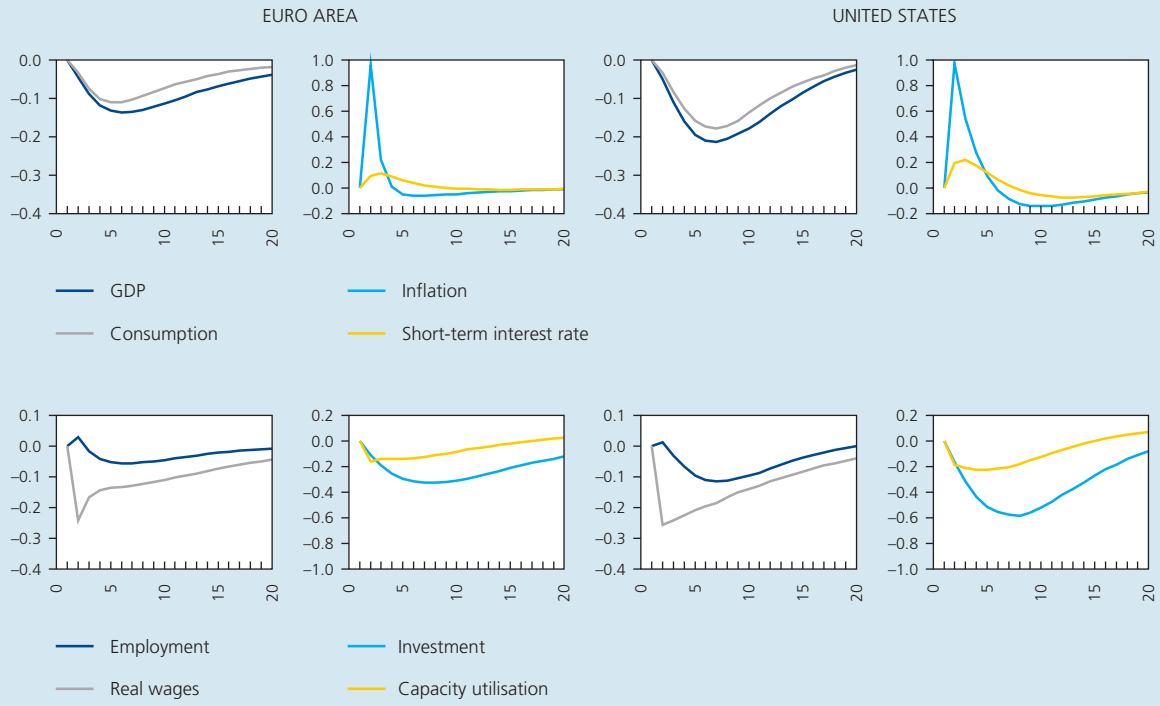
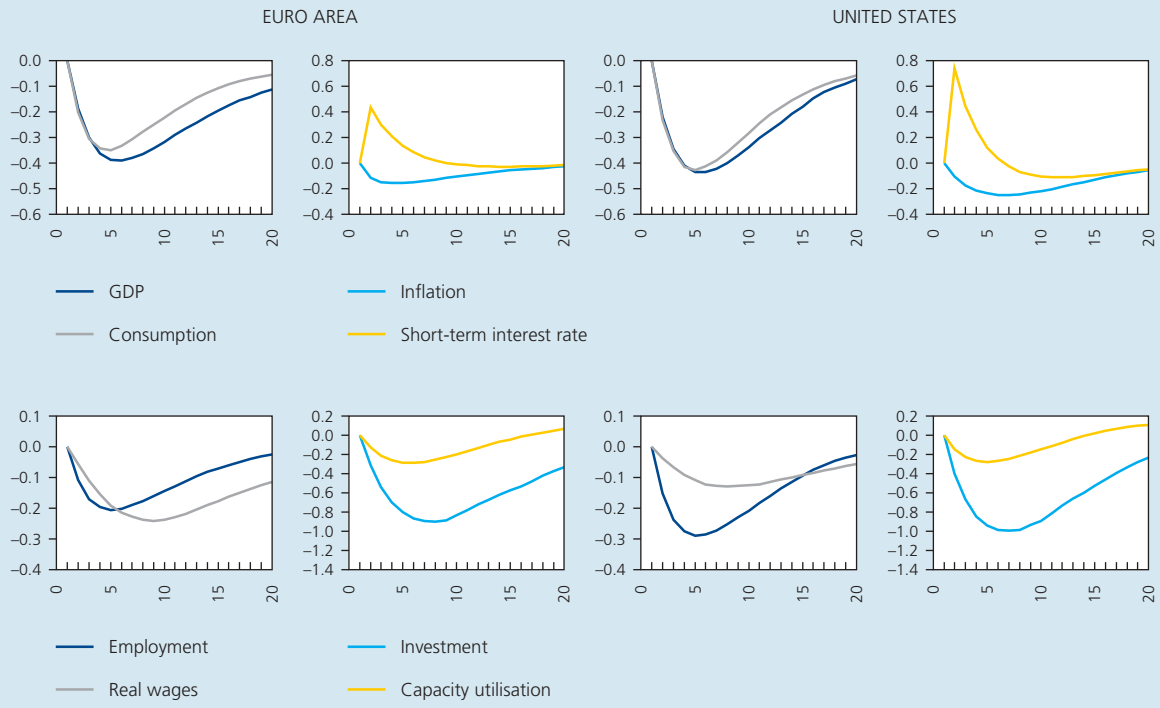


CHART 1D IMPULSE-RESPONSE FUNCTION FOR A MONETARY SHOCK AFFECTING THE SHORT-TERM INTEREST RATE

(Deviation relative to base, in percentage points)



relationships also frequently produce very comparable estimation results for the two economies : for instance, Gali and Gertler (1999) and Gali et. al. (2001) estimate the same nominal rigidity for price-fixing in the US and in the euro area. Our estimation results relating to nominal rigidities also tally closely with those results.

2. Decomposing the business cycle into the underlying shocks

The cycle or, in other words, the volatility of the economies considered, can be decomposed in two ways. First, it is possible to arrive at an average split of the cyclical volatility of each of the variables considered. Here, "average" means the average contributions made by the shocks over the period considered, namely 1974-2002. This exercise can be performed for various prediction horizons : what is the expected average variation of output, employment, inflation or the interest rate in a prediction exercise over one quarter, four quarters, ten quarters or thirty quarters. For each of these horizons, the variance recorded in the variables can be broken down into the various shocks, revealing the extent to which the shocks have contributed to the expected average variance of the variables over that horizon. Since thirty quarters – or about eight years – corresponds to the average length of the cycle, a breakdown over that horizon will indicate which shocks determine the long-term economic picture.

A second way of effecting the decomposition is to consider the values recorded for the different variables during specific observation periods and ascribe them to the historically specific shocks which gave rise to them. Such an exercise may give some idea, for example, of the shocks which have occurred during the last four recession periods (1974-1975, 1981-1982, 1990-1992-1993, 2000-2002) or during the intervening economic expansion phases.

2.1 Average decomposition of the cycle in the euro area and in the US

If we consider the decomposition of output, measured on the basis of GDP, then it is apparent that the volatility or variance of output over a short prediction horizon of between one quarter and one year is determined mainly by the various demand shocks (Chart 2). Shocks in government spending or in other exogenous components of demand, preference shocks in consumption or monetary stimuli are dominant here ; they determine over half of the total variance in the output of the euro area and more than 70 p.c. of the variance in US output. However, the influence of these shocks is short-lived and over a longer horizon it is the "supply" shocks that are dominant. Here, supply shocks means mainly TFP shocks and labour supply shocks. Over a 10-quarter horizon, these two shocks account for roughly 70 and 50 p.c. of the variance in the euro area and the US respectively. Over an eight-year horizon, those figures increase to 87 and 74 p.c. This decomposition of the trend in output ties in closely with other results in the literature. A SVAR model for the US-based study by Shapiro and Watson (1988) also showed that, taken over a longer horizon, shocks in the labour supply and productivity are the predominant factors dictating the pattern of the cycle, while demand shocks are more important in the short term.

In consumption, too, the supply shocks mentioned above (TFP shocks and labour supply shocks) appear to be the main driving force behind the long-term trend. Demand shocks once again play a key role in short-term consumption trends. Here it is the shock of intertemporal preferences – i.e. exogenous changes in consumer spending patterns, causing people to postpone or accelerate their consumption – that predominates. Monetary policy also influences consumption over shorter horizons, precisely because it has an impact, via the interest rate, on the consumer's intertemporal decisions. The importance of these two demand shocks for short-term consumption trends is evidently rather greater in the US than in the euro area.

Apart from the two supply shocks which affect GDP and consumption (namely TFP shocks and labour supply shocks), the long-term investment trend is also influenced by the productivity shock specific to capital goods. Together with the more volatile shock in the cost of financing investments, this more persistent shock also largely explains the short-term volatility of investment.

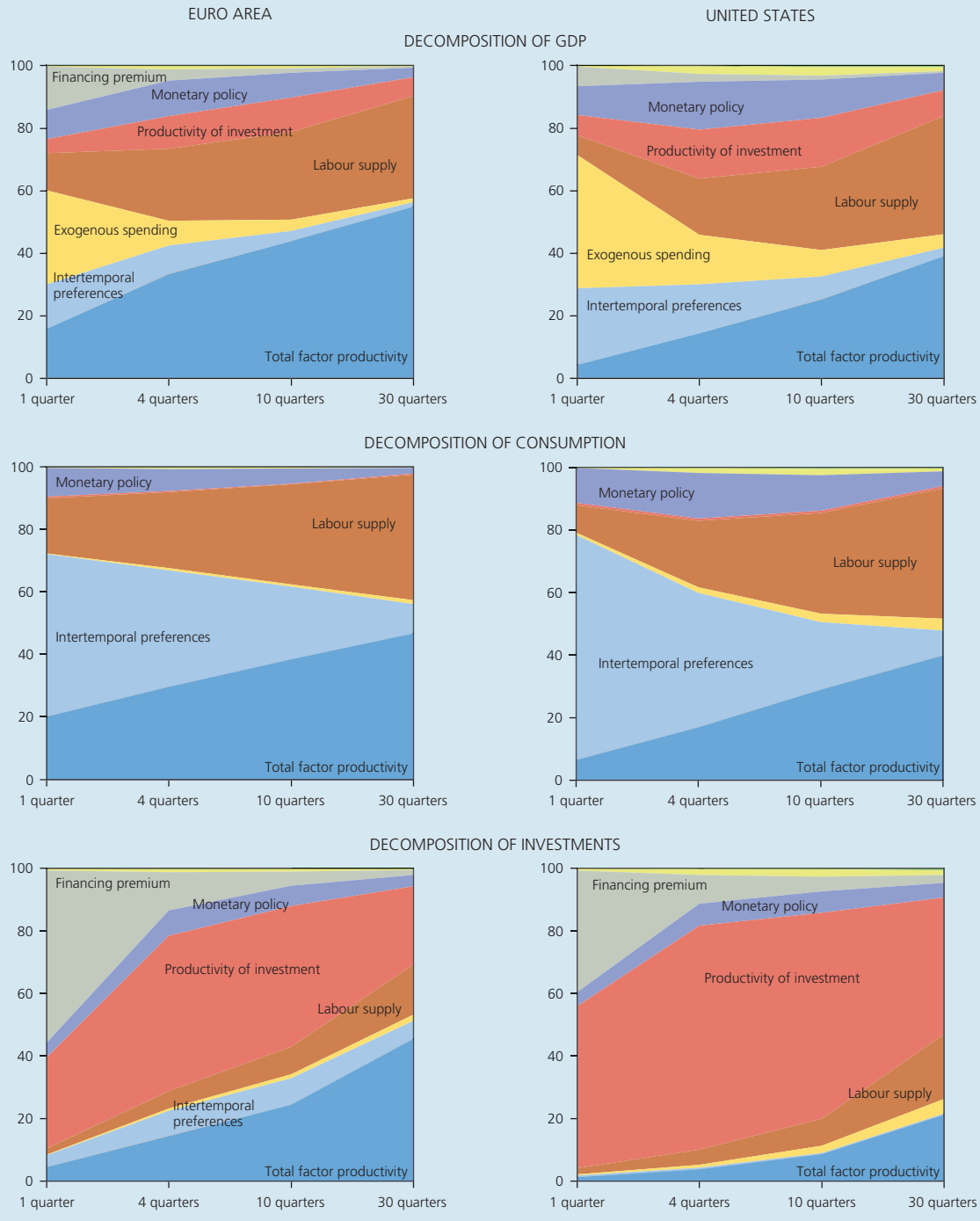
As regards the movement in real wages, the shock in the wage mark-up plays a key role in the short term. This concerns short-term variations in the influence of labour as a production factor on wage-setting. The labour supply has hardly any influence on real wages. In the long term, the TFP shock is the principal fundamental economic determinant of wages. Technological progress is thus reflected in an increase in production together with an increase in purchasing power, generating the demand to absorb the greater production capacity.

The labour supply is the only important factor in the long-term employment picture. In contrast, the productivity shock plays little if any part in employment in the long term. On the other hand, the short-term employment trend is greatly influenced by the TFP shock, as well as by the demand shocks which also affect output.

Overall, it is evident that the monetary policy shock plays only a relatively minor role in the decomposition of the real variables. However, this must not be interpreted as meaning that monetary policy is unimportant for what actually happens in the economy. The influence of the various shocks on the real decisions is largely determined by the central bank's systematic policy. A typical example is the impact of a productivity shock. The short-term

CHART 2 DECOMPOSITION OF OUTPUT AND DEMAND COMPONENTS IN THE EURO AREA AND IN THE UNITED STATES (1)

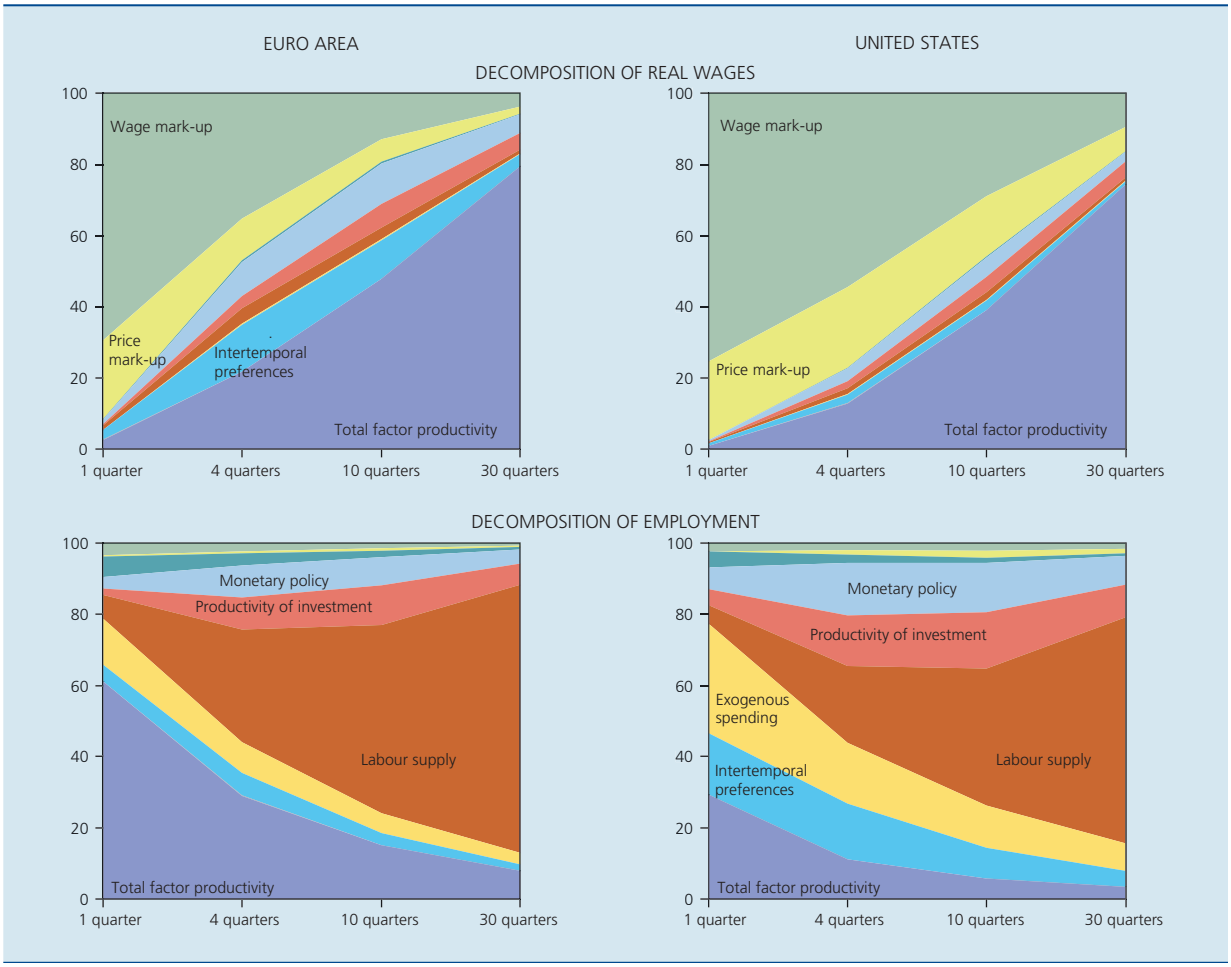
(Percentage contributions of the various shocks to the variance)



(1) The decomposition of the average variance of the prediction error for an horizon of between 1 quarter and 30 quarters, calculated on the basis of the estimated models.

CHART 3 DECOMPOSITION OF REAL WAGES AND EMPLOYMENT IN THE EURO AREA AND IN THE UNITED STATES

(Percentage contributions of the various shocks to the variance)

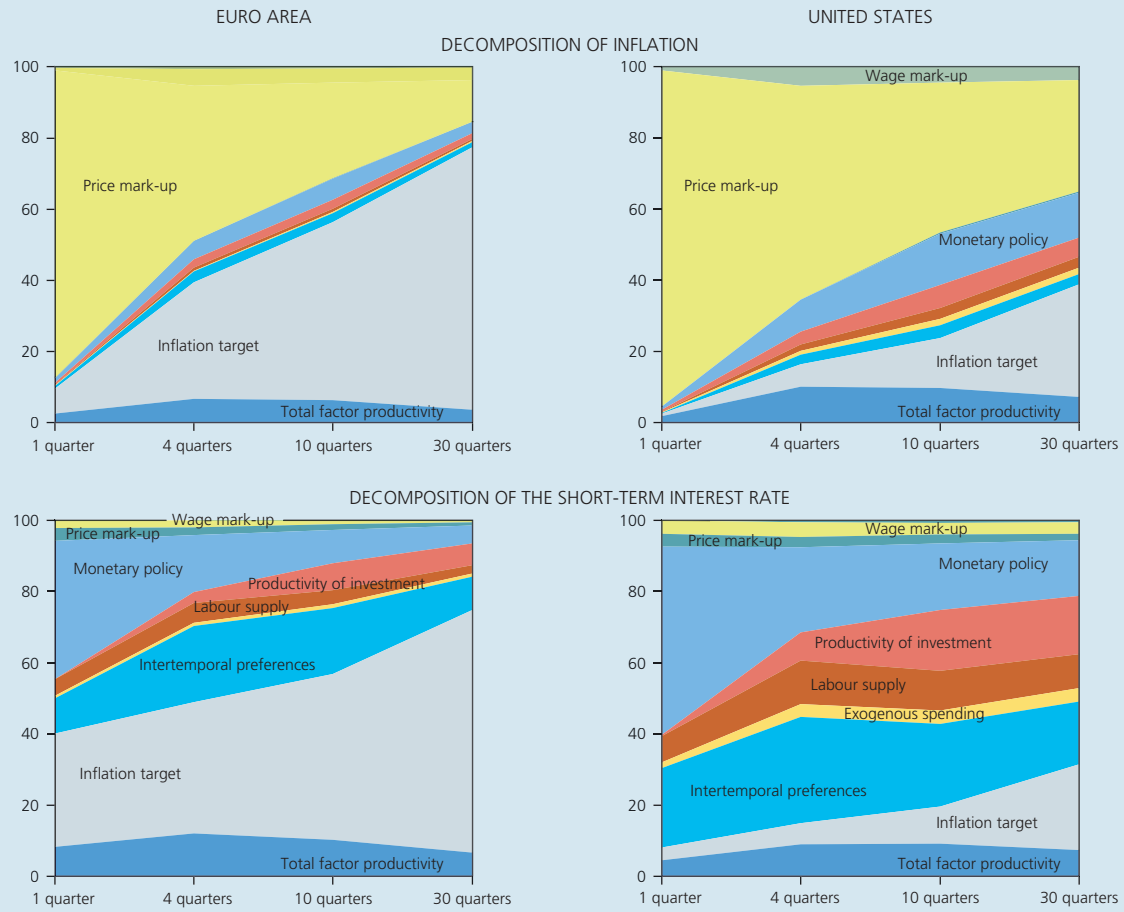


expansionary effect of a productivity shock depends very much on how accommodating monetary policy is in its response to such a shock. If the nominal interest rate remains unchanged in the event of an exogenous positive shock in productivity, the real interest rate will rise as a result of the fall in marginal costs, prices and inflation expectations. Such an increase in the real interest rate will have a negative influence on the demand components which may largely offset the positive wealth effect of the shock. In that situation, employment will contract and the negative pressure on costs and prices will consequently be further exacerbated. Given such a restrictive monetary response to productivity shocks, demand and output will show only a modest increase while employment will contract. Under those circumstances, one can hardly expect the productivity shocks to provide the main explanation for the cycles, as a key feature of the economic cycle is that output and employment show a positive correlation throughout the cycle. A productivity shock has a totally different effect in the case of a highly accommodating monetary policy that supports demand as much as possible in order to take advantage of the increased production capacity of the economy. Such a response by monetary policy is more probable if, on the one hand, the interest rate systematically produces a sharper response to inflation and if, on the other hand, the output gap – to which monetary policy may respond – is correctly estimated, which means that the estimated production potential and hence the output target is in fact adjusted upwards as a result of increased productivity.

However, monetary policy plays a far more visible role in the nominal course of the economy. Thus, monetary policy – certainly in Europe – is by far the most important determinant of inflation in the long term. A shock in the inflation target plays a particularly important role. That also explains the importance of announcing an explicit inflation target which, if credible, forms an anchor point for inflation expectations and thus becomes an important factor determining long-term inflation. In the short term,

CHART 4 DECOMPOSITION OF INFLATION AND THE SHORT-TERM INTEREST RATE IN THE EURO AREA AND THE UNITED STATES

(Percentage contributions of the various shocks to the variance)



inflation is determined to a large degree by what is called the mark-up shock which – by definition – is exogenous so that the monetary authority has no control over it. For the intermediate horizons (4 and particularly 10 quarters), monetary policy gradually acquires more control over inflation. That also explains why the definition of price stability applicable to the Eurosystem is explicitly geared to the medium term.

The upward trend in inflation during the 1970s and the downward trend since the early 1980s are thus largely attributed to changes in the systematic behaviour of the central bank and more particularly to the inflation target applied. In the model, such systematic disinflation is indeed associated with a fairly modest influence on the real economy. The model may perhaps underestimate the "sacrifice ratio" of such disinflation, because the estimation implicitly assumes that all economic agents immediately adjust their inflation expectations in line with the modified monetary policy. Presumably this takes much longer to happen in reality, and only results from the negative output and employment effects which such a tightening of policy entails in the short term.

The inflation target shock also plays an essential role in the other nominal variable, namely the short-term interest rate. In the euro area, the inflation target is manifestly the main factor determining the long-term trend in the short-term interest rate. In addition, the monetary policy shock itself is a driving force behind short-term interest rates, and in the United States the same holds true for intermediate and even long-term horizons. The monetary policy shock must therefore be interpreted as an exogenous deviation in the interest movements generated (endogenously) by the reaction function of the monetary authorities. The reaction function comprises the systematic component of monetary policy, whereas the monetary policy shock reflects the discretionary component, e.g. if the monetary policy response to the output gap, or to an inflation level that deviates from the target, is more (or less) marked

than usual, or if monetary policy reacts to economic developments which are not modelled in the reaction function. The fact that, for all horizons considered, the monetary policy shock is greater in the United States than in the euro area indicates that monetary policy there has been conducted less systematically in the past.

2.2 Decomposition of output during specific periods of recession and economic expansion

The analysis of the specific periods of expansion and recession in terms of underlying shocks is more informative than their average decomposition. In this respect, it is necessary to draw attention to the diversity of the shocks which occurred during the four recession periods considered, even though the shocks affecting demand generally played a very important role. Table 1 contains the estimates, based on the general equilibrium models, of the contribution of the various types of shocks to the growth of GDP in the euro area and in the United States during those specific periods. The table presents the contributions which the various shocks made to growth during certain sub-periods.

During the 1974-1975 recession, a series of negative shocks affected the determinants of investment and the intertemporal preferences underlying consumption expenditure (in the United States only). In the euro area, a significant fall in exogenous demand was also recorded, probably as a result of the decline in world trade following the oil shock. The increased price mark-up, probably also

TABLE 1 DECOMPOSITION OF GDP DURING SPECIFIC PERIODS OF RECESSION AND EXPANSION

(Percentage contributions to the growth of GDP during the period in question)

	Decomposition of the four recessions in the euro area and in the US							
	Euro area	US	Euro area	US	Euro area	US	Euro area	US
	74:1 – 75:1		80:1 – 82:4		92:1 – 93:2	90:1 – 91:4	00:2 – 02:2	
TFP shock	–0.27	–0.57	–0.27	–0.38	1.08	0.96	–2.79	2.49
Labour supply shock	–1.66	–1.45	0.65	–1.06	–0.74	–0.42	2.44	0.11
Investment shock	–1.04	–0.98	1.61	0.42	–1.59	–2.20	–0.90	–2.64
Intertemp. pref. shock	0.12	–1.33	–1.71	0.01	–1.29	–1.76	–0.15	–1.68
Exog. spending shock	–1.59	–0.38	0.33	–0.66	0.68	0.72	0.89	0.17
Monetary policy shock	1.28	0.02	–3.02	–5.16	–0.77	0.06	1.00	–0.47
Iinflation target shock	–0.05	0.00	0.07	–0.01	0.02	0.01	0.00	–0.01
Financing shock	–0.47	–0.33	–0.27	–0.42	–0.46	–0.47	–0.31	–0.39
Price mark-up shock	–0.37	–1.07	0.13	–0.72	0.21	–1.09	–0.10	0.93
Wage mark-up shock	0.03	0.07	0.00	–0.25	–0.12	0.36	0.06	–1.06

	Decomposition of the three expansion periods in the euro area and in the US					
	Euro area	US	Euro area	US	Euro area	US
	75:1 – 80:1		82:4 – 92:1	82:4 – 90:1	95:1 – 00:2	
TFP shock	4.87	–1.72	4.96	–2.03	0.60	1.34
Labour supply shock	–0.42	0.49	9.53	11.05	7.33	1.52
Investment shock	2.26	3.61	2.57	–2.15	–2.33	1.31
Intertemp. pref. shock	2.76	2.67	0.08	0.46	1.58	1.17
Exog. spending shock	1.15	–0.91	–0.06	2.47	–0.28	–0.18
Monetary policy shock	1.53	–0.68	–1.73	1.66	1.10	1.21
Inflation target shock	–0.03	–0.08	0.01	–0.06	–0.03	–0.04
Financing shock	0.42	0.90	0.42	0.29	–0.11	0.07
Price mark-up shock	0.55	1.41	–0.03	0.82	–0.31	0.78
Wage mark-up shock	–0.36	–0.39	0.30	0.63	0.14	1.11

due to the oil shocks, had a negative impact on output, especially in the United States. Moreover, a negative shock affecting the labour supply led to increased pressure on labour costs and exerted a negative influence on activity in both economies. That shock could also be linked with the oil shock, which caused labour costs to rise owing to wage rigidity.

In both Europe and the United States, the 1980-1982 recession was determined to a large extent by the reversal of monetary policy. As pointed out earlier, a perfectly credible change to the inflation targets in the context of monetary policy has only a minor negative effect on output. That is why the model first considers the tightening of monetary policy applied in the early 1980s as a series of short-term changes in interest rates. Such interest rate shocks have a greater negative impact on demand. The change in monetary policy is only gradually reflected in a permanent shift in the inflation target. That interpretation of the recession in the US in the early 1980s conforms overall to the one given in the literature concerning the turn of on the monetary policy pursued by the Federal Reserve System while Paul Volcker was chairman, following the more accommodating stance which had characterised the 1970s. In Europe, too, those years coincided with the first phase of adjustment on the road to greater monetary stability within the EMS. The long period of negative real interest rates in the 1970s was thus succeeded by a period of high real interest rates in the 1980s.

The fact that the recession which occurred in the early 1990s was not synchronous between the US and the euro area was due mainly to German reunification. Despite the different timing, the two recessions were caused mainly by the shocks affecting the propensity to consume and invest. Although it is debatable whether the shock affecting investment is a demand shock or a supply shock, the decline in demand during that period seems to have been considerable (the temporary rise in the cost of financing investment is another reason for that recession).

The latest recession in the US presents exactly the same profile. For the euro area, the situation is less clear. Although a number of negative shocks affecting demand did occur in mid 2001, influencing consumption, investment and exogenous or public spending, their overall impact during the period in question was relatively neutral. However, what is striking is the large difference in the contribution of productivity to economic growth in the euro area and in the US during this recent period: while the increase in productivity made a positive contribution to economic activity in the US, in the euro area the contribution of productivity appears to have been decidedly negative. The latest recession therefore did show a different profile in the two economies.

It is also noticeable that the exogenous demand shock during each of the recession periods considered did not make any really negative contribution to growth. Since, in a closed economic model, this is the only channel through which external demand can influence the economy, that may well mean that the traditional channel for the transmission of a decline in economic activity via the trade flows did not play a crucial role during these recessions. It is more a question of general shocks which had a more or less simultaneous negative impact on activity. However, the specific character of those general shocks varied over time: oil prices and the labour supply during the 1974-1975 recession, monetary policy in 1980-1982, asynchronous demand shocks in the early 1990s. It is only the demand shocks affecting consumption and the negative investment shocks that apparently recurred during the various recessions.

As already stated, the longer periods of economic recovery are supported mainly by positive developments concerning productivity and the labour market. The fact that the euro area in the 1970s and 1980s featured strong growth of productivity may be attributable largely to the radical sectoral restructuring during that period. In the 1980s and – for the euro area – during the whole of the last decade of the 20th century, there were significant positive developments affecting labour supply. During the expansion period of the 1980s, the growth of real wages remained relatively modest, despite the strong expansion in employment and consumption. The model therefore interprets that as an exogenous increase in the labour supply affecting the trend in wages and consumption. It should be noted that, for the US, all variables are expressed per capita (population over the age of 16), so that fluctuations in immigration should not have any direct effect on the results.

2.3 The output gap concept in these general equilibrium models

Unlike the traditional Keynesian view on recession periods, general equilibrium models do not necessarily see a recession as an undertilisation of capacity and a period of negative output gap, because in these models the production potential is determined by the whole of the structural or fundamental shocks to which households and firms react in a totally rational and efficient way.

The output gap concept in these models is typically calculated as the difference in output that results from the fundamental shocks in technology and preferences in the model "with" nominal rigidities on the one hand, and in the model "without" nominal rigidities on the other. In the model, the nominal rigidities form the main reason why the economic agents do not adapt their real decisions immediately to the altered circumstances. The difference between the outcome in the economy "with" and "without" nominal rigidities therefore reflects the inefficiency of the economy. An economic policy and in particular a monetary policy geared to the stability of (rigid) prices

CHART 5A THE NATURAL OUTPUT GAP AND ITS DETERMINANTS IN THE EURO AREA

(Deviation from a linear trend, in percentage points)

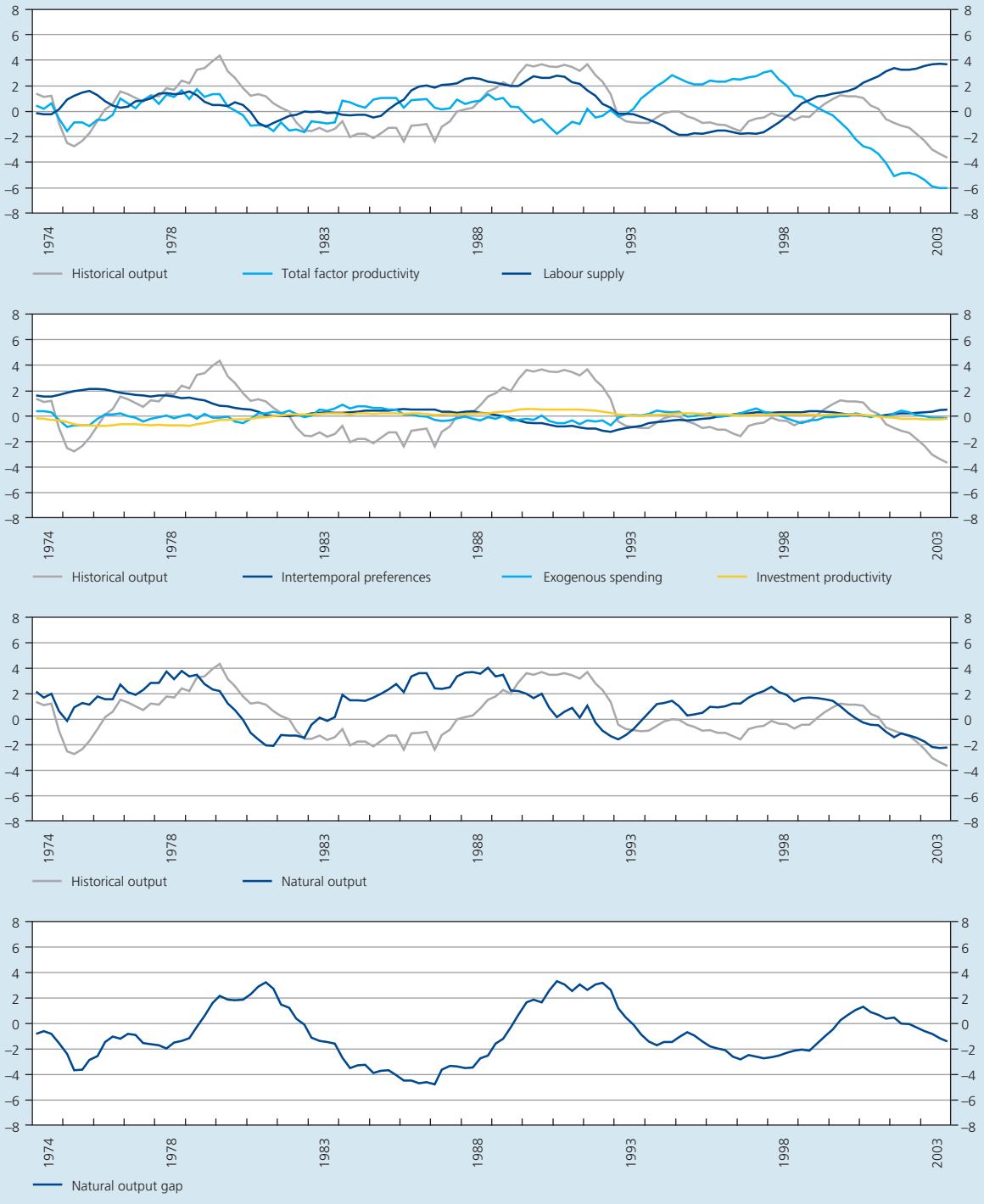
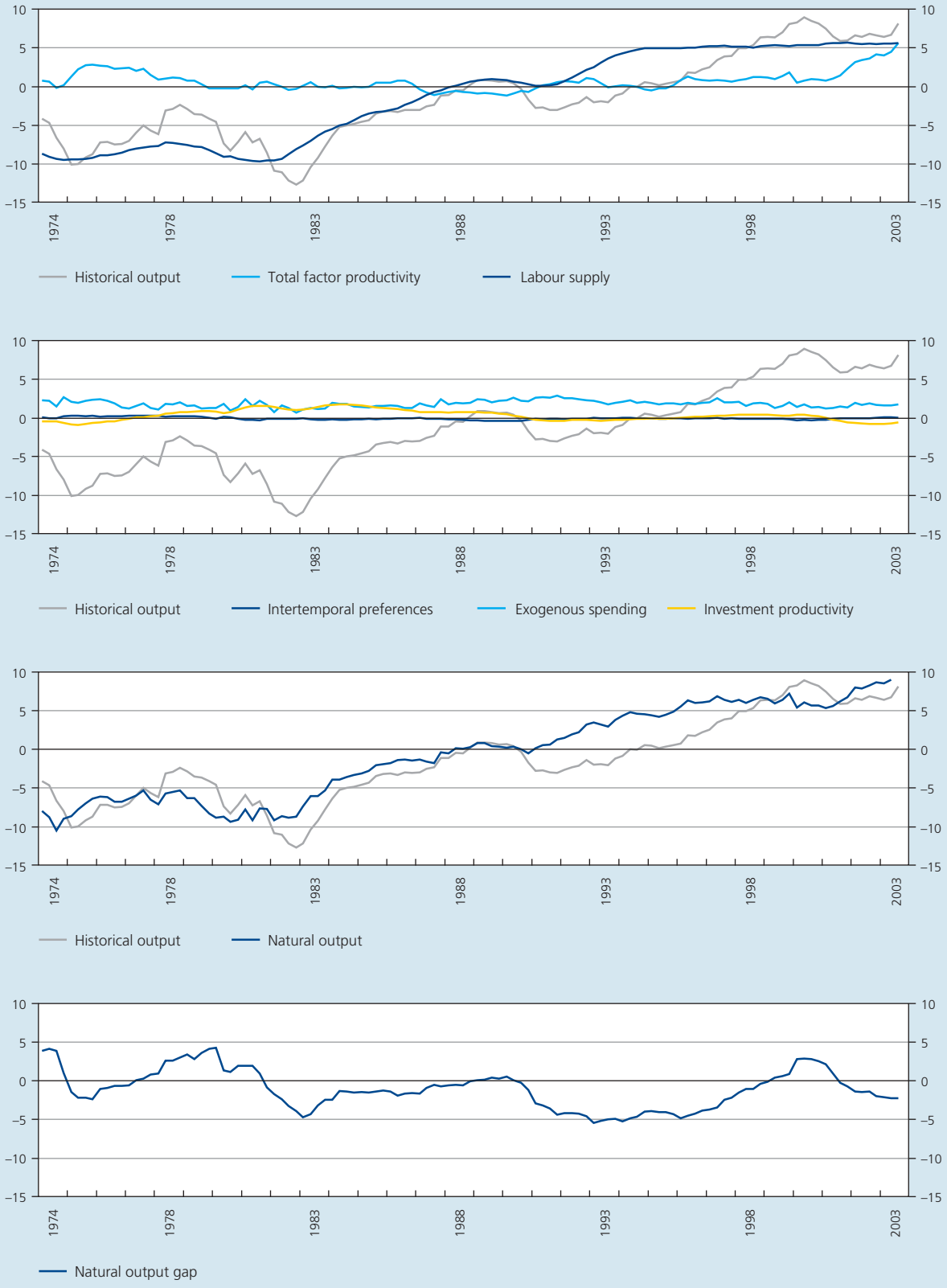


CHART 5B THE NATURAL OUTPUT GAP AND ITS DETERMINANTS IN THE UNITED STATES

(Deviation from the linear trend, in percentage points)



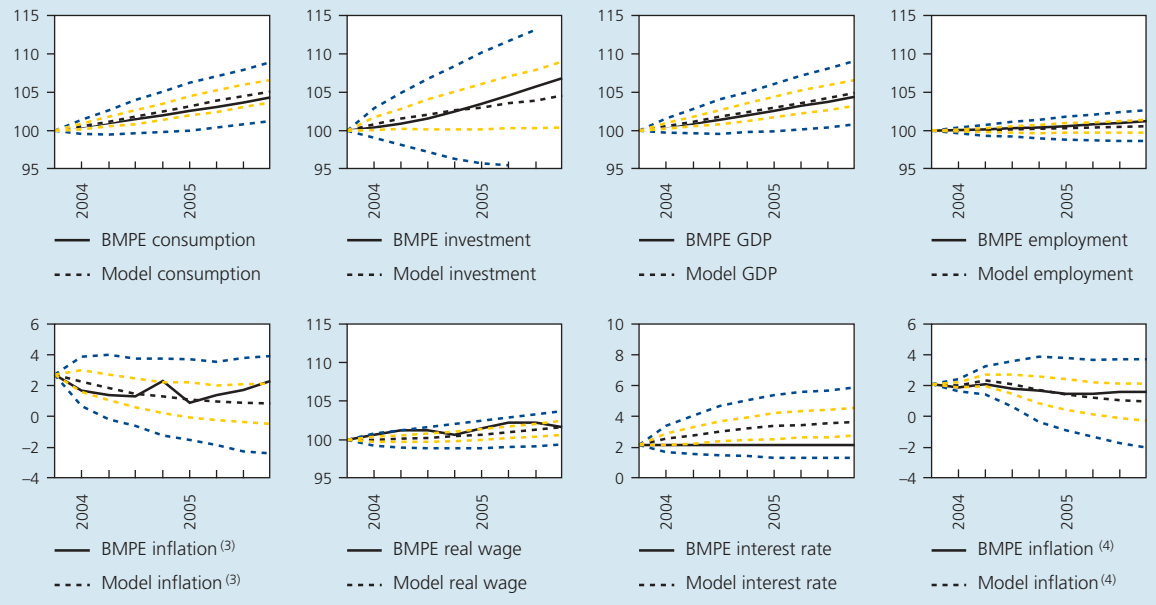
and wages, will therefore lead to a smaller output gap and to more efficient adjustment of the economy to the underlying fundamental shocks. In the charts, the output gap is estimated for the two economies: the top two charts show the contributions to potential output made by persistent fundamental shocks. The third chart shows the actual output and the natural or efficient output (calculated as the sum of the contributions of the various fundamental shocks), with a linear trend growth removed from both series. Finally, the fourth chart shows the natural output gap.

In these models, recession periods therefore do not necessarily coincide with negative output gaps, since the underlying shocks may also cause a sharp reduction in production potential. The natural output in the model does indeed decline sharply during each recession period, which explains why recessions do not automatically coincide with periods of weaker inflationary pressure. This concept of the output gap therefore largely avoids the potential conflict between the two monetary policy objectives, namely stable inflation and a stable output gap.

2.4 Predictions based on the model for the euro area

The model can generate a prediction on the basis of the interpretation of recent economic developments. By way of example, chart 7 shows the results of such a prediction exercise together with the outcome of the macroeconomic projection produced by the Eurosystem (Broad Macroeconomic Projection Exercise – BMPE). The prediction runs from the last quarter of 2003 through 2004 and 2005. While the BMPE indicates only the central scenario on the assumption that the short-term interest rate remains constant (the continuous line in the charts), the model offers not only a central prediction but also a margin of uncertainty for that prediction (dotted lines for the 5 p.c. and 25 p.c. upper and lower bounds). Moreover, the model prediction can also be based on an alternative assumption regarding monetary policy.

CHART 6 PREDICTION BASED ON THE MODEL FOR THE EURO AREA COMPARED WITH THE BMPE PREDICTION FOR 2004-2005 (1) (2)



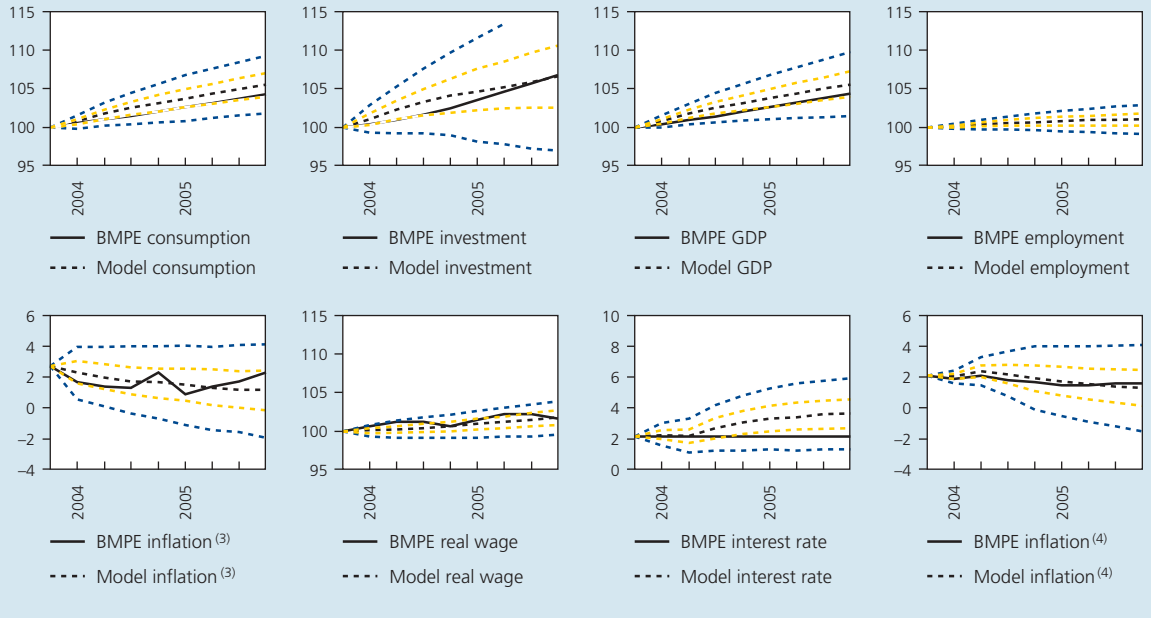
Source: ECB Monthly Bulletin, December 2003, and own calculations
(1) The blue (yellow) dotted lines indicate the 25% (5%) upper and lower bounds of the predictions.
(2) Compared to the fourth quarter of 2003 (base = 100).
(3) Percentage change compared to the preceding quarter (on an annual basis).
(4) Percentage change compared to the previous year.

The central model prediction is very similar to the BMPE prediction for the components of demand, GDP and employment. The model produces a slightly lower estimate than the BMPE for the movement in real wages and inflation during 2005. According to the model, the short-term interest rate will gradually move back up to its historical average level.

Chart 7 below repeats the prediction for an interest rate scenario in which the interest rate does not begin to rise until the second half of 2004. These additional negative interest rate shocks lead to more buoyant demand and increased output in the second half of 2004 and 2005. According to this scenario, inflation will therefore accelerate during 2005. In the second half of 2004, the interest rate rises more steeply to its normal level as a result of the more dynamic economic activity and less favourable inflation outcomes. According to this interest rate scenario, growth will speed up slightly during 2004, though the effect is offset by a decleration in 2005.

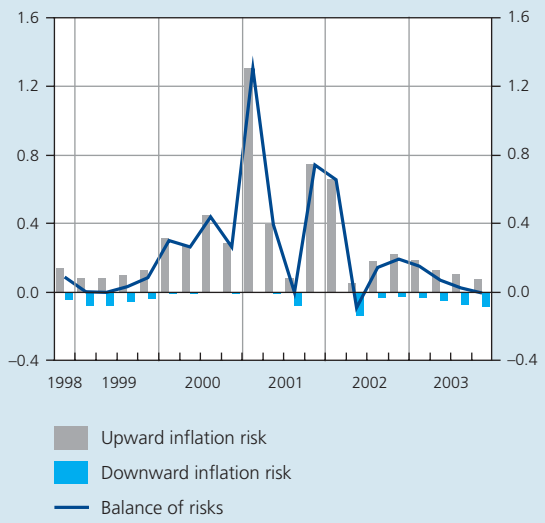
The margins of uncertainty around the central prediction are due to two components: the uncertainty concerning the model parameters and that concerning the future occurrence of the exogenous shocks. The uncertainty is generated mainly by the possible future shocks in the exogenous processes for technology, preferences and government intervention. In order to estimate that uncertainty, the model simulation is supplemented with stochastic shocks which, in terms of their average size, correspond to the estimated standard deviations. The margins of uncertainty are then calculated as the highest and lowest 5 p.c. and 25 p.c. of the predictions for a large number of simulations. These margins can also be used to calculate the probability of certain scenarios. Monetary policy makers attach great importance to risk scenarios in which inflation is too high (risk of inflation running at over the 2 p.c. target during the ensuing year) or in which there is a risk of deflation (risk of inflation averaging less than zero during the ensuing year). The difference between the two, namely the risk of rising inflation and the risk of deflation, is called the balance of risks. These risks were calculated on the basis of the predictions formulated quarterly since 1999 and are then combined in a chart. The balance of risks equalled zero for the first time during 1999, a period that coincided with the uncertainty about the impact on the real economy of the financial crises which occurred during 1998. In 2002 the risk balance became negative: during that period, the risk of deflation was estimated to exceed the risk of

CHART 7 PREDICTION BASED ON THE MODEL FOR THE EURO AREA WITH THE SHORT-TERM INTEREST RATE CONSTANT FOR THE FIRST HALF OF 2004, COMPARED TO THE BMPE PREDICTION FOR 2004-2005 (1) (2)



Source : ECB Monthly Bulletin, December 2003, and own calculations.
(1) The blue (yellow) dotted lines indicate the 25% (5%) upper and lower bounds of the predictions.
(2) Compared to the fourth quarter of 2003 (base = 100).
(3) Percentage change compared to the preceding quarter (on an annual basis).
(4) Percentage change compared to the previous year.

CHART 8 RISK ANALYSIS BASED ON THE MODEL PREDICTIONS



(1) Inflation predictions above and below the margin, multiplied by their respective probability.

inflation. These relatively low inflation predictions reflect the impact of the sluggish growth on inflation expectations. In the course of 2003, the equilibrium in the inflation risk was restored.

Risk analyses like these can provide additional information which cannot be deduced directly from the traditional central prediction results. For the policy makers, during periods of increased, uncertainty, they can offer an idea of the risks of certain extreme outcomes. Policy cannot be geared to the optimum outcome according to the average scenario alone, but must also endeavour to avoid extreme situations as far as possible. That type of consideration is attracting increasing attention in the central bank terminology. Alan Greenspan, chairman of the Federal Reserve Board (2003), recently therefore described monetary policy as a risk management exercise, since the economic environment is changing faster and becoming harder to predict than before.

CHART 9 DECLINE IN THE VOLATILITY OF ECONOMIC GROWTH

(Percentage growth of GDP, quarter on quarter)

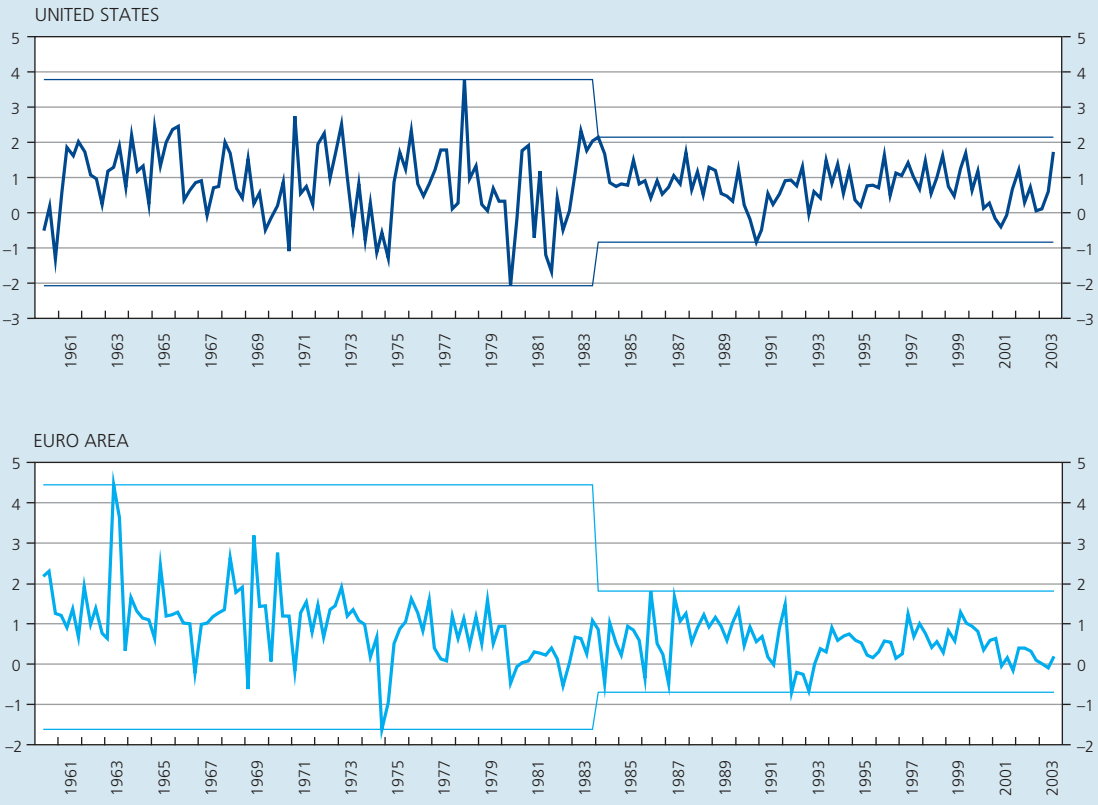


TABLE 2 DOWNWARD TREND IN THE VOLATILITY OF THE REAL ECONOMY

	Variance of real growth in the euro area			Variance of real growth in the US		
	1960-2003	1960-1983	1984-2003	1960-2003	1960-1983	1984-2003
GDP growth	0.77	1.16	0.29	0.61	0.80	0.25
	1974-2003	1974-1983	1984-2003	1974-2003	1974-1983	1984-2003
GDP growth	0.35	0.47	0.29	0.73	1.53	0.30
Consumption growth	0.30	0.35	0.28	0.50	0.90	0.27
Investment growth	2.07	2.11	1.94	5.42	10.51	2.94
Employment growth	0.09	0.47	0.10	0.51	0.97	0.28
Growth of real wages	0.29	0.38	0.22	0.31	0.22	0.36
Change in inflation	0.10	0.16	0.08	0.08	0.15	0.05
Change in short-term interest rate	0.03	0.05	0.01	0.08	0.20	0.02

3. Decline in the volatility of economic growth in recent decades

During the past thirty years, economic activity has become less volatile. From 1984 to the present day, the variance in GDP growth (quarter on quarter) in both the euro area and the US has more than halved compared to the period 1960-1983. That lower volatility is reflected very generally in a range of macroeconomic aggregates and economic sectors, but also in various countries. However, this trend does differ from sector to sector and from country to country: in the US, for example, a sudden break clearly occurred in 1984. In a recent report on structural shifts within the European economy (5th Structural Issues Report, MPC 2003), the ECB also discusses this trend in detail. According to some sources, volatility has actually declined more sharply in Europe than in the US.

Table 2 offers a summary of this trend in volatility for the various aggregates in both economies.

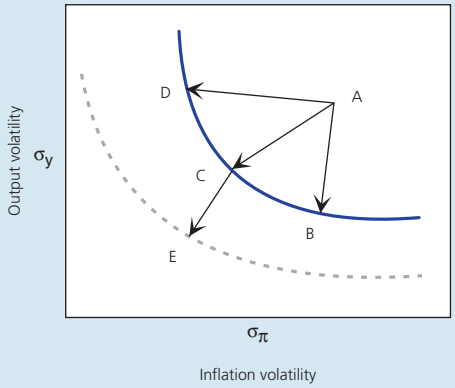
There are three main theories put forward to explain this increased stability in economic growth, and they can be verified on the basis of simulations using the general equilibrium model.

3.1 A more efficient monetary policy

A first theory is that the real stability is a by-product of greater nominal stability or more stable inflation due to a more efficient monetary policy. This debate focuses mainly on monetary policy because there are clear signs of a change in that policy, e.g. in terms of inflation stability.

However, a more efficient monetary policy will not necessarily result in greater real stability. The effect produced by monetary policy on both real and nominal volatility is summarised in chart 10. The two monetary policy objectives, namely output volatility (σ_y) and inflation volatility (σ_π), are shown on the two axes. For a particular variance

CHART 10 POTENTIAL IMPACT OF MONETARY POLICY ON REAL VERSUS NOMINAL VOLATILITY OF THE ECONOMY



in the exogenous shocks and a particular economic structure, an efficient monetary policy will have an "efficiency frontier" shown by the curve DCB. Each of the points on that curve indicates the outcome of an efficient policy, but for different central bank preferences as regards the relative importance attached to inflation stability and output stability respectively. In contrast, under these conditions point A indicates a monetary policy that does not produce the optimum response to the various shocks. Many writers have described the experience of the 1970s, when inflation was accelerating, as the result of such an inefficient policy that produces too weak a response to inflationary pressure. On the assumption that monetary policy in the 1970s was not implemented efficiently and was therefore typically at point A, a more efficient policy can cause a shift to each of the three points D, C or B. Furthermore, if the shocks become smaller or if the economic structure evolves towards a more stable economy, the whole "frontier" will move farther out, making result E achievable.

The general equilibrium model can be used to investigate which of the three movements – AD, AC or AB – is the most likely outcome of a more efficient monetary policy. The impact of various monetary policy rules on the combination of real/nominal volatility can then be examined for a particular size of exogenous shocks. Stock and Watson (2003) duly carried out this exercise on the basis of four macroeconomic models (including our models for the US and the euro area). A switch from a relatively accommodating monetary policy towards a stricter anti-inflation policy always produced an internal movement that was closer to the shift AC (or even AD) than to the shift AB. In other words, σ_π (inflation volatility) becomes smaller, but that does not necessarily hold true for σ_y (output volatility). A more efficient monetary policy therefore did indeed contribute towards greater real stability in the economy, but that is not a sufficient explanation in itself.

3.2 Shifts or changes in the economic structure

In this context, three different structural changes in the economy are often mentioned.

First, there is the long-term **shift in the sectoral production structure** away from industry in favour of the services sector. In this context, it is pointed out that the more volatile sectors – e.g., those which produce durable goods – are becoming smaller in relative terms in favour of services sectors, which are more stable. A simple exercise in which the sectoral production structure is kept constant both before and after the mid 1980s but retaining the sectoral growth which occurred during the more recent period shows that this shift made only a small contribution to the increased stability.[1] Furthermore, these sectoral shifts are typical long-term phenomena which can hardly explain a sudden break in volatility, such as that seen in the US.

A second explanation for the increased stability is based on the hypothesis **that firms are managing their stocks more efficiently**, perhaps with the aid of increasing computerisation and better communication facilities, so that the same fluctuations in demand now make output less volatile. Two findings support this assertion: output volatility is indeed falling more sharply than volatility in sales, especially in the highly cyclical sectors. In addition, before the mid 1980s stocks tended to make a pro-cyclical contribution in the sectors producing durable goods, whereas more recently stocks have tended to follow an a-cyclical pattern. However, more detailed studies at both sectoral and macroeconomic level have shown that, although it is important at the level of the individual firm, more efficient stock management cannot make a significant contribution towards maintaining more stable output during the economic cycle.

Finally, there is the hypothesis that **financial deregulation** has increased the probability of a more stable development in demand. Both the development of interest-bearing liquid assets and easier access to all kinds of credit should enable households to increase the stability of their spending over time, making it more closely aligned with their permanent income and less dependent on temporary shocks affecting current income. The main argument in favour of this is the greater stability in the US housing construction sector. On the other hand, household consumption in the US has become less stable, if anything, over the period considered.

3.3 Random decline in the variance of the fundamental shocks

Since the above hypotheses do not jointly offer any really convincing explanation for the increased stability, the only remaining possibility is that the world economy has been spared any serious exogenous shocks over the past twenty years. That implies that the reduced volatility cannot be guaranteed in the future.

Although our model estimations are based on the assumption that the volatility of the shocks remained constant over the entire period considered (1974-2003), the shocks which actually occurred can nevertheless provide

(1) The 5th Structural Issues Report (MPC 2003) also arrives at the same conclusion for the euro area.

TABLE 3 DOWNWARD TREND IN THE VOLATILITY OF THE ESTIMATED SHOCKS

	Variance of the shocks in the euro area			Variance of the shocks in the US		
	1974-2003	1974-1983	1984-2003	1974-2003	1974-1983	1984-2003
TFP shock	0.29	0.42	0.23	0.21	0.27	0.18
Labour supply shock	1.63	1.61	1.51	0.81	1.39	0.47
Investment shock	0.00	0.00	0.00	0.03	0.04	0.01
Intertemp. pref. shock	0.03	0.03	0.03	1.72	3.17	1.02
Exog. spending shock	0.12	0.17	0.09	0.29	0.51	0.18
Monetary policy shock	0.01	0.01	0.01	0.05	0.11	0.02
Inflation target shock	0.00	0.01	0.00	0.00	0.00	0.00
Financing shock	0.22	0.28	0.19	0.31	0.63	0.15
Price mark-up shock	0.03	0.05	0.02	0.03	0.04	0.02
Wage mark-up shock	0.06	0.07	0.05	0.08	0.04	0.09

an indication of whether shocks were indeed smaller in the more recent period. Quite a few of the shocks identified in the model do in fact present a variance which is declining over time. The table shows that the variance of the shocks in the euro area has fallen most sharply in the case of total factor productivity, exogenous demand shocks, the cost of financing investment and price mark-up shocks. In the US, too, the variance declined in the case of exogenous demand shocks, financing costs and price mark-up shocks, but it was also lower in interest rate shocks and intertemporal preferences regarding consumption. Hardly any of the shocks presented an increase in variance between the two periods.

The conclusion is that probably half of the decline in the recorded volatility is due to the absence of major shocks. Adjustments in the economy may perhaps account for a quarter to a half at most. In addition, the more efficient monetary policy has also contributed towards the real stability of economic growth. Being geared more towards stability, the monetary policy has also led to a more stable nominal inflation and interest rate, which in the long term may indirectly reduce uncertainty and thus create the framework for stable and sustained economic growth.

4. Synchronisation of the international business cycle and globalisation

Most studies unequivocally indicate a close connection between the business cycles of the various large economies, so that a global cycle clearly exists. This close link between the cycles in the various economic blocs is evident both from the chart showing the movement in GDP and from a simple yardstick such as the correlation between the various economies in terms of GDP growth.

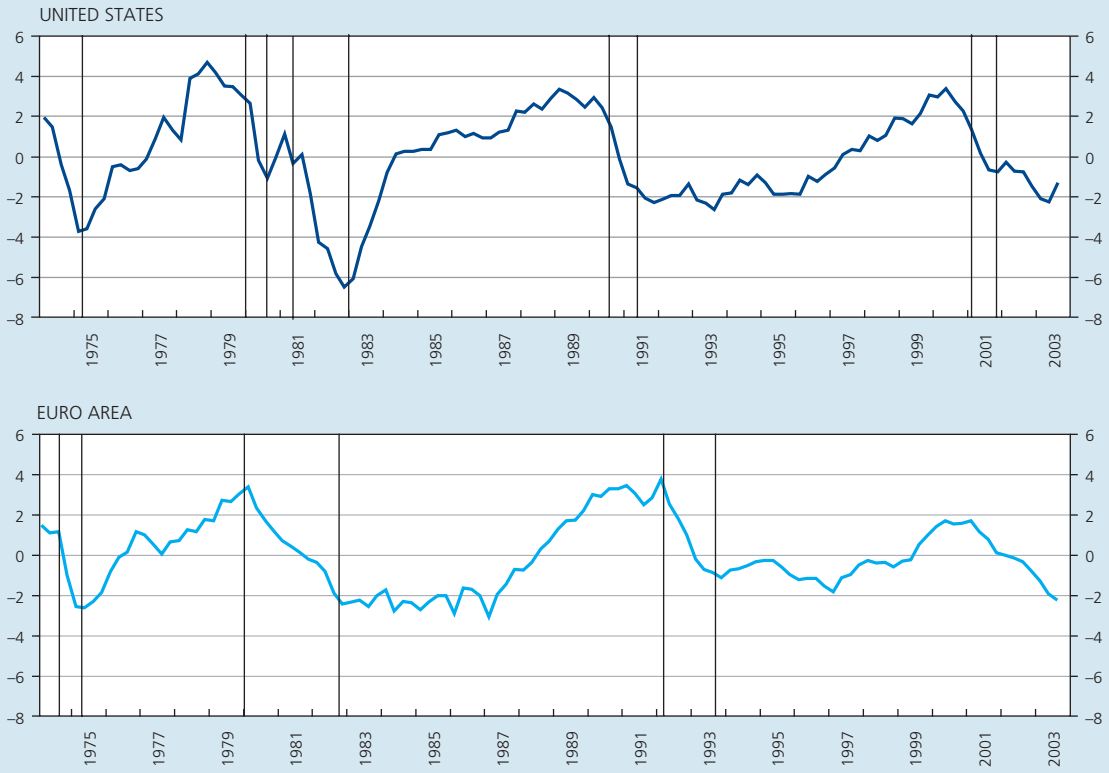
This correlation is usually stronger for the growth of output (measured by GDP) and investment than for consumption growth. The latter is still affected by country-specific shocks, indicating that household incomes are still heavily dependent on domestic activity with little international diversification. The international correlation also appears to be stronger during periods of recession than during periods of economic revival, which are often slower and less synchronised. One possible interpretation is that recessions are generated mainly by global shocks while their duration and the recovery tend to be more dependent on the specific structure and policy response of each individual country.

Has the globalisation of the economy in the form of increasing trade and financial flows led to greater synchronisation in recent times? No theoretical or empirical evidence has yet been offered for that assertion. In theory, the increased integration of the economies could lead to greater specialisation, with countries or regions potentially becoming more sensitive to sectoral shocks. Increased integration and diversification of the resources should nevertheless lead to a closer correlation in terms of consumption, but not necessarily as regards output.

Various empirical studies show that there has been no particular increase in this international correlation in economic activity during the recent period. The asymmetric shocks triggered by German reunification and the economic malaise in Japan tended to reduce rather than increase synchronisation during the 1990s.

CHART 11 SYNCHRONISATION OF GDP BETWEEN THE UNITED STATES AND THE EURO AREA

(Percentage deviation from the quadratic trend, vertical lines show the official recession periods according to NBER and CEPR)



Our models were estimated separately for the two economies, and the two blocs are regarded as closed economies. That is not exactly the best way of studying the question of synchronisation and spill-over effects. In our models, the correlation in the business cycle can only originate from the correlation between the various types of shocks in the two separately estimated models. The correlation between the various shocks over the period as a whole is not particularly high: the only significant correlation is between monetary policy shocks measured on the basis of temporary interest rate shocks. If the two sub-periods are considered separately, then a clearly higher correlation becomes apparent between the shocks for the first period, 1974-1984. The correlation during the first period is positive and significant for the shocks affecting interest rates, investment, the labour supply, the price mark-up and financing costs.

If we look at the correlation between the shocks during the three synchronised recession periods (1974.1-1975.1, 1980.1-1982.4, 2000.2-2002.2), we find a very strong positive correlation in the case of six shocks: those concerning interest rates, investment, preferences, the labour supply, financing costs and the price mark-up. During the recession period there is therefore in fact a very close correlation which occurs mainly in shocks affecting demand. The international recessions are therefore evidently due mainly to common shocks affecting the economy principally on the demand side, so that a globally synchronised recession, such as that in 2001, appears to be the rule rather than the exception. Consequently, the lower correlation during the 1990s is due more to the relatively small size of the simultaneous shocks which occurred during that period, as already stated in the preceding section. However, this is not very promising for the future, since there remains a real risk of larger, simultaneous shocks. Over-optimistic predictions concerning the stability of the real economy and the more efficient stabilisation policy are then perhaps premature.

TABLE 4 INTERNATIONAL CORRELATION BETWEEN GROWTH IN THE EURO AREA AND IN THE UNITED STATES

	Correlation between the euro area and the US							
	Changes quarter-on-quarter				Average changes year-on-year			
	1960-2003	1960-1983	1984-2003	Recessions	1960-2003	1960-1983	1984-2003	Recessions
GDP growth	0.20	0.21	0.15	0.24	0.43	0.50	0.27	0.40
	1974-2003	1974-1983	1984-2003	Recessions	1974-2003	1974-1983	1984-2003	recessions
GDP growth	0.31	0.40	0.20	0.26	0.39	0.51	0.23	0.34
Consumption growth	0.25	0.45	0.08	0.57	0.21	0.42	0.04	0.29
Investment growth	0.31	0.40	0.20	0.26	0.20	0.51	–0.07	0.36
Employment growth	0.05	0.26	–0.14	0.25	0.07	0.43	–0.21	0.50
Growth of real wages	0.00	–0.05	0.05	–0.22	0.04	0.35	0.01	–0.23
Change in inflation	–0.07	–0.12	–0.02	0.21	0.17	0.35	–0.18	0.21
Change in short-term interest rate	0.40	4.47	0.19	0.59	0.56	0.71	0.23	0.84
	Correlation between shocks in the euro area and in the US							
	Quarter-on-quarter				Average over four quarters			
	1974-2003	1974-1983	1984-2003	Recessions	1974-2003	1974-1983	1984-2003	Recessions
TFP productivity shock	0.03	–0.01	0.07	–0.47	–0.12	–0.10	–0.14	–0.36
Labour supply shock	0.09	0.29	–0.20	0.56	0.20	0.50	–0.41	0.79
Investment shock	0.09	0.29	–0.20	0.56	0.20	0.50	–0.41	0.79
Intertemp. pref. shock	0.18	0.36	0.02	0.53	0.45	0.54	0.37	0.69
Exog. spending shock	0.02	0.01	0.03	0.12	0.01	–0.01	0.06	0.16
Monetary policy shock	0.46	0.56	0.28	0.65	0.67	0.80	0.44	0.77
Inflation target shock	0.07	0.23	0.06	0.13	0.01	0.31	0.11	–0.01
Financing shock	0.15	0.19	0.12	0.50	0.29	0.30	0.27	0.39
Price mark-up shock	–0.07	–0.17	0.04	0.22	0.10	0.30	0.00	0.38
Wage mark-up shock	0.06	–0.03	0.07	0.05	0.19	0.09	0.11	0.09

Conclusion

This article describes the pattern of economic activity in the euro area and in the US on the basis of a general equilibrium model. Such a model makes it possible to analyse the empirical data in a strictly theoretical framework. That may produce some interesting findings, though other theoretical models could perhaps produce different conclusions. The explanatory and forecasting capability of the various models therefore needs to be tested using the latest estimation methods.

Comparison of the pattern of economic activity in the euro area and in the US revealed that the two economies have strong similarities: there are no significant divergences in the behavioural parameters of either the private sector or the monetary authority, and the various exogenous shocks which are the driving force behind the economic cycles in these models appear comparable in terms of size and persistence. In the future, by expanding the model (e.g. with a more detailed labour market, public sector and an open economy dimension) it should be possible to reconcile the interpretation of these exogenous shocks with institutional, structural or discretionary changes to economic policy.

In the short term, the economic cycles seem to be generated mainly by demand shocks (shocks affecting preferences and investment, exogenous demand shocks and monetary shocks). During recession periods, in particular, simultaneous demand shocks affecting consumption and investment spending evidently play a key role. In

the longer term, shocks affecting the labour supply and productivity are the driving force. As regards inflation, the main factors in the short term are temporary mark-up shocks, although in the long term inflation is primarily a monetary phenomenon, influenced by the central bank's inflation target. The limited impact of monetary shocks on the real economy does not imply that monetary policy is of no significance. The systematic behaviour of the central bank is important in order to understand how the other shocks affect the economy. It is here that an efficient monetary policy can contribute to more stable and efficient economic growth.

The reduction in the volatility of real growth in both the euro area and the United States, especially since the mid 1980s, is due mainly to the fact that the exogenous shocks were smaller. Changes in the economic structure or dynamics and a more efficient monetary policy are not in themselves sufficient to explain the sharp reduction in real volatility. These same findings can also help to explain the synchronisation of the business cycles between the two economic blocs. Despite the globalisation of the economy, there is no clear trend towards a closer correlation in economic growth. The small scale of the simultaneous – predominantly demand-related – shocks occurring in the recent period may provide some explanation. In the absence of severe synchronised shocks, shocks specific to particular countries or sectors remain relatively important for the pattern of economic activity. As far as the future is concerned, this implies that it would be wrong to be over-optimistic about the dynamic stability of the economy or the efficiency of the stabilisation policy.

Bibliography

Agresti, A.-M. and B. Mojon (2001), "Some Stylised Facts on the Euro Area Business Cycle", ECB Working Paper Series, No. 95, Dec. 2001.

ECB (2003), "Economic and monetary developments in the euro area", Monthly Bulletin, December

Gali, J. and M. Gertler (1999), "Inflation Dynamics: A Structural Econometric Analysis", Journal of Monetary Economics, Vol. 37, No. 4, pp. 195-222.

Gali, J., Gertler M. and D. Lopez-Salido (2001), "European Inflation Dynamics", European Economic Review, Vol. 45, No. 7, pp. 1121-1150.

Greenspan, A. (2003), "Monetary Policy under Uncertainty", Remarks at the symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, August 2003.

Monetary Policy Committee (2003), "Sectoral Specialisation in the EU: a Macro-Economic Perspective", 5th Structural Issues Report, ECB.

Shapiro, M.D. and J. Watson, "Sources of Business Cycle Fluctuations", NBER Macroeconomics Annual, 1988, pp. 111-148.

Smets, F. and R. Wouters (2003), "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area", Journal of the European Economic Association, September 2003, pp. 1123-1175.

Smets, F. and R. Wouters (2003), "Forecasting with a Bayesian DSGE Model: An Application to the Euro Area", mimeo ECB and NBB.

Smets, F. and R. Wouters (2003), "Comparing Shocks and Frictions in US and Euro Area Business Cycles: A Bayesian DSGE Approach", mimeo ECB and NBB.

Stock, J. and M. Watson (2003), "Has the Business Cycle Changed? Evidence and Explanations", Prepared for the Federal Reserve Bank of Kansas City symposium, Jackson Hole, August, 2003.

Stock, J. and M. Watson (2003), "Understanding Changes in International Business Cycle Dynamics", mimeo Harvard University, Princeton University and NBER.