Monetary-Fiscal Interactions in an Uncertain World: Lessons for European Policymakers

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Abstract

This paper reviews the roles of monetary and fiscal policies in macroeconomic stabilization. In particular, we take account of interactions between the two policy instruments and ask whether the extent of macroeconomic and policy uncertainty has changed over time, especially with the advent of EMU. We also analyze how uncertainty should be incorporated into the policy formulation process.

Keywords: monetary policy, fiscal policy, uncertainty, stabilization.

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1 Introduction

The goal of this paper is to address how various forms of uncertainty should affect the thinking of policymakers concerning the interactions between monetary and fiscal policies under EMU. It is an inescapable fact of life that policy decisions must be taken in the absence of perfect knowledge about past, current or future economic data and structures or even in regard to the decisions made by other policymakers that are simultaneously influencing macroeconomic outcomes. In general, incorporating the presence of such uncertainty into the operating strategies and institutional structures that shape monetary and fiscal policies (and their interaction) should contribute to improved quality in policy decisions. In turn, this facilitates a more robust, stable macroeconomic environment.

In order to provide a useful guide to policymakers, we adopt a wide-ranging perspective on the sources of uncertainty that matter for interactions between monetary and fiscal policies. In addition, we explore whether EMU provides a more stable environment for policymaking than previous regimes. The structure of the paper is as follows. Section 2 briefly reviews the literature on the effectiveness of monetary and fiscal policies and describes the various interactions between monetary and fiscal policies that should be incorporated into policy analysis. In section 3, we explore empirical and theoretical considerations regarding the evolution of overall macroeconomic uncertainty over time: is there reason to believe that the level of uncertainty has changed, especially with the advent of EMU? Section 4 provides an illustrative model of policymaking under uncertainty about the strength of monetary-fiscal interactions and also discusses more general considerations about the impact of uncertainty on policy decisions. Some concluding comments are offered in section 5.

2 Policy Effectiveness and Monetary-Fiscal Interactions

As a benchmark, it is useful to review the evidence on the effectiveness of macroeconomic policies and the different ways in which monetary and fiscal policies may interact. We begin by addressing the impact of monetary policy on fiscal positions, before turning to the set of influences that run in the opposite direction.

2.1 The Effectiveness of Monetary and Fiscal Policies

Are monetary and fiscal policies potentially effective in stabilising the economy? There is a large literature documenting that monetary policy has significant real effects on macroeconomic variables such as output and employment: in a European context, the findings of the ESCB's Monetary Transmission Mechanism Network provide the most recent evidence.[1] Moreover, the "Taylor Rule" literature also finds that the Federal Reserve and the ECB pursue stabilising monetary policies, in that interest rates respond aggressively to signs of incipient inflation (see Alesina et al 2001, Begg et al 2002 for recent estimates for the ECB).[2]

On the fiscal side, there have been much less empirical research on the effectiveness of fiscal policy. Some recent contributions have to some extent succeeded in identifying the macroeconomic impact of fiscal shocks and obtained evidence of a significant impact on macroeconomic variables (Burnside et al 1999, Blanchard and Perotti 2001, Fatas and Mihov 2001a, 2001b). Although these studies are welcome, this literature is in an early

[1] Angeloni et al (2002) provide an overview. See also ECB Working Papers Nos. 91-114 for the individual studies commissioned under the network.

[2] Looking forward, we may be fairly confident that monetary policy will continue to exert a significant influence on macroeconomic outcomes. Although Friedman (2000) has raised the prospect that the rise of electronic money will render central banks impotent, Woodford (2001) provides a convincing demonstration that suitably-modified operational procedures can ensure that short-term interest rates remain controllable by the monetary authorities.

phase and the identification of fiscal shocks remains a difficult and controversial problem.

With respect to policy interactions, Lane and Perotti (1998, 2002) show how the impact of fiscal shocks depends on the monetary stance: specifically, effectiveness varies between fixed and flexible exchange rate regimes. Melitz (1997) emphasizes another reason to study the joint behavior of monetary and fiscal policies: there is evidence of substitutability between fiscal and monetary instruments: tight fiscal policy is associated with a more relaxed monetary stance and vice-versa.

An important matter for concern is whether fiscal policy actually moves in a stabilizing fashion. While Melitz (1997), Taylor (2000) and Lane (2002) amongst others show that the primary deficit is typically countercyclical, there is considerable evidence that some elements of fiscal policy has behaved procyclically in many OECD countries. For instance, Lane (2002) shows that several components of government spending display a procyclical pattern. With respect to wage government consumption, this pattern is most severe for those countries with volatile business cycles and political systems characterized by a large number of veto points. Fatas and Mihov (2001b) also show in a cross-sectional study that the discretionary component of fiscal policy has tended to raise output volatility, whereas automatic stabilizers do indeed dampen fluctuations.[3]

Finally, the connection between cyclical movements in fiscal policy and the long-run fiscal position should not be ignored. Hercowitz and Strawcsynki (1999) show that the growth in the size of government in many OECD countries since the 1960s can be largely attributed to counter-cyclical expansions in downturns that were not reversed during recovery phases. This pattern indicates that it is essential to take account of potential irreversibilities in evaluating the potential role of fiscal policy in stabilizing the economy.

In summary, the empirical literature generally indicates that fiscal and monetary policy actions have a significant impact on macroeconomic variables. However, the econometric evidence does not pin down in any precise fashion the key elasticities in terms of how these

[3]Cohen and Follette (1999) emphasize that it is important to distinguish between demand and supply shocks in evaluating the performance of automatic stabilizers. In general, automatic stabilizers tend to suppress the equilibrium adjustment required by supply shocks.

policies affect macroeconomic behaviour. There is also evidence that monetary policy has been fairly effective in recent years in achieving the primary target of medium-term price stability. However, there is much less knowledge about the effectiveness of fiscal policy in contributing to the smoothing of business cycles.

Clearly, the overall performance of macroeconomic policy is also affected by the interactions between the two instruments. To frame the subsequent analysis, we review the various channels by which these policy instruments interact in the rest of this section.

2.2 Monetary Influences on Fiscal Policy

The level of interest rates directly affects fiscal positions through its impact on servicing costs and debt sustainability calculations. It follows that volatility in interest rates induces fluctuations in the level of the primary surplus required to stabilise the debt-output ratio: of course, the importance of this effect is the greater, the larger is the stock of debt. While optimal public debt management theory typically does recommend a state-contingent payout on government liabilities, this requires high interest rates to apply in "good" states of the world and low rates during "bad" states (see Barro 1979, Lucas and Stokey 1983, Missale 1999). It is not at all clear that this is the historical pattern for European countries.

The level and volatility of inflation also influences the state of the public finances. Seigniorage remains a significant if minor source of revenue. Unexpectedly high inflation reduces the real value of unindexed domestic-currency debt obligations. Imperfect indexation of tax bands means that fiscal drag occurs: high inflation increases the real tax burden. High inflation also generates an incentive to delay tax payments (the Tanzi-Olivei effect). Since the public sector is typically highly unionized, price inflation also quickly feeds into wage growth for government employees, placing the expenditure side under strain. Overall, the net effect of inflation volatility is to make more unpredictable the state of the public finances and make more difficult fiscal planning exercises.

Monetary strategy also exerts an indirect influence on fiscal policy. If the monetary authority takes responsibility for smoothing unnecessary fluctuations in output (subject to

attaining medium-term price stability), then the discretionary component of fiscal policy can be entirely dedicated to the pursuit of microeconomic efficiency and social objectives. However, the target of fiscal policy may change if the central bank places zero weight on output stabilization, since the fiscal authority may wish to actively pursue counter-cyclical stabilization policies in that case.

2.3 Fiscal Influences on Monetary Policy

Relatively more attention has been paid in recent years to the potential impact of fiscal positions on the monetary stance. For instance, expansionary fiscal policies potentially threaten price stability if it leads to overheating of the economy, requiring a countervailing monetary intervention. The severity of this offsetting action by the central bank will depend on the relative weights the central bank places on price stability versus output stabilization and its assessment of the balance of risks.

In turn, forward-looking fiscal authorities should incorporate this monetary feedback into its decision process but subject to possessing imperfect information about these two factors. We have discussed the former issue in the previous subsection but the latter is also quite important to the extent that the fiscal and monetary authorities do not have the same "model" of the economy or do not have access to the same information and analysis on the state of the economy. We return to this issue in section 4.

The level of public debt also will affect monetary policy. If Ricardian equivalence fails to hold (as is plausible), an increase in the stock of government liabilities depresses total savings and raises real interest rates. In turn, this plausibly reduces the potential output level for the economy, requiring a tighter monetary stance. Although the trend towards globalization of capital markets suggests a weakening of the relation between European levels of public debt and European real interest rates, portfolio balance effects plus remaining home bias in investor preferences indicate that a sizeable effect still remains (Lane and Milesi-Ferretti 2002). However, the ongoing deepening and integration of intra- and extra-European financial markets suggests that this relation is continuing to evolve, such

that there uncertainty about the quantitative importance of this mechanism.

Of course, other elements of fiscal policy may also adversely affect the potential output level and so induce a more restrictive monetary policy. Wasteful public expenditure projects, inefficient tax systems and excessive transfer programmes would all fall under this category. Again, there is considerable debate about the net impact of such fiscal distortions on the trend growth path, making it difficult for the central bank to determine the appropriate monetary response.

So far we have discussed the indirect impact of the fiscal position on monetary policy via its influence on the state of the real economy (output, real interest rates). It is also well understood that the public debt can also have more direct implications for price level dynamics. High nominal unindexed debt places pressure on the central bank to unleash a surprise inflation, in order to erode the real value of the debt — this is a variant of the time inconsistency problem of optimal discretionary monetary policy. In this regard, it is noteworthy that Campillo and Miron (1997) demonstrate that there is a strong empirical cross-country correlation between high initial public debt levels and average inflation rates.

Even more directly, a monetary policy that passively adapts to fiscal needs means that a high unfunded fiscal deficit translate into a requirement for extra seigniorage revenues, with more rapid monetary growth inevitably generating an increase in the inflation rate over time (see also Sargent and Wallace 1981). In addition to the seigniorage channel, the recent "fiscal theory of the price level" literature has illustrated that, in a scenario in which the government budget constraint is not satisfied for all price paths, the price level must adjust to ensure that the stock of nominal debt is consistent with the real present value of future budget surpluses (Woodford 1995).[4]

In the context of European Monetary Union, it is not clear how relevant is this theoretical concern. If taxes and spending are actively adjusted to ensure sustainability of the government debt for all price paths, then the price level can be determined independently of the fiscal stance. Since public finances in member countries are closely monitored and are

[4]See Chaddha and Nolan (2002) for a recent overview.

constrained to remain within fairly tight boundaries, it is likely that sufficient budgetary adjustment would take place to ensure sustainability. In addition, the ECB is strongly committed to actively responding to inflationary pressures. This institutional framework should ensure that fiscal policies have a 'Ricardian' nature. It is also useful to be aware that the fiscal theory of the price level has implausible predictions along other scenarios: Kocherlakota and Phelan (1999) provide an example under which the fiscal theory generates a speculative hyperinflation in response to a one-time decrease in the money supply. However, the problem studied by Benhabib et al (1999) and Sims (1999) is an important scenario to keep in mind: if nominal interest rates are near-zero, a policy of fiscal surpluses can potentially validate a deflationary spiral. However, additional restrictions on monetary and fiscal policies can eliminate this equilibrium.

In summary, the discussion in sections 2.2 and 2.3 highlights that monetary and fiscal policies interact along many dimensions. In a perfect-information environment, the main problem generated by such interactions is that coordination between the monetary and fiscal authorities may be required to in order to achieve efficient outcomes. However, the complexity of making policy is compounded under uncertainty about the economic environment or about the nature of policy interactions. Accordingly, we turn our attention to this issue in the next section.

3 Is the Extent of Macroeconomic and Policy Uncertainty Changing Over Time?

In this section, we set the context by presenting empirical evidence and discussing theoretical issues concerning the dynamic evolution of macroeconomic uncertainty for the eurozone economy. We then discuss whether shifts in economic structures are raising the level of intrinsic uncertainty and review the role of policy errors in raising volatility. Finally, we address whether EMU provides a more stable macroeconomic environment.

3.1 Empirical Review

In Figures 1 to 9, we review the evolution of macroeconomic volatility over time. Figure 1 documents the 5-year rolling standard deviation of eurozone aggregate output growth over 1961-2001.[5] As is well known, the mid-1970s and (less so) the early 1990s were periods of quite volatile growth: the magnitude of fluctuations in the most recent period has been very low by comparison. To the extent that the scale of uncertainty is positively correlated with output volatility, this would seem to indicate that the macroeconomic environment in recent years has been comparatively tranquil.[6] A similar pattern applies to the volatility of inflation, as is recorded in Figure 2. The volatility of inflation in the late 1990s returned to a level last experienced in the 1960s. Again, a comparatively smooth path for inflation suggests a reduction in macroeconomic uncertainty.

Blanchard and Simon (2001) in fact provide some suggestive cross-country evidence that the decline in inflation volatility may have played a causal role in the reduction in output volatility. In addition, these authors point out that structural changes help to explain the decline in output volatility — for instance, the comparatively stable services sector accounts for an increasing proportion of overall economic activity. Their study of US data also shows that the decline in output volatility can be attributed to a decline in the magnitude of output shocks rather than a change in the persistence dynamics of output.

Figure 3 shows the cross-sectional standard deviation of national annual output growth rates for eurozone member countries over 1965-2001. Over the entire sample period, we do observe some reduction in dispersion: the variation was typically higher in the 1960s than in the 1990s. However, over 1987-2001, there appears to be no trend reduction in dispersion, with substantial year-to-year variation. In other words, stability at an aggregate level is still accompanied by significant volatility in national output growth rates. On the prices

[5] The 1965 value is the standard deviation of growth over 1961-1965; the 1996 value is for 1962-1966; and so on.

[6] Of course, a volatile economic series may be completely predictable so there is not necessarily a direct link between volatility and uncertainty. However, as an empirical matter, it is eminently plausible that economic uncertainty and volatility are positively correlated.

side, Figure 4 shows that the dispersion in national inflation rates was lower by the late 1990s than in any previous phase during the sample period: of course, this convergence in inflation rates was required in order to make EMU a politically feasible enterprise.

If we look beyond the internal European economic data, Figures 5 and 6 document the rolling 5-year correlations between eurozone and US growth rates and inflation rates respectively. From Figure 5, US and eurozone growth rates were highly correlated during the 1970s and early 1980s when the world economy was dealing with common shocks such as the OPEC oil price increases and the subsequent international trend towards disinflation. The late 1980s and early 1990s saw a decline in international growth correlations but the strength of the comovement has increased again in the most recent years.[7] However, it may also reflect changes in the nature of international linkages that generate direct interdependence between the major blocs in the world economy. Figure 6 shows that inflation rates between the eurozone and the US have returned to quite a high correlation: unlike the 1970s, this reflects the fact that both economies have converged to a low inflation regime.

We turn to the volatility of exchange rates in Figures 7 and 8. Figure 7 shows the monthly standard deviation of the real effective exchange rate for the "synthetic" euro for the years 1970-2000. It is evident that the exchange rate has been quite volatile since the advent of generalized floating in the early 1970s. Indeed, if anything, volatility appears to have increased in the later 1990s, after a phase of greater exchange rate stability in the 1992-1995 period. Such exchange rate volatility matters for those engaged in trade and investment outside the euro zone and these agents may perceive a high degree of uncertainty. For the aggregate eurozone economy, however, fluctuations in the exchange rate represent a limited form of macroeconomic uncertainty. Similarly, Figure 8 shows that there is no long-run trend change in the level of volatility in the dollar but also that recent years have not witnessed anything like the "long swing" of the dollar during the 1981-1985 period.

[7] See also Heathcote and Perri (2001) on global comovements and Angeloni and Dedola (1999) on intra-EMU cyclical correlations.

We turn to volatility in asset markets in Figures 9 and 10. Figure 9 shows that volatility in European 10-year government bond yields declined sharply during the 1990s: financing conditions are much more stable now than under previous monetary arrangements. Stability in interest rates helps to reduce uncertainty in investment decisions, debt servicing costs and in making present value calculations. The volatility of the MSCI world equity index is shown in Figure 10. Again, there is no clear trend in the level of volatility over the 1970-2001 period. However, it is true that there has been an uptick in the volatility of equity markets in the second half of the 1990s as compared to the first half. There is also evidence that correlations between national stock markets have also increased in recent years (International Monetary Fund, 2001).

In summary, this empirical review highlights that a number of key indicators suggest that the macroeconomic environment is currently much more stable than was the case in the 1970s and 1980s: output growth is smoother and the decline in inflation volatility is even more spectacular. Moreover, volatility in bond yields has sharply fallen. That said, dispersion in member country growth rates remains significant such that national output growth is (unsurprisingly) more volatile than the eurozone average. In addition, the evidence from exchange rate and equity indices is that there has been a recent "local" increase in volatility compared to a comparatively more tranquil period in the mid-1990s. The fact that the correlation in business cycles and in financial markets between the eurozone and the US has also recently increased may also have led to perceptions of greater economic insecurity to the extent that European agents believe global or international factors are uncontrollable by domestic policy interventions.

3.2 Economic Fundamentals

Understanding the dynamics of the underlying macroeconomic trends and cycles that drive the economy is an important challenge for policymakers. An ability to distinguish between temporary and permanent shocks to output is obviously important for the conduct of stabilization policies. Knowledge about the trend output growth rate is also critical to long-

term fiscal planning in terms of infrastructural development and projecting the tax rates and benefit levels that are consistent with the sustainability of unfunded liabilities such as publicly-provided pensions. In addition, fluctuations around the trend path are directly of concern to policymakers if excess volatility is harmful to voters. In particular, on the fiscal front, the demand for social insurance (explicit or implicit) will be an increasing function of the amplitude of the business cycle. Macroeconomic volatility also translates into volatility in the public finances, for instance through the operation of automatic stabilizers.

Is the extent of macroeconomic uncertainty changing over time? At a theoretical level, several factors deserve consideration. First, it is possible that "new economy" technologies may have altered the potential output growth rate. This is the subject of a ongoing debate but is accepted that major technological innovations can generate structural breaks in the sustainable medium-term growth rate. The information revolution may also have altered the nature of business cycles, via its impact on inventory management techniques and depreciation rates.

Second, the globalization of financial markets and production processes may also alter the volatility of European output. International capital mobility increases the responsiveness of investment flows to local economic conditions: a positive shock draws in overseas capital; a negative shock leads to a capital outflow. In this way, the impact of shocks to the level of production is magnified. Moreover, greater portfolio diversification may also encourage greater specialization in production since income insurance can be provided by financial markets rather than by spreading production activity over a wide range of sectors.

Volatility may also be increased if an increase in international trade permits greater specialisation, since sectoral shocks then have a larger aggregate impact. On the other hand, if the source of trade is the vertical specialization that is made possible by the fragmentation of the production process, local volatility will be diminished and global factors will play a larger role in determining output.[8] At an empirical level, the historical evidence of Frankel and Rose (1998) suggests that international trade tends to increase

[8] See Kose and Yi (2001).

business cycle correlations but the long-term net impact of EMU and other aspects of European economic integration on patterns of specialization remains to be seen.[9]

Of course, since international portfolio diversification potentially allows the delinking of income and output, national income may be smoothed even if the amplitude of output fluctuations increases.[10] At a corporate level, foreign direct investment also spreads risk. In principle, such market insurance may reduce the demand for social insurance and policy interventions. Of course, while international risk-sharing on average reduces income volatility, it also means that incomes are partially exposed to foreign shocks.[11] Furthermore, if policymakers are less informed about the international economy relative to the domestic economy, this may provide an additional source of uncertainty. Moreover, it also means that domestic conditions are influenced by foreign policy decisions. This international policy interdependence adds a further layer of complexity in decision making.

These issues are all relevant for the aggregate European economy. It is also worth emphasizing that they apply *a fortiori* at the national level, since there is typically a higher level of integration within the European Union than between member states and other countries — the extent of portfolio diversification is larger within Europe than internationally and trade linkages are tighter within the European single market than at the global level. In addition, labour mobility within the European Union provides an another powerful magnification channel by which the impact of local shocks is amplified: for instance, the recent boom in the Irish economy has been partly sustained by the inflow of workers from the UK and continental European countries with high youth unemployment (eg Spain and

[9] Ricci (1997) highlights that the elimination of national currencies provides an impetus for a reduction in specialization within the eurozone since there is less reason for firms within a sector to cluster together. Corsetti and Pesenti (2002) offer an additional reason why national outputs may become more correlated under a monetary union: with prices set in a common currency, the output shifts associated with "producer currency" pricing strategies are no longer experienced.

[10] Since the overall return on portfolio holdings includes net capital gains, this refers to a broad definition of income.

[11] A similar point applies to those forms of trade in goods and services that increase the comovement between domestic and foreign output levels.

Italy). For these reasons, the volatility of national output levels may increase under EMU, even if the volatility of aggregate European output declines.

Finally, for welfare analysis and a proper understanding of the political economy of economic policy management, it is important to recognize that an important element missing from this analysis of aggregate output and income is the relation between national risks and idiosyncratic household uncertainty. A more flexible labor market and an increased dispersion in wage incomes and unemployment probabilities mean that a decline in aggregate volatility is potentially consistent with a rise in individual-specific uncertainty.

3.3 Policy Errors and Volatility

Of course, it should be recognized that policy errors are themselves a potential source of macroeconomic volatility. Fiscal and currency crises can generate large and extended deviations from the trend path, while inappropriately procyclical policies can magnify the amplitude and duration of the business cycle. In a European context, it is plausible that the propensity for policy-induced volatility has fallen over time.

On the monetary side, the move to floating exchange rates in the early 1970s plus the large economic shocks of that era saw high and variable inflation in many countries. In the 1980s and early 1990s, quasi-fixed exchange rates under the EMS system were vulnerable to speculative attack in those cases where countries were maintaining inappropriate policies or where economic fundamentals were weak, making politically infeasible the sustained high interest rates that are required to fend off currency pressures. High and volatile inflation and exchange rates of course also induces fiscal instability, in view of the relation between inflation and real tax revenues and the impact on cost pressures in the public sector.

With respect to fiscal policy, it is well known that government deficits and debts also grew quickly in many countries in the 1970s and 1980s. This in turn led to increases in the tax burden and in high real interest rates. Of course, high debt levels also fed into currency risk premia, with implications for the exchange rate and the monetary stance. Several smaller European countries also issued significant amounts of foreign-currency debt during

this period in a bid to improve access to external financial markets. High debt levels in turn implied a significant feedback from monetary to fiscal policies: high interest rates made more expensive the servicing of the public debt and exchange rate depreciation raised the real domestic burden of foreign-currency liabilities. Another consideration is that financial deregulation and capital account liberalisation also altered the policy environment during these years. These structural changes altered policy transmission mechanisms; in some countries, post-deregulation banking crises generated significant fiscal and monetary costs.

In summary, the policy mix from the 1970s through the early 1990s period was often not conducive to macroeconomic stability. Moreover, there was significant bilateral interaction between fiscal and monetary policies, with monetary and currency instability adversely affecting the fiscal stance and vice-versa. Of course, this set of conditions provided much of the motivation underlying the Maastricht Treaty, the drive towards EMU and the establishment of the Growth and Stability Pact (GSP). On a worldwide basis, it also contributed to the trend towards political independence for central banks and an increased critical interest in the procedural rules governing monetary and fiscal policy decisions.

3.4 Policymaking under EMU

In line with these reforms, there is a strong case to be made that EMU (plus the prior convergence process) provides a more stable environment in which policy-induced volatility is less of a problem. The Maastricht criteria provided an impetus towards achieving a low inflation rate prior to the advent of EMU and much improved fiscal deficits and debt positions. Lower and more stable inflation improves the predictability of the public finances. A decline in debt-GDP ratios has made debt servicing a less important component in government budgets and hence fiscal exposure to interest rate fluctuations has declined. In addition, the fact that government debts are now largely denominated in euros has meant that vulnerability to exchange rate swings has also decreased. To the extent that the ECB provides a more stable overall monetary environment than independent national monetary strategies, the general level of macroeconomic uncertainty has been attenuated.

Furthermore, the eurozone economy will be more stable and fiscal decisions will be easier to make, the better understood is the ECB's monetary strategy.[12] At a global level, the establishment of the ECB should also make international policy coordination more feasible by replacing twelve (quasi-) independent monetary authorities with a single monetary institution for the eurozone.

However, counter-arguments also exist. The eurozone is a new, unknown concept and Lucas Critique reasoning suggests that it is difficult to establish the structural relations governing the behavior of this aggregate economy.[13] The ECB itself is a young, evolving institution that is still in a phase of self-definition in terms of its objectives and policy framework. Moreover, its short track record plus a unwieldy board structure potentially makes it relatively harder to predict ECB policy decisions. The fact that the size and nature of the eurozone will soon change with membership of the accession countries further clouds the horizon in terms of assessing the long-term features of the eurozone's monetary regime and economic structure.

In addition, the research of the ESCB's Monetary Transmission Mechanism Network cited above also indicates that there remain considerable asymmetries in the transmission of monetary policy across the different eurozone countries and that the standard errors concerning the impact of monetary policy on real and nominal variables are substantial. Ongoing economic and financial convergence, accelerated by the EMU process itself, is also surely altering these tranmission mechanisms over time. For instance, the integration and deepening of eurozone money and financial markets represents a major challenge in the implementation of appropriate monetary policy. The difficult process of constructing and interpreting eurozone aggregate data is another formidable task for the ESCB.

[12] The ECB's communications performance has been much criticised, especially in its confusing emphasis on the monetary pillar of its strategy (see Begg et al 2002). However, its interest rate policy has been fairly predictable — see, for example, Gaspar et al (2001).

[13] The interesting findings produced by the ESCB's monetary transmission network show that there is much heterogeneity and much uncertainty about the impact of monetary policy in different member countries. Of course, the monetary transmission mechanism is likely further changed by EMU itself, since it represents a major structural policy shift.

Paradoxically, the attainment of low inflation also raises new challenges for monetary policy. The zero bound problem and the risk of entering a liquidity trap constrains the ability of the central bank to respond to negative shocks by aggressive interest rate reductions. At low levels of inflation, it is also plausible that the aggregate supply schedule is relatively flat, such that movements in the inflation rate are relatively uninformative of output conditions — in such an environment, the central bank must expend more effort in distilling the signals from real indicators in formulating the appropriate monetary stance (Begg et al 2002).

On the fiscal side, the operation of the GSP continues to be a source of much debate. It remains to be proven that sanctions would actually be imposed in the event of a breach of the 3 percent deficit rule and whether all countries are treated equally in the review of fiscal behaviour. As noted above, the relation between debt ratios in member nations and the level of European real interest rates is also not known with any degree of confidence.

EMU has also altered the role of national and aggregate fiscal positions in achieving stabilization goals. With respect to common eurozone shocks, it is not yet fully apparent the extent to which the ECB will seek to prevent unnecessary fluctuations in output — however, the findings of Begg et al (2002) suggest that the ECB was fairly active in responding to the growth slowdown during 2001 and there is comparatively little difference in the policy strategies of the ECB and the US Federal Reserve. Moreover, a common monetary response to collective shock is more efficient and direct than an uncoordinated set of independent monetary policies. However, residual uncertainty about the strength of the ECB's commitment to avoid unnecessary output fluctuations does make it more difficult to work out the appropriate collective eurozone fiscal stance. Finally, achieving the desired aggregate fiscal stance is also made problematic by the weak degree of coordination among the individual fiscal policies of member nations.

Of course, monetary policy under EMU can no longer be employed to stabilize idiosyncratic national macroeconomic disturbances.[14] The implication is that national fiscal policy

[14]See Lane (2000) for a model of the relation between asymmetric shocks and monetary policy in a currency union.

needs to take up the slack on this front. This represents a new challenge since national stabilization strategies have historically relied on monetary and exchange rate policies in addition to the fiscal instrument. Although national fiscal policy should be more powerful inside a currency union than under a flexible exchange rate, we know relatively little about the national fiscal transmission mechanism under these conditions. Again, spillover effects across member countries may also lead to inefficient stabilization policies in the absence of coordination.[15]

Overall, disinflation and significant fiscal adjustment in the convergence process prior to EMU means that the stability of the eurozone economy has substantially improved relative to conditions during the 1970s and 1980s. This should permit more effective operation of monetary and fiscal policies under EMU. The efforts made by the ECB to establish a clear and transparent monetary strategy plus the constraints imposed by the GSP on fiscal behavior should also reduce vulnerability to policy errors and bound the range of uncertainty concerning macroeconomic policy decisions inside the eurozone. However, significant uncertainty remains on account of structural economic changes (the information revolution, globalization and deepening integration within Europe) and the difficulty of understanding policy transmission mechanisms and policy preferences in the radically new policy regime that has been introduced by the formation of a currency union. We turn to how uncertainty should be incorporated into the policy formulation process in the next section.

4 Policy Interactions and Policy Decisions under Uncertainty

In this section, we first present a simple model of policymaking under uncertainty. In particular, we extend the classic model of Brainard (1967) to incorporate uncertainty about policy interactions. In the following subsection, we discuss more general considerations

[15] Alesina et al (2001) make the point that coordination may be undesirable if fiscal authorities are motivated by short-term political goals such as engineering a pre-election output boom.

about policymaking under uncertainty.

4.1 An Illustrative Model

Consider a setup in which two independent policymakers 1 and 2 have responsibility for the targets x and y respectively. Policymaker 1 has the loss function

$$L_1 = x^2 \tag{1}$$

and the behavior of the target x is given by

$$x = P_1 + bP_2 + \varepsilon \tag{2}$$

where P_1 and P_2 are the policies set by policymakers 1 and 2 and ε is an zero-mean independent error term with a known variance. Let us assume that P_1 is set after P_2 is known but before ε is realized. Moreover, we take it that policymaker 1 knows the value of b with certainty. Clearly, the optimal policy here is to set

$$P_1 = -bP_2 \qquad\qquad b > 0 \tag{3}$$

That is policymaker 1 just responds to counteract the destabilising impact of P_2 on its target x. Uncertainty concerning the additive disturbance term ε does not affect the optimal policy.

Now let us consider the policy challenge facing policymaker 2. Let its target y be related to the policy instruments P_1 and P_2 by

$$y = a_1P_1 + a_2P_2 + u \tag{4}$$

where u is a zero-mean, independently distributed disturbance term with a known variance σ_u^2. Policymaker 2 sets P_2 in advance of the realization of u and also must take into account the feedback from P_2 to P_1. However, we assume that policymaker 2 does not know the value of b in the feedback rule [3].

We assume the impact of P_1 on y is known (a_1 is a fixed parameter) but there is policy uncertainty about (i) the effectiveness of P_2 (a_2 is unknown); and (ii) the reaction of P_2 to

P_1 (b is unknown to policymaker 2).[16] Although the actual values of the parameters are uncertain, their variances are known.

We use equation [3] to rewrite equation [4] as

$$y = (a_2 - a_1 b)P_2 + u \tag{5}$$

It follows that the expected level of the target y is

$$\bar{y} = (\bar{a}_2 - a_1 \bar{b})P_2 \tag{6}$$

where $\bar{a}_2$ and $\bar{b}$ are the mean values of a_2 and b respectively. In turn, the variance of output is

$$Var(y) = Var(a_2 - a_1 b)P_2^2 + Var(u) \tag{7}$$

since we assume that the shock term u is not correlated with the unknown parameters a_2 and b.

How should the controller of P_2 set its policy? Let the policy loss function be given by

$$L = (y - y^*)^2 \tag{8}$$

where y^* is the desired level of y. The goal of policy is to minimize the expected loss

$$\underset{P_2}{Min}\ E(L) \tag{9}$$

This expected loss can be rewritten as

$$E(L) = (\bar{y} - y^*)^2 + Var(y) \tag{10}$$

Choosing P_2 to minimize this expression delivers the optimal policy

$$P_2^* = \frac{1}{1 + V^2} \frac{y^*}{(\bar{a}_2 - a_1 \bar{b})} \tag{11}$$

[16] In this setup, uncertainty about the policy reaction function is equivalent to uncertainty about the impact of P_2 on the target x. That is, we effectively assume policymaker 1 has private information about the process for x.

where

$$V^2 = \frac{Var(a_2 - a_1 b)}{(\bar{a}_2 - a_1 \bar{b})^2} \tag{12}$$

In line with the classic Brainard insight, it is evident from equations [11]-[12] that parameter uncertainty ($V^2 \neq 0$) about the effectiveness of P_2 or the reaction of P_1 to P_2 induces the policymaker to act more conservatively and only partially attain the target gap y^*. Again, uncertainty about the additive shock u has no impact on the optimal policy.

We can expand upon this result by examining the components of the numerator of V^2

$$Var(a_2 - a_2 b) = Var(a_2) + a_1^2 Var(b) - 2a_1 Cov(a_2, b) \tag{13}$$

As is clear from this expression, negative covariance between a_2 and b should induce greater caution in policymaking: if P_2 is unusually effective when the feedback from P_2 to P_1 is weak, then policymaker 2 should act yet more conservatively. Conversely, a positive covariance reduces aggregate uncertainty and allows policymaker 2 to pursue a more aggressive strategy. At a stretch, let us interpret x and y as inflation and output and P_1 as monetary policy and P_2 as fiscal policy.[17] Under this scenario, the latter case may be more relevant: it is likely that it is when fiscal expansions have the biggest effect on output (a_2 large) that it also has the biggest impact on the price level (a higher value of b), which in turn induces the central bank to act more aggressively in order to ensure stability in the price level.

Clearly this model is highly stylized. We have examined only one-sided uncertainty about the nature of the policy interaction and the assumption of sequential policy moves also reduces the dimensionality of the problem. In practice, each policymakers may also care about both x and y rather than having an exclusive focus on a single target each. In addition, the true value of a_1 and also the elasticity of x with respect to P_1 is also likely to be unknown. Moreover, it is likely that uncertainty about the policy feedback rule would diminish the longer a regime is in place, since repeated play would help to reveal the value of b to policymaker 2. Finally, efficiency would clearly be improved if policymaker 1 could

[17] This interpretation relies on the notion that we know far more about the transmission of monetary policy than fiscal policy and also that the greater flexibility of monetary policy makes plausible that the fiscal authority moves first, with the monetary authority subsequently deciding its policy.

communicate the true value of b to policymaker 2. In the next subsection, we review more broadly the impact of uncertainty on optimal policy decisions.

4.2 More General Issues

As in the previous subsection, the Brainard (1967) result is that parameter uncertainty typically induces caution. However, Soderstrom (2000) demonstrates that some forms of parameter uncertainty may actually make optimal policy more aggressive. For instance, if the central bank cares about stabilizing output in addition to inflation, uncertainty about about the persistence of inflation increases the optimal reaction function coefficients. With persistence, an excessively cautious initial policy response implies inflation will deviate for a longer period of time from its target — to avoid this outcome, the optimal policy should strongly respond to signs of incipient inflationary pressures. More generally, the capacity to distinguish among transitory, persistent and permanent shocks is central to gauging the optimal monetary policy response

Morever, it is possible that some other types of uncertainty may also induce a more aggressive policy response. For instance, in a dynamic learning environment, policy shifts reveal new information about the true state and structure of the economy and so more active policy today may reduce future uncertainty about the economy (see, for example, Bertochhi and Spagat 1993 and Wieland 2000). Orphanides and Williams (2001) emphasize that optimal policies designed under rational expectations can be quite inefficient when knowledge is imperfect and agents are continuously updating their beliefs about the state of the economy. This deterioration in performance is particularly severe when policymakers put a high weight on stabilizing real economic activity versus price stability. However, economic performance can be improved significantly by placing greater emphasis on controlling inflation and inflation expectations. Such policies facilitate learning by private agents and mitigate the negative influence of imperfect knowledge on economic stabilization and yield superior macroeconomic performance.

An important case is when the form of the distribution of a key parameter or variable

is unknown (ie Knightian uncertainty rather than Bayesian uncertainty). A "robust control" literature has developed to tackle this problem and work out policy strategies (such as minmax rules) that are relative insensitive to model misspecification errors (Hansen and Sargent 2000).[18] Von Zur Muehlen (2001) provides an accessible introduction to this approach and makes the point that there is no general presumption as to whether policy should be more or less conservative under Knightian uncertainty than in the Bayesian case. Knightian uncertainty is plausibly especially to the fore during regime switches, since backward-looking studies provide poor a guide during such transitional phases. As such, these considerations may be especially relevant during the infancy of EMU.

However, Sims (2001) cautions against current applications of robust control monetary policy analysis. For tractability, this literature has focused on parameter while making strong assertions about other model features that are also subject to uncertainty and have a bigger impact on uncertainty. For instance, uncertainty about the impact of inflation on the level of trend productivity growth is as important as uncertainty about the elasticity of output with respect to the interest rate. Moreover, incorporating the risk of a deflationary spiral is potentially far more important than uncertainty about parameter values. Svensson (2000) also criticises the minimax rule employed in much of the analysis as placing excessive weight on unlikely extreme events in setting policy.

As indicated above, some forms of uncertainty make it optimal to act more aggressively than in the Brainard case. Meyer et al (2001) study a setting which the state of the economy (the natural rate of unemployment) is unknown and the nature of the uncertainty does not fit a Gaussian distribution. If a (bounded) range of parameter values have similar likelihoods, it is optimal to react little to small changes in the level of employment but to move aggressively in the event of a large shock that moves unemployment away from the most likely zone for the natural rate. This implies the optimal policy rule is nonlinear in the values of fundamentals. A related point is made by Von Zur Muehlen (2001) who highlights that if Knightian uncertainty also applies to the level or trend growth rate of

[18] See also Cho et al (2001) for an interesting example in which policy experimentation may be desirable.

potential output, a minmax filter may be more appropriate than a Bayesian approach in empirically assessing the value of potential output.

In addition to model uncertainty, another potential justification for a cautious approach is the extent to which policy changes face irreversibilities. This is particularly relevant for fiscal policy, since spending programmes or tax adjustments may be hard to undo quickly. However, it is also pertinent for monetary policy since we know there is typically significant serial correlation in interest rate movements. Although in part this may be a strategy to increase leverage over long-term interest rates, it may also reflect a fear that rapid policy reversals may be more likely to attract popular or media criticism of the central bank's performance.

Fears about model misspecification may increase the attractiveness of simplicity of policy rules. Some studies have shown the performance of the Taylor rule to be more robust across a range of model specifications than more complicated strategies (Levin et al 1999). However, the study of Meyer et al (2001) in comparing the comparative robustness of a linear rule to their preferred nonlinear alternative indicates that this is not a general proposition. Again, it would be interesting to have similar studies performed in relation to the robustness of alternative fiscal rules.

Indeed, an emphasis on robustness as a key criterion in evaluating policies is probably the strongest message emanating from this "policymaking under uncertainty" literature. The brief review in this subsection has highlighted that there are few other general propositions concerning the impact of uncertainty on optimal policy responses. However, the potential for irreversibility does suggest that the use of discretionary fiscal policy as an active counter-cyclical stabilization device is a risky endeavour and that, at the least, the use of fiscal incentives with a strict termination date should be preferred to more open-ended commitments.

5 Conclusions

EMU represents a remarkable regime shift in the environment facing European monetary and fiscal policymakers. On the face of it, this would suggest that incorporating uncertainty into policy formulation is an important priority. This is reinforced to the extent the eurozone economy is undergoing significant structural changes by virtue of new economy factors, international financial integration and a deepening of the single market within Europe. Furthermore, the establishment of a new monetary institution and novel restrictions on national fiscal policies that are imposed by the GSP also introduce new uncertainties into the operational conduct of policy.

However, taking a broader perspective, the successful attainment of low inflation, fiscal adjustment and improved conduct of policy in the years prior to the formation of EMU is probably a more important consideration: especially compared to the 1970s and 1980s, macroeconomic uncertainty is surely substantially lower in the current environment.

That said, it remains the case that our knowledge concerning the effectiveness of macroeconomic policies and their interaction is still quite incomplete. To the extent that EMU represents a radical structural break in the nature of the eurozone economy and the policy transmission mechanism, recent literature suggests that it may actually be appropriate for policymakers to be more activist than normal in order to learn about the behavior of this new economic entity. However, if EMU-induced uncertainty can be better characterized by a simple increase in dispersion (of known form) in key policy parameters, then the Brainard principle applies and policy decisions should err on the side of caution.

However, it is uncontroversial that further improving the clarity of the rules and strategies guiding monetary and fiscal decisions can only help to improve the quality of policymaking and minimize inefficiencies from the non-coordination of monetary and fiscal policies. In terms of priorities for future research, most of the applications of the "policymaking under uncertainty" literature so far have been to monetary policy and extensions to fiscal policy and monetary-fiscal interactions would appear to be an extremely promising avenue.

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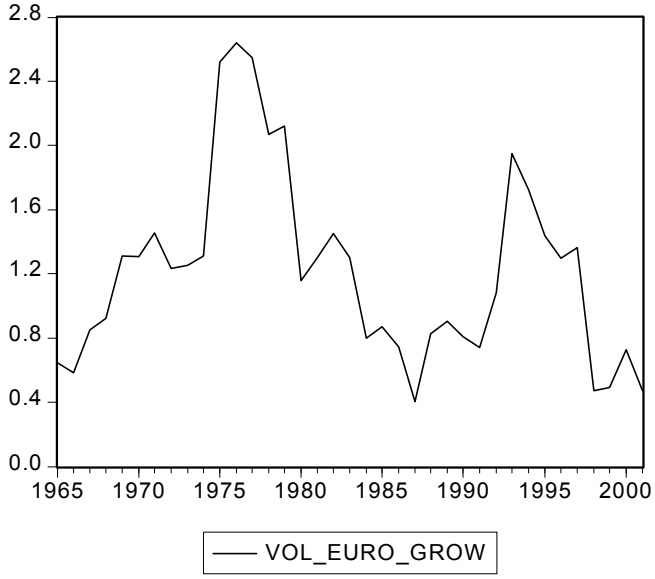

Figure 1: Rolling 5-year standard deviation of eurozone aggregate output growth rate, 1965-2001. Data Source: European Economy. Luxembourg excluded.

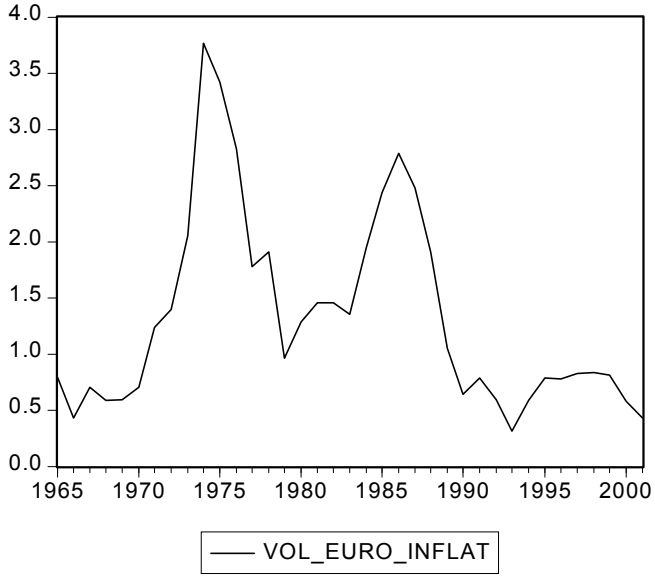

Figure 2: Rolling 5-year deviation of eurozone aggregate inflation rate, 1965-2001. Data Source: European Economy. Luxembourg excluded.

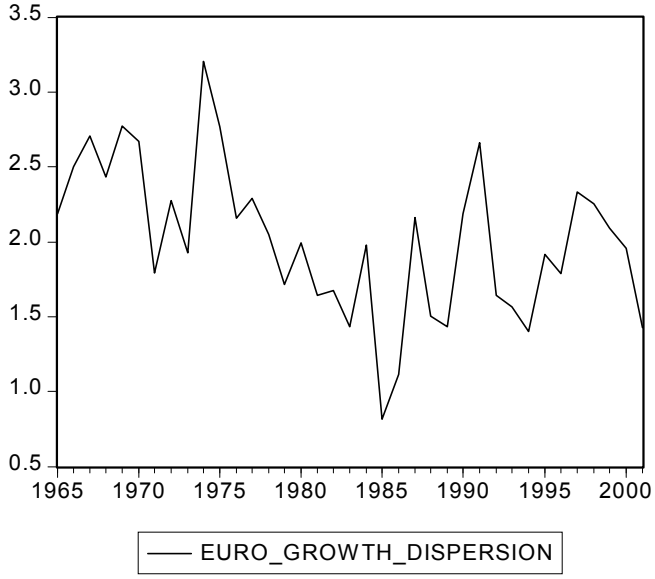

Figure 3: Standard deviation of national growth rates across eurozone members, 1965-2001. Data source: European Economy.

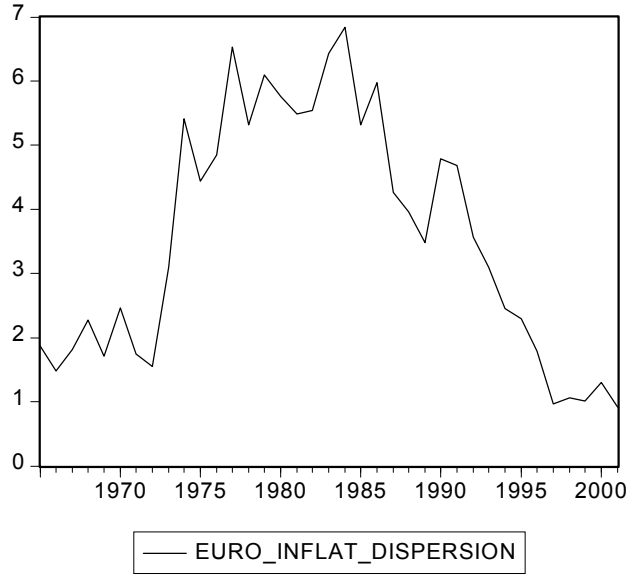

Figure 4: Standard deviation of national inflation rates across eurozone members, 1965-2001. Data source: European Economy. Luxembourg excluded.

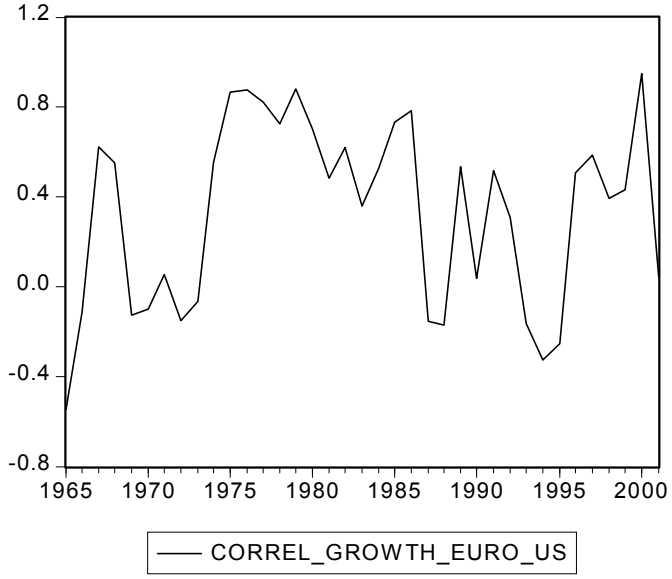

Figure 5: Rolling 5-year correlations between US and Eurozone output growth rates. Data source: European Economy. Luxembourg excluded.

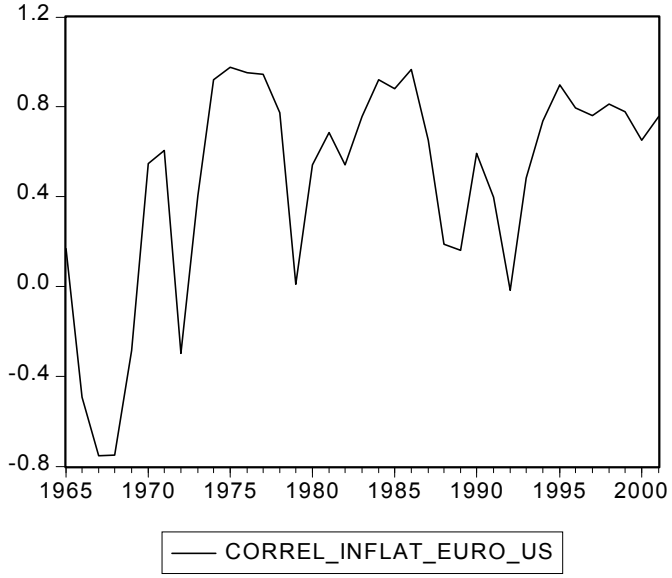

Figure 6: Rolling 5-year correlations between US and eurozone inflation rates. Data source: European Economy. Luxembourg excluded.

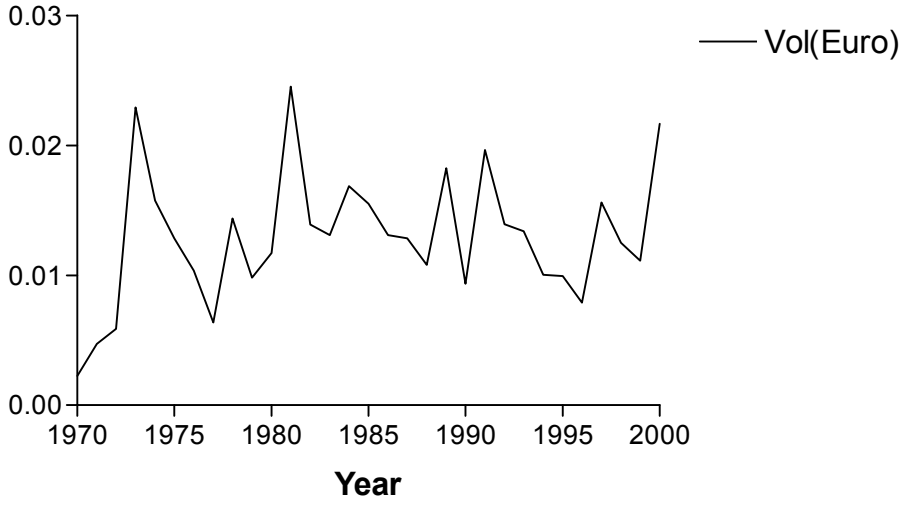

Figure 7: Monthly standard deviation of euro real effective exchange rate, 1970 to 2000. Data source: BIS. Data in log first differences.

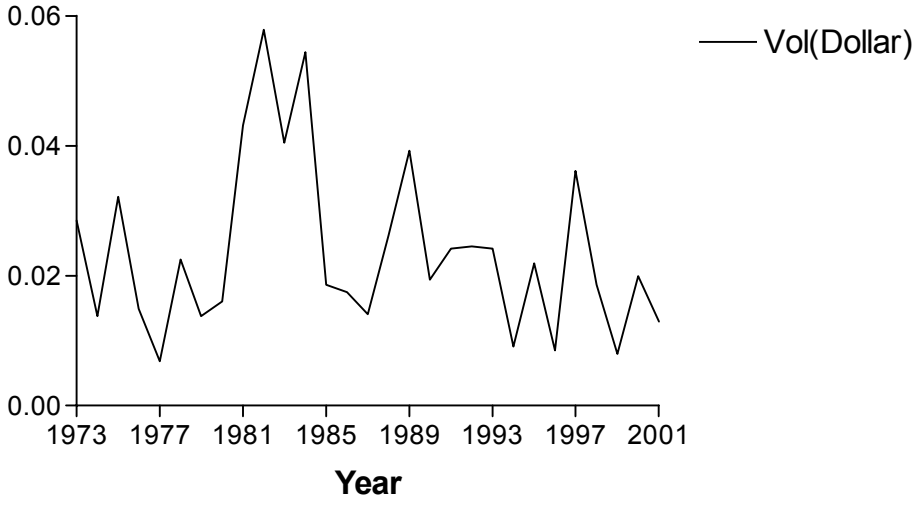

Figure 8: Monthly standard deviation of broad dollar index, 1973-2001. Data Source: Global Financial Data. Data in logs.

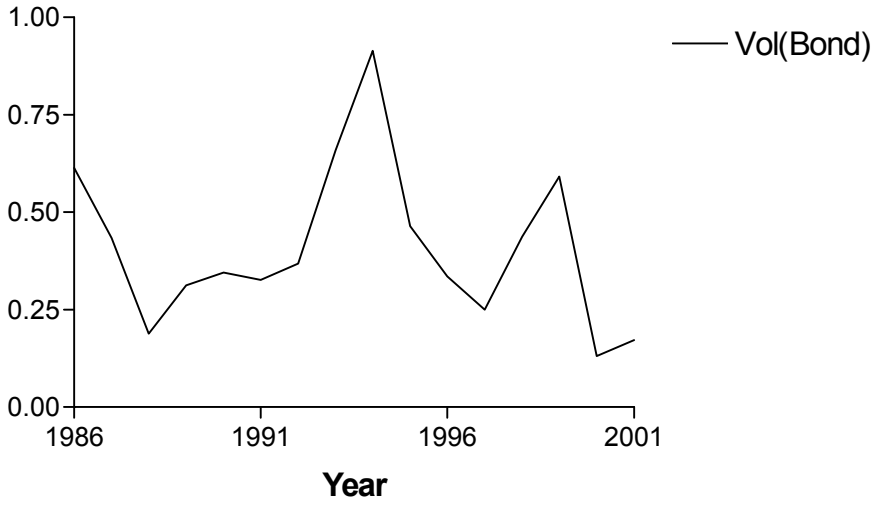

Figure 9: Daily standard deviation in European 10-year government bond yields, 1986 to 2001. Data source: Global Financial Data. Data in levels.

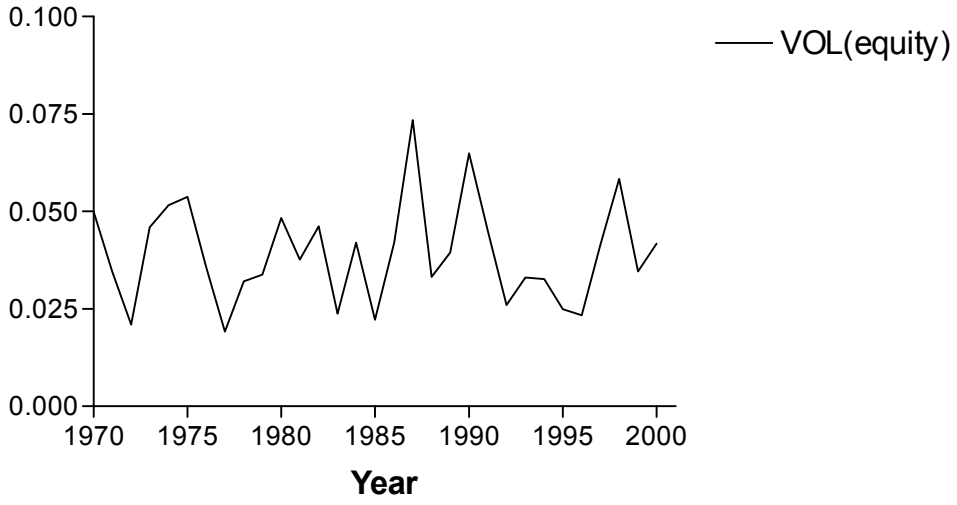

Figure 10: Monthly standard deviation of world equity index, 1970-2001. Data Source: MSCI. Data in log first differences.