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Rating the EC as an Optimal Currency Area

by Lorenzo Bini Smaghi and Silvia Vori



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RATING THE EC AS AN OPTIMAL CURRENCY AREA

by

Lorenzo Bini-Smaghi(*) and Silvia Vori(*)

Abstract

The viability of EMU has been questioned on the grounds that the loss of the exchange rate instrument is not compensated by the availability of alternative adjustment policies. This paper aims to assemble evidence on this issue taking the US as reference. The following indications emerge. Firstly, the economies of the EC countries are more homogeneous than those of the US states and therefore less likely to experience asymmetric disturbances. Secondly, the exchange rate instrument is less efficient in the EC, because of the higher real wage rigidity and the scarce labour mobility within the EC states. Finally, different budgetary tools are available in the EC and in the US to ease adjustment in the face of asymmetric shocks.

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"In view of the apparent strength of the forces pushing Europe towards more integration, one wonders whether political leaders are simply ill-informed, whether they are assigning more weight to non-economic considerations than are the economists, or whether economic analysis is itself deficient in some ways."

Ingram (1973), p. 2.

Introduction¹

In discussions of European economic and monetary union (EMU), a recurrent - and challenging - question is whether the European Community is an optimal currency area. The literature has recently re-opened this issue, most often reaching negative conclusions at a time, paradoxically, when major political decisions to move towards EMU have been taken. Indeed, EC countries' authorities have already accepted that the exchange rate constraint become more and more binding, despite powerful external and internal shocks such as large swings in oil prices and in the exchange rate of the dollar or German unification. The apparent contradiction between economic reasoning and political decisions, pointed out by Ingram two decades ago, has not been addressed.

The aim of this paper is to throw some sand in the works and disarrange the apparently smooth, rational line of reasoning taken up in the recent optimal currency area

1. We wish to thank A. Liccardi for research assistance and V. D'Ambrosio for the editing. This is an expanded version of the forthcoming article in the 1992 Amex Bank Review Prize Essays, edited by R. O'Brian (Oxford University Press). Although the research is the result of a joint effort, L. Bini Smaghi is mainly responsible for the introduction and Section 2, S. Vori for Section 1 and the Appendix. We are the only responsible for remaining errors and for opinions.

literature, which can be summarized as follows: giving up the exchange rate as an instrument for adjustment to asymmetric shocks will entail major costs for European economies; EMU will therefore not be viable unless other instruments, such as factor mobility or fiscal policy, become available.

Our objective is a limited one - not to make an overall assessment of the optimality of the EC as a currency area but to highlight some pieces of evidence that may call into question the underlying assumptions of this literature. Somewhat provocatively, we take the United States as a benchmark for the EC.² We are obviously aware of the limitations of such a comparison. The EC is not yet a currency union -- in fact, the latest members have not yet fully liberalized trade and capital movements. The transition to a different exchange rate regime may bring about modifications of economic structures and of agents' behaviour affecting the way in which economies respond to economic disturbances. The relevant comparison, if the data were available, would presumably be with the US at the start of its union; even then, other relevant differences would still distort the analysis.

Bearing these caveats in mind, the analysis of the EC and US economies lead to the following broad conclusions:

- the economies of the EC states, especially the founding members, are more homogeneous than those of the various regions of the United States and are therefore less likely to be subject to asymmetric disturbances;
- in the EC, real wage rigidity is greater than in the US; therefore, prima facie, the exchange rate should be a less efficient instrument of adjustment to asymmetric shocks within the former than within the latter;

2. Analyses of the US as reference optimal currency area have also been carried out by Eichengreen (1990a, b), Bayoumi and Eichengreen (1992), Atkeson and Bayoumi (1991), Sachs and Sala-i-Martin (1991), Poloz (1990), Emerson et al. (1990).

- in the EC, labour mobility within member states is as low as between member states; therefore the exchange rate does not represent an efficient instrument of adjustment within the EC;
- powerful budgetary instruments for adjustment to asymmetric shocks are available in the EC and the US; in the former they operate through state budgets, in the latter through the federal budget.

The paper is organized in two sections. The first one examines the likelihood and relevance of asymmetric shocks and inquires whether the basic characteristics of the EC economies are such as to make exchange rate variations an efficient instrument of adjustment. The second section assesses labour mobility and budgetary policy as substitutes for the exchange rate.

1. The exchange rate as an instrument of adjustment

The exchange rate can be an instrument of adjustment to shocks that affect economies differently insofar as it favours the modification of the relative prices of goods produced in two economies. Therefore, the usefulness of the exchange rate depends on:

- i) the extent to which the economies are subject to differential shocks;
- ii) the extent to which the exchange rate can modify relative prices.

1.1. Asymmetry of shocks

Regions within a monetary area may experience different shocks that alter their relative performances. The extent to which regional economies have been affected by different shocks can be assessed by comparing their behaviour over time. We examined the correlation of each member state's

GDP with GDP in the rest of the area, in terms of deviation from a linear trend.³ The US and the EC are both considered: for the EC, the aggregates EC total, EC10 (ERM countries in 1991) and EC6 (founding countries) have been analyzed; for the US, the states have been regrouped according to the 12 Federal Reserve districts (Table 1; see also Tootell, 1990). The results (Table 2) suggest that the economies of the founding members move more uniformly than the US regions. This holds independently of the time period: the simple average correlation is .95 in the 1963-89 period (.96 in 1979-89), .69 for the US (.66 in 1979-89).⁴ When the new EC members are considered, the average correlation tends to fall, especially due to the low or negative values for the UK and Denmark. On the other hand, when the weighted average correlation is considered for the comparison, the US mean correlation is higher than the EC10 and EC12 mean for the 1979-1989 period.

Differences between countries' economic performances can arise either from differences in the shocks that have been experienced or in the responses. The above simple correlation analysis cannot discriminate between the two aspects (Bayoumi and Eichengreen, 1992).⁵ The higher

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3. The results do not substantially differ, however, when the correlation between rates of growth is considered.
 4. These results are consistent with those of Weber (1991), who finds that shocks to inflation rates and other nominal variables are highly symmetrical between EMS countries; besides, the asymmetrical components have been shrinking. Supply shocks have also been fairly symmetrical. Cohen and Wyplosz (1989) found that symmetrical shocks to the French and German economies are much larger than asymmetric shocks.
 5. Bayoumi and Eichengreen (1992) distinguish between demand and supply shocks depending on the price and output response to shocks. Their empirical analysis suggests that demand shocks affecting EC countries are smaller than those affecting US regions (with a different regrouping from ours). Supply shocks affecting the EC countries are similar in amplitude to those affecting the

correlation between GDP movements within the EC may be partly due to the past use of autonomous responses in the member states, such as exchange rate modifications, to absorb the impact of differentiated shocks. One way to address this issue is to distinguish between shocks affecting individual regions, such as an earthquake or a wage push, and shocks impinging on all the regions but with a variable intensity because of structural differences -- a good instance being an oil shock. The two types of shock may be termed, respectively, state-specific and sector-specific.

We have examined the extent to which the behaviour of EC economies can be explained by sector-specific or state-specific factors, using a methodology developed by Stockman (1987).⁶ The analysis concentrates on manufacturing production. Table 3 shows the proportion of the variance in EC manufacturing output explained by sector-specific and by state-specific factors.

Considering the founding members of the EC, from 1976 to 1990 over 60 per cent of the variance explained by both factors as a whole is accounted for by sector-specific factors, 15 per cent by state-specific factors, and the remainder by the interaction of the two. For the period 1981-1990 the weight of the state-specific factors falls to 10 per cent. Considering the broader group of EC countries, the share of production variance explained by both factors which is due to sector-specific factors is about 40 per cent. The corresponding exercise for US Federal Reserve districts shows that about 70 per cent of the variance explained by the two different components can be attributed to sector-specific

(Continuazione nota 5 dalla pagina precedente)

US regions. However, their analysis covers a period (1962-1988) of widely changing exchange rates, in which some countries as Portugal, Greece and Spain were not for the most part members of the EC.

6. For a brief description of the methodology see the Appendix.

factors; state-specific factors accounted for 6 per cent.

The impact of sectoral factors depends on the sectoral composition of an economy's output. On average, the differences between regional production structures are much larger within the US than within the EC. EC national economies are much more alike than US regions. Table 4 shows that the average dispersion in the composition of industrial production in the EC is half that of the US.⁷ Table 5 shows the correlation between countries' rates of change in production which are explained only by sector-specific factors. The results show that, following the high similarity between EC countries' industrial structures, ignoring state-specific factors yields a very large correlation between countries' production. This suggests that differences in economic performances between member countries are not due to structural differences in production but to state-specific factors such as the conduct of economic policies, which have sometimes largely differed in the period examined.

Interestingly, for all EC countries except Ireland there is a significant inverse correlation between the sector-specific and state-specific factors (Table 6). In the US, several regions show positive correlations and only two significant negative coefficients in the longer interval; only one significant negative coefficient is reported for 1981-1989. This suggests that in the EC state-specific factors tend to move in a direction which offsets the effects of sector-specific factors; in the US, on the contrary, the former tend to compound the latter. EC countries' productions tend to be affected by very similar shocks, but have reacted in relatively different ways, due either to different policy preferences or different institutional policy structures. It is difficult to assess to what extent the passage to EMU will

7. Krugman (1992) examines a more broadly aggregated set of regions within the EC and the US and also finds that specialization is much greater in the US.

reduce such differences. Certainly, the recourse to exchange rate changes will be removed. However, there will still be room for differences in fiscal or income policies. The results of Table 5 should be interpreted as indicating that if differences between state-specific factors were eliminated, a situation approaching that of the US, the EC countries' economies (manufacturing production) would behave in a very similar manner, much more alike than US regions' economies. This evidence reflects the fact that EC economies are more similar in structure and tend to behave more as a group than US regions and are therefore less likely to suffer from asymmetric shocks.⁸ This would suggest that the exchange rate is a less useful instrument of adjustment in the EC than it would be in the US.

Of course, this result is based on the present structure of the EC economies. Economic and monetary union could promote increased specialization, with EC countries becoming as highly specialized as US regions. According to Krugman (1992), a reduction in transaction costs, whether these costs take the form of transportation expenses, tariffs or regulatory disparities, would increase the probability of external economies leading to geographical concentration of an industry. According to Emerson et al. (1990), however, the removal of barriers tends to spur intra-industry integration, which would make the effects of sector-specific shocks more uniform.

Whether the "peripheral" members are specializing in the same sectors as the founders is an interesting line of research.⁹ It is difficult to make an empirical assessment at

8. According to Kenen (1969) "a well diversified national economy will not have to undergo changes in its terms of trade as often as a single product national economy".

9. Krugman (1992) gives some anecdotal evidence on the geographical distribution of auto production in the EC and the US, showing that in the latter it is more localized. It is interesting to see that from 1980 to

this stage. However, the data on foreign direct investment in Portugal and Spain (Table 7) indicates that the latter is concentrated in sectors in which these countries are relatively less specialized, such as finance, insurance and real estate in Portugal and manufacturing in Spain. In sectors as agriculture and tourism, whose share of GDP is higher in Portugal and Spain than in the EC, foreign direct investment is relatively limited.

Preliminary evidence tends to suggest that within the EC factors other than those emphasized in the recently revitalized literature on economic geography play an important role in determining industrial location.¹⁰ One such factor might be the greater population density and the higher cost of land (compared with the US), which impede the concentration of industry in certain areas. Other reasons could be Europe's lower labour mobility, discussed below, which limits the possibilities of industrial concentration.

In summary, the evidence indicates that thanks to its economic structure the EC should be less subject to asymmetric shocks than is the US. Other things being equal, therefore, the exchange rate is presumably a less useful instrument of adjustment in the former than it would be in the latter. Other type of shocks, restricted to a specific area might occur, such as an earthquake, on the recent example of German unification. Arguments can be made in favour of maintaining the possibility of using the exchange rate to adjust to these shocks, although presumably other instruments have been used as has been the case of German

(Continuazione nota 9 dalla pagina precedente)

1990 the concentration of automobile production in the EC has strongly decreased. The variance of production shares of the 6 largest producing countries has fallen by about 20 per cent. In 1991 Spain has overtaken Italy to become the third producer in the EC. Furthermore, production has started in Portugal, which in 1991 supplied 0.5 per cent of the automobiles manufactured in the EC.

10. On this, see also Bertola (1992).

unification.

1.2. Effectiveness of the exchange rate instrument

In a country which is affected by a negative shock, such as a reduction in the demand for its home-produced tradable goods, full employment can be maintained if real wages adjust accordingly, to the extent necessary for the supply curve to shift in a way that restores equilibrium (Mundell, 1968). If wages and prices are fully flexible and can move downward, in response to the excess supply or demand in the labour markets, internal and external equilibrium can be achieved without any change in the exchange rate. If, on the contrary, prices and wages are rigid downward, internal and external equilibrium can be restored through an expansionary monetary policy which: i) unexpectedly increases the price level and therefore reduces real wages and; ii) leads to a devaluation of the exchange rate which lowers the price of the good, expressed in foreign currency, thereby increasing its foreign demand. The necessary condition for the adjustment in real wages and in relative prices to be effective is that nominal wages are not reactive to increases in domestic prices. If unions negotiate on the basis of real wages, i.e. if agents have no money illusion, real wages cannot be reduced and the ratio of domestic to foreign prices cannot be modified.

Real wage rigidity can be assessed on the basis of the elasticity of nominal wages with respect to: i) prices and ii) excess supply or demand in the labour markets. The higher is the first elasticity with respect to the second, the less effective is the exchange rate as an instrument for modifying relative prices. If nominal wages are highly responsive both to changes in the price level and to unemployment, adjustment in a region negatively affected by a shock will not be possible through a devaluation but will take place through a temporary rise in unemployment. On the

contrary if wages are little sensitive to unemployment and are not indexed, adjustment can be attained through a devaluation.

Table 8 reports estimates of elasticities of wages with respect to prices and unemployment from OECD (1989). These measures differ among EC countries, but for all responsiveness of wages to prices appears to be higher than to unemployment.¹¹ In the US and Japan, on the contrary, the elasticity of the real wage with respect to prices is larger than that with respect to unemployment.¹² The ratio of the two elasticities, which represents the real wage rigidity, is greater than unity in all European countries, particularly in Germany, even though indexation is forbidden.

The degree of wage flexibility could change with the increasing integration of Community goods and labour markets, eventually if EMU were accompanied by more centralized wage negotiations. However, if real wage rigidity continues to be larger in the EC countries, the exchange rate will be a less effective instrument for adjustment than it would be in the US.

2. Alternative instruments

The literature has concentrated on two main instruments that are expected to compensate for the renunciation of exchange rate flexibility: labour mobility and fiscal policy.

2.1. Labour mobility

11. The high degree of real wage rigidity in the EC might in fact explain why recently EC countries have rarely used the exchange rate as an instrument of adjustment.

12. This result is confirmed by Bruno and Sachs (1985) and Coe (1985).

Mundell (1961) pointed to the importance of labour mobility as an instrument of adjustment in a fixed exchange rate system. As mentioned in the previous section, if a country is affected by a negative shock that for instance reduces the demand for its products, full employment cannot be restored unless relative prices and wages adjust. In the presence of nominal wage rigidities, a change in the exchange rate can contribute to bring about the necessary change in the real wage and in relative prices so as to maintain full employment. If exchange rates are not allowed to vary, full employment can be maintained only through the migration of unemployed workers towards the regions experiencing a relative increase in the demand for their products.

Direct evidence on labour mobility is rather difficult to assemble. A study by the OECD (1986) concluded that mobility within the US is two or three times greater than mobility among European states. Eichengreen (1990b) found that the dispersion of rates of unemployment is about twice as high in the EC as in the US. The data shown in Table 9 confirm these results. The coefficient of variation of unemployment rates within the founding members of the EC is about twice that within the US; for the entire EC the dispersion is four times higher.

Eichengreen also attempted to estimate the speed of adjustment of labour markets in various countries. His results confirm that labour markets adjust more quickly to disturbances in the US than in the EC, although not substantially (adjustment is about 25 per cent faster in the US). This points to the existence of barriers to labour mobility within the EC, including cultural and language differences. While the completion of the internal market is bound to reduce the barriers to labour mobility, it is most unlikely that the sort of labour market integration prevailing in the US can be replicated in the EC in the foreseeable future. The lack of labour mobility between EC

countries would lead to the conclusion that renouncing to the exchange rate instrument will create major unemployment problems in the EC and will therefore be welfare decreasing.

The above conclusion is subject to two qualifications. The first is that the adjustment mechanism described above is based on a one country-one sector model. In such a model, when countries specialize in production, the adjustment to a negative shock can be achieved through a devaluation which reduces real wages and increases foreign demand so as to maintain full employment. In multisector economies, however, a change in the exchange rate increases the demand for all products, not only that of the sector that has been negatively hit; if relative prices within the country are not flexible, adjustment is achieved through an increase in production in the sectors that have not been negatively hit. This can be achieved if resources, including labour, migrate from the negatively hit sector to the other sectors. If labour mobility is limited not only between countries but also within countries, the exchange rate will have little effect in favouring adjustment to asymmetric shocks.¹³

Table 10 reports data on the dispersion of unemployment rates within the EC countries. Interestingly, internal dispersion increased in all countries during the eighties, regardless of the trend in the national rate. Comparing the data of Tables 9 and 10, it can be seen that dispersion of unemployment rates is greater within Italy, Spain and the UK than among EC countries; dispersion in

13. Fully aware of the limitations of his simple model, Mundell (1961) explained that: "if labour and capital are insufficiently mobile within a country, then flexibility of the external price of the national currency cannot be expected to perform the stabilization function attributed to it, and one could expect varying rates of unemployment or inflation in the different regions." Following this reasoning, Mundell noted that Canada, which does not have substantial labour mobility among its regions, is not a good candidate for flexible exchange rates.

Germany, France and the Netherlands is lower, but still at least as high as between the founding members of the EC.¹⁴ Following Mundell's analysis these countries are poor candidates for flexible exchange rates.

The second qualification regards the balance between the welfare costs of labour mobility and unemployment. In Mundell's analysis, labour mobility does not affect welfare. Therefore, in such models, if wages are not sufficiently flexible, it is preferable for a region to have its excess labour force migrating than experiencing unemployment. The fact that labour is not mobile within countries, and that even large inter-regional unemployment disparities persist without inducing equilibrating labour migration, indicates that this assumption may be a gross simplification in the case of Europe.¹⁵ In EC countries, migration is not considered a desirable means of adjustment as it entails social and economic costs that economists generally ignore. On the other hand EC economies have equipped themselves to cope with the welfare costs of temporary unemployment by establishing wide-ranging social benefits. Though this issue is clearly beyond the scope of the present work, this attitude strongly suggests that the lack of labour mobility is not seen as an obstacle to EMU and

14. De Grauwe and Van Haverbeke (1991) found similar evidence.

15. As Ingram (1973, p. 25) pointed out:
"Society may prefer to maintain a certain dispersion of population and to resist tendencies towards its concentration in a few urban areas, even at a cost of reduced output and efficiency. Nations have a variety of regional economic and social programs through which they attempt to deal with problems of regional imbalance. These programs can continue to function in a monetary union, and capital market integration may even increase their effectiveness."

that adjustment would be achieved by other means.¹⁶ In particular, regional policies to attract investment to areas hurt by shocks already play an important role in the EC and will become even more important in EMU.

2.2. Fiscal policy

The literature has emphasized the role of fiscal policy in ensuring the viability of a currency union,¹⁷ but we need to distinguish between the stabilization, redistribution and allocation functions of fiscal policy. The relevant one for adjustment to asymmetric shocks is stabilization.

Sachs and Sala-i-Martin (1991) examined the role played by the US federal budget in compensating for changes in states' relative income. In a US state adversely affected by a shock, disposable income is sustained by a reduction in the proportion of taxes paid to the federal government and by direct transfers in the form of federal grants-in-aid. Other federal expenditures, such as interest payments and military outlays, are not considered as forms of income support that can foster the adjustment to asymmetric shocks.¹⁸ Sachs and Sala-i-Martin found that on average about 35 per cent of a change in states' relative income is offset through the federal tax system. Furthermore, federal grants-in-aid are

16. According to Kenen (1969, p. 48) "when there is immobility between single-product regions of a single nation, it may be very difficult to maintain full employment and price stability throughout its territory; the nation must rely on rather sophisticated internal policies to reallocate demand rather than augment or curb it."

17. Early proponents of this instrument were Kenen (1969), Ingram (1973) and Allen (1976). For more recent work, see Masson and Méritz (1990).

18. Military spending, for instance, which amounts to about one fourth of non-interest federal expenditure, is concentrated in a handful of states such as California, Florida, Virginia and Texas.

correlated with relative income with a coefficient of 22 per cent. On the basis of the average tax and transfer to states, the elasticity of personal disposable income with respect to personal income is about 40 per cent. Hence the fraction of the initial shock absorbed by the federal fiscal system is about 40 per cent. The authors argued that EMU could be at risk if it failed to envisage some comparable federal shock absorber mechanism.

However, the findings of Sachs and Sala-i-Martin are open to a number of critical observations.

One objection concerns the empirical analysis. Von Hagen (1991) pointed out that federal tax receipts are related to the level of income, not to changes in states' relative income. Correcting for this effect, the proportion of the disposable income change offset by the federal tax system falls to just 8 per cent. Federal grants-in-aid are also correlated with income level rather than changes in relative personal income, suggesting that the US federal budget plays an important role in income redistribution but a much more limited one than often claimed in relative income stabilization.

A second objection is that the analysis concentrates on the US federal budget and ignores the state and local public finances. In 1991 state and local receipts and expenditures amounted to about 40 per cent of total general government spending, so their impact is substantial indeed.¹⁹ Every state but Vermont has either statutory or constitutional balanced budget requirements, although the

19. On average, the state and local budgets have recorded a surplus, which in 1991 amounted to \$30 billion (0.5 per cent of GDP), \$5 billion more than in 1990. The federal budget, by contrast, recorded a deficit of \$171 billion (3 per cent of GDP). In certain years, such as 1981, the states' surplus matched the federal deficit. In 1991 the net interest paid by the federal government on its debt amounted to \$195 billion, while state and local governments had net interest receipts of \$66 billion.

restrictions are not all equally binding.²⁰ A balanced budget requirement is bound to produce a procyclical policy, exacerbating the effects of asymmetric shocks, as recent research tends to demonstrate.²¹

Two additional pieces of evidence point in the same direction. An often ignored fact is that US unemployment insurance is largely administered at the state, not the federal, level. It is funded largely by corporate taxes. Benefit levels and eligibility criteria vary among states according to specific laws. Furthermore, "the financing structure of the unemployment insurance program levies higher taxes on companies with histories of sizable layoffs" (Council of Economic Advisers, 1992, p. 106). In states affected by adverse shocks the increase in unemployment often gives rise to budget difficulties, which may prompt higher taxes or a reduction in unemployment benefits, exacerbating the macroeconomic effects of the shock and presumably providing an incentive for migration.²²

Second, as was noted in section 2.1 (Table 3), for many US areas there is a positive correlation between the state-specific and the sector-specific factors in output variability. Since state fiscal policy can be taken as one of the main state-specific factors influencing income, this finding indicates that state budgets have played little role in countering sector-specific disturbances.

Overall, when appropriate methodology is adopted

20. See Eichengreen (1990b).

21. Stotsky (1991), Mattoon and Testa (1992).

22. A comparison of the rates of growth of personal and disposable income in the last decade reveals that in six of the twelve US Federal Reserve districts disposable income grew faster than total personal income in fast growing areas or slower than personal income in slow-growing ones. This evidence shows that budgetary policy has in some cases widened the divergence in the growth rates.

the inter-state stabilization role of US budgetary policy seems to be more limited than is generally believed. Atkeson and Bayoumi (1991) found that no more than 13 per cent of a change in relative personal income is counteracted by US fiscal policy. They also found that the protection against income fluctuation provided by EC states is comparable to that offered in the US. In principle, therefore, as recognized by Mussa (1991), the EC has the tools to counter asymmetric shocks. However, the EMU Treaty limits, with some flexibility, government deficits to 3 per cent of national product.²³ The ability of member states to perform the desired stabilization function in the face of adverse shocks will therefore largely depend on their disciplined behaviour in favourable years.

The difference between income stabilization in the face of asymmetric shocks in the US and the EC concerns the level of government at which it is performed. The issue is whether one system is preferable to the other. The prevailing view within the EC seems to have shifted from advocacy of the centralized approach (McDougall, 1977) to acceptance of a more decentralized one, based on the principle of subsidiarity (Padoa-Schioppa et al., 1987). Scholarly views also differ as arguments are raised in favour and against both systems. Indeed, several monetary unions, such as Switzerland or Belgium and Luxembourg, have done without a federal budget responsible for stabilization, and the US

23. Article 104c of the Treaty states that a deficit is excessive if it exceeds 3 per cent in relation to gross domestic product, unless:

- "- either the ratio has declined substantially and continuously and reached a level that comes close to the reference value,
- or, alternatively, the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value."

federal budget played no major role before 1929.²⁴

This debate goes beyond the scope of this work. An interesting aspect on which greater attention should be devoted is the relationship between the integration of labour markets and the centralization of fiscal policy. Allen (1976) argued that one reason for centralizing fiscal policy is to prevent labour mobility from high-tax to the high-spending regions from undermining the stabilization function of regional fiscal policy and provoking budget crises. If labour mobility within the EC increases or wage negotiations tend to be conducted increasingly at a centralized level, stabilization policy might be more efficiently conducted at the centralized level.

The above discussion has concentrated on the performance of the stabilization function through budgetary policy in the face of asymmetric shocks, which are the most disruptive to monetary unions. However, the Union may experience symmetric shocks, affecting all countries similarly, and therefore want to engineer a common budgetary policy response. In a centralized system the homogeneity of the budgetary response across states is guaranteed; in a decentralized system, strong forms of cooperation will be needed to overcome the externalities resulting from cross-border budgetary effects.²⁵

Finally, some authors have argued that a viable monetary union also requires income redistribution between regions, to ease the effects of stabilization on the poorest economies in case of negative shocks. Such a redistribution

24. In an early debate, Lutz and Triffin noted that budgetary centralization is not required for monetary union, while Lundberg and Scitovsky took the opposite view. See Machlup et al. (1972). For a survey of recent debate see Inman and Rubinfeld (1991).

25. These issues have been addressed in particular by Buiter and Kletzer (1990), Wyplosz (1991) and Van der Ploeg (1990).

would occur mainly through budget centralization, the establishment of uniform criteria for levying taxes and allocating transfers, precluding a situation in which regional governments can constantly evaluate their respective costs and benefits from the programme. However, as Allen (1976) recognized, redistribution requires a Union-wide welfare function, which itself can only be formulated by a political union.²⁶

In advocating a greater role for redistributive policies in the EC the McDougall report (1977) indicated in the 3-10 per cent range generally observed in monetary union the target for the ratio of net transfers from the EC to recipient regions.²⁷ Others, as Eichengreen (1990a), indicated the US system of federal grants-in-aid, which amount to 2.7 per cent of GDP in 1991, as the model to follow for the EC.

We do not intend to discuss the validity of these arguments, but only to point out that the Community redistributive policies are much more important than is generally perceived. The data reported in Tables 11 and 12 show that although in 1990 per capita transfers in the US averaged 481 dollars, twice as much as in the EC (223 dollars), the variance is much lower in the former (8455 dollars across US states against 45,059 dollars in the EC). The US federal budget makes large transfers to all states, including the richer ones. On the contrary, the EC budget makes transfers mostly to poorer states. In 1990, per capita transfers to Germany amounted to 96 dollars, those to Ireland 822, Portugal 133, Greece 381. The transfers to Ireland are as large as those to the poorest US states. Those to Portugal

26. Greater centralization of budget policies has also been advocated on grounds of regional insurance provision. See, on this particular matter, Van der Ploeg (1990) and Mélitz and Vori (1992).

27. In some states, small poor regions such as Brittany and Northern Ireland, receive state transfers for as much as 20 per cent of their income.

and Greece are smaller but have increased by 100 and 50 per cent, respectively, since their admission to the EC (in 1986 and 1984). Net transfers to Ireland and Greece amount to 7 and 5 per cent of their GDP. These numbers are similar or close to those advocated in the McDougall report.

There are no doubts that budgetary issues will be the subject of increasing discussions as the EC moves towards EMU. Plans have already been agreed to restructure and to further increase the amounts distributed by EC budget in the next few years. This however might not result in a greater centralization of budgetary policy until more decisive steps are taken towards political union.

Table 1

Main indicators for EC States and US Federal Reserve districts - 1989 (1)

Belgium	GDP	= 153.0	(% EC GDP: 3.2)	FED1 = Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island, Vermont	GDP	= 311.9	(% US GDP: 6.1)
	Population	= 9.9			Population	= 13.0	
	GDP per capita	= 15.5			GDP per capita	= 24.0	
Denmark	GDP	= 104.7	(% EC GDP: 2.2)	FED2 = New York	GDP	= 441.1	(% US GDP: 8.6)
	Population	= 5.1			Population	= 18.0	
	GDP per capita	= 20.5			GDP per capita	= 24.5	
France	GDP	= 958.2	(% EC GDP: 19.7)	FED3 = Pennsylvania, New Jersey, Delaware	GDP	= 446.7	(% US GDP: 8.7)
	Population	= 56.2			Population	= 20.4	
	GDP per capita	= 17.0			GDP per capita	= 22.0	
Germany	GDP	= 1189.1	(% EC GDP: 24.5)	FED4 = Ohio	GDP	= 211.5	(% US GDP: 4.1)
	Population	= 62.0			Population	= 10.9	
	GDP per capita	= 19.2			GDP per capita	= 19.4	
Greece	GDP	= 54.2	(% EC GDP: 1.1)	FED5 = Virginia, West Virginia, Maryland, North Carolina, South Carolina	GDP	= 453.7	(% US GDP: 8.9)
	Population	= 10.0			Population	= 22.7	
	GDP per capita	= 5.4			GDP per capita	= 20.0	
Ireland	GDP	= 33.9	(% EC GDP: 0.7)	FED6 = Tennessee, Mississippi, Louisiana, Georgia, Alabama, Florida	GDP	= 634.2	(% US GDP: 12.4)
	Population	= 3.5			Population	= 35.2	
	GDP per capita	= 9.7			GDP per capita	= 18.0	
Italy	GDP	= 865.8	(% EC GDP: 17.8)	FED7 = Wisconsin, Michigan, Iowa, Indiana, Illinois	GDP	= 690.2	(% US GDP: 13.5)
	Population	= 57.5			Population	= 34.2	
	GDP per capita	= 15.1			GDP per capita	= 20.2	
Luxembourg	GDP	= 7.0	(% EC GDP: 0.1)	FED8 = Kentucky, Missouri, Arkansas	GDP	= 203.1	(% US GDP: 3.9)
	Population	= 0.4			Population	= 11.3	
	GDP per capita	= 17.5			GDP per capita	= 18.0	
Netherlands	GDP	= 223.7	(% EC GDP: 4.6)	FED9 = Montana, North Dakota, South Dakota, Minnesota	GDP	= 129.0	(% US GDP: 2.5)
	Population	= 14.9			Population	= 6.5	
	GDP per capita	= 15.0			GDP per capita	= 19.8	
Portugal	GDP	= 45.3	(% EC GDP: 0.9)	FED10 = Wyoming, Nebraska, Kansas, Colorado, Oklahoma	GDP	= 209.6	(% US GDP: 4.1)
	Population	= 9.8			Population	= 11.1	
	GDP per capita	= 4.6			GDP per capita	= 18.9	
Spain	GDP	= 380.0	(% EC GDP: 7.8)	FED11 = New Mexico, Texas	GDP	= 365.5	(% US GDP: 7.1)
	Population	= 33.9			Population	= 18.5	
	GDP per capita	= 11.2			GDP per capita	= 19.8	
U. Kingdom	GDP	= 837.5	(% EC GDP: 17.3)	FED12 = Washington, Oregon, Idaho, Nevada, California, Utah, Arizona, Alaska, Hawaii	GDP	= 1028.8	(% US GDP: 20.0)
	Population	= 57.2			Population	= 45.7	
	GDP per capita	= 14.6			GDP per capita	= 22.5	
EC (2)	GDP	= 4852.4	(4752.9) (3396.8)	USA (3)	GDP	= 5125.3	
	Population	= 320.4	(300.6) (200.9)		Population	= 247.5	
	GDP per capita	= 15.1	(15.8) (16.9)		GDP per capita	= 20.7	

Source: OECD, BEA, US Department of Commerce.

(1) Data at current prices and exchange rates. GDP is measured in billion dollars; population in millions; GDP per capita in thousands dollars.
(2) Data in the first parenthesis refer to the EC10, in the second parenthesis to EC6.
(3) The total does not include the District of Columbia.

Table 2

Correlation of real GDP between states and rest of area (1)

	BLEU	F	D	I	NL	DK	IRL	E	UK	P	GR	Mean simple weighted		
EC	1963-89	.97	.95	.91	.97	.71	.81	.93	.29*	.95	.95	.85		
	1979-89	.93	.83	.96	.87	.94	.90	.87	-.15*	.90	.89	.74		
EC10	1963-89	.96	.94	.91	.90	.97	.81	.92	.29*			.83		
	1979-89	.91	.79	.96	.85	.94	.90	.88	-.14*			.69		
EC6	1963-89	.97	.97	.91	.95	.97						.95		
	1979-89	.98	.95	.93	.99	.98						.96		
	FED1	FED2	FED3	FED4	FED5	FED6	FED7	FED8	FED9	FED10	FED11	FED12	Mean	
USA	1963-89	.49	.66	.83	.97	.93	.79	.91	.98	.64	.16*	.10*	.78	.69
	1979-89	.70	.72	.84	.99	.93	.90	.99	.98	.45*	-.27*	-.30*	.96	.66

Sources: EUROSTAT, BEA, US Department of Commerce.

(1) Correlation between the States' Real per capita GDP (deviation from trend) and the rest of area Real per capita GDP (deviation from trend). The coefficients are all significant at .01 level, except those marked by an asterisk.

Table 3

State and sector specific components of manufacturing production variability (1)

	state SS	sector SS	R ²	total SS	explained SS	state and sector SS
A. Period 1976-90						
EC	4.36 (3.69)	3.90 (3.96)	.795	23.35	18.55	9.30
EC10	2.63 (3.53)	2.99 (4.13)	.803	16.08	12.90	6.69
EC6	.49 (2.54)	2.14 (6.32)	.805	4.40	3.54	3.29
USA (2)	1.56 (2.40)	19.23 (31.87)	.902	33.32	30.05	27.01
B. Period 1981-90						
EC	1.56 (3.16)	1.34 (2.67)	.716	9.54	6.83	3.58
EC10	.96 (3.51)	1.28 (3.76)	.711	6.11	4.34	2.78
EC6	.15 (2.05)	.83 (4.03)	.777	2.44	1.90	1.53
USA (2)	.78* (1.58)	9.08 (30.40)	.899	19.70	17.70	13.08

(1) SS= sum of squares. See the appendix for the methodology and data description.

In parenthesis are the F statistics, all significant at the .01 level, except that marked by an asterisk, which is significant at the .05 level.

Luxembourg is excluded from EC aggregates.

(2) For the USA the last available data refer to 1989.

Table 4

Composition of manufacturing production
(percentage points)

Areas Sectors		EC		EC10		EC6		USA	
		Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
Food, Beverages and Tobacco	1980	11.3	12.2	11.2	12.0	10.2	10.2	10.8	15.3
	1989	11.2	11.3	11.1	10.5	10.3	10.3	8.3	3.9
Textiles, Clothings and Leather	1980	10.0	30.3	9.6	26.2	9.4	27.4	6.5	30.0
	1989	8.1	25.9	7.7	21.8	7.5	24.6	4.8	15.9
Wood and Wood Products	1980	4.4	1.6	4.4	1.5	4.9	1.3	4.9	8.0
	1989	3.8	1.4	3.9	1.4	4.2	1.5	4.3	3.1
Paper and Paper Products	1980	6.7	6.1	6.7	6.2	5.5	3.3	9.8	10.8
	1989	7.4	5.9	7.4	6.0	6.3	3.1	8.8	8.6
Chemicals and Chemical Products	1980	15.7	2.5	15.7	2.6	15.7	3.4	14.2	28.3
	1989	17.0	5.8	16.9	5.6	16.9	7.8	17.1	33.9
Non-Metallic Mineral Products	1980	5.4	1.1	5.4	0.9	5.4	1.1	3.3	0.7
	1989	4.8	1.4	4.6	0.8	4.6	1.0	2.7	0.3
Basics Metals	1980	6.9	4.2	7.0	4.2	7.2	3.7	7.5	9.5
	1989	6.2	2.4	6.2	2.3	6.4	1.6	4.1	3.7
Metals Products, except Machinery and Equipment	1980	9.9	3.9	10.0	3.7	11.1	0.7	8.4	4.8
	1989	9.3	2.9	9.4	2.6	10.3	1.2	7.4	5.0
Machinery except Electrical	1980	9.3	12.9	9.5	12.0	9.8	11.2	13.5	20.3
	1989	10.1	12.9	10.3	11.4	10.6	10.9	19.8	27.2
Electrical Machinery	1980	9.2	5.3	9.3	4.7	9.8	3.9	9.9	6.3
	1989	10.5	8.6	10.6	7.8	10.8	9.6	10.3	9.6
Transport Equipment	1980	11.2	6.1	11.2	6.1	11.0	7.2	11.3	27.8
	1989	11.7	7.5	11.8	6.7	12.2	7.5	12.5	26.4
Average (1)	1980		8.39		7.72		7.07		16.71
	1989		8.38		7.51		7.85		17.97

Sources: OECD, BEA, U.S. Department of Commerce.
Luxembourg is excluded from EC aggregates.

(1) The average variances have been computed using the corresponding mean values as weights.

Table 5

Correlation of sector-specific industrial production between states and rest of area (1)

	BLEU	F	D	I	NL	DK	IRL	E	UK	P	GR	Mean
EC 1976-90	.998	.999	.997	.998	.998	.998	.997	.998	.999	.997	.995	.998
EC10 1976-90	.999	.999	.998	.998	.999	.998	.995	.998	.999			.999
EC6 1976-90	.999	.999	.999	.998	.997							.999

	FED1	FED2	FED3	FED4	FED5	FED6	FED7	FED8	FED9	FED10	FED11	FED12	Mean
USA 1976-89	.974	.992	.987	.969	.986	.991	.974	.994	.986	.970	.949	.953	.975

Sources: EUROSTAT, BEA, US Department of Commerce.

(1) Correlation between the sector-specific industrial production (rates of change) and that of the rest of area. The coefficients are all significant at .01 level.

Table 6

Correlation between state and sector specific factors of manufacturing production variability (1)

	B	F	D	I	NL	DK	IRL	E	UK	P	GR		
EC	1976-90	-.823	-.888	-.801	-.770	-.651	-.422*	-.766	-.497	-.726	-.832		
	1981-90	-.872	-.885	-.798	-.733	-.595	-.478*	-.705	-.839	-.921	-.909		
EC10	1976-90	-.827	-.887	-.798	-.772	-.653	-.440*	-.761	-.498				
	1981-90	-.877	-.887	-.803	-.735	-.595	-.511*	-.698	-.840				
EC6	1976-90	-.828	-.893	-.797	-.770	-.871							
	1981-90	-.885	-.893	-.809	-.734	-.853							
	FED1	FED2	FED3	FED4	FED5	FED6	FED7	FED8	FED9	FED10	FED11	FED12	
USA	1976-89	-.368*	-.800	-.626	.538	.001*	.226*	.541	.567	.150*	-.357*	-.258*	-.195*
	1981-89	-.172*	-.799	-.371*	.303*	.075*	.073*	.516*	.350*	-.178*	-.103*	-.247*	-.229*

(1) Correlation between the percentage change of two different indices of manufacturing production, built as the weighted sum of the estimated indices relative to single sectors of production obtained by fitting the model described in the appendix first considering only the sector specific component, then only the state specific component.

Luxembourg is excluded from EC aggregates.
The coefficients are all significant at .05 level, except those marked by an asterisk.

Table 7

Sectoral distribution of foreign direct investments in Portugal and Spain
(percentage points)

Sectors	Foreign direct investments		Memo: Sectoral distribution of GDP (1)	
	Portugal (2)	Spain (3)	Portugal	Spain
Agriculture, hunting, forestry and fishing	1.11	0.72	8.62	6.36
Manufacturing and mining industries	18.50	33.27	33.84	30.00
Electricity, gas and water	0.05	4.86	3.58	3.01
Construction and public works	6.33	1.62	6.44	7.36
Wholesale and retail trade, restaurants and hotels	10.36	11.60	24.88	22.74
Transport, storage and communication	0.71	1.43	7.79	6.15
Finance, insurance, real estate and business services	61.77	45.85	11.20	18.99
Community, social and personal services	1.18	0.64	3.65	5.40
				EC6
				3.73
				32.18
				3.69
				6.38
				17.16
				7.27
				17.04
				12.56

Sources: OECD and Banco de Portugal.

(1) Year 1986.

(2) Average 1989-1990.

(3) Average 1990-1991.

Table 8

Real wage rigidity

Countries	Elasticity of nominal wage with respect to:		Index of real wage rigidity
	Prices (a)	Unemployment rate (b)	- (a)/(b)
Belgium	.25	- .25	1.0
Denmark	.25	- .10	2.5
France	.50	- .29	1.7
Germany	.75	- .11	6.8
Italy	.60	- .39	1.5
Netherlands	.50	- .27	1.9
Spain	.25	- .20	1.3
U. K.	.33	- .15	2.2
USA	.14	- .61	.22
Canada	.18	- .51	.35
Japan	.66	-1.87	.35

Source: Calculations based on OECD (1989).

Table 9

**Unemployment rates
(percentage points)**

		Mean	Variance	C. V. (1)	Maximum	Minimum	Difference
EC	1983	10.91	8.89	.27	17.0	7.8	9.2
	1990	8.93	12.03	.39	15.9	4.6	11.3
EC10	1983	11.60	8.20	.25	17.0	8.2	8.8
	1990	9.55	12.07	.36	15.9	5.5	10.4
EC6	1983	10.14	4.92	.22	13.2	8.2	5.0
	1990	8.45	2.94	.20	10.8	6.2	4.6
USA	1983	9.28	3.03	.19	12.2	6.8	5.4
	1990	5.43	0.33	.11	6.2	4.6	1.6

Sources: OECD, US. Dept. of Labour.

Luxembourg is excluded from EC aggregates.
(1) Coefficient of Variation.

Table 10

**Regional unemployment rates
(percentage points)**

	Mean	Variance	C. V. (1)	Maximum	Minimum	Difference
W. Germany						
1983	7.47	3.42	.25	10.8	4.4	6.4
1990	6.12	4.85	.36	10.4	3.0	7.4
France						
1983	7.93	2.23	.19	10.2	5.8	4.4
1990	9.08	3.33	.20	11.8	6.7	5.1
Italy						
1983	9.35	10.71	.35	16.1	5.8	10.3
1990	11.02	45.22	.61	21.0	3.3	17.7
Netherlands						
1983	12.60	3.50	.15	14.0	9.9	4.1
1990	8.43	2.91	.20	10.9	7.2	3.7
Spain						
1983	14.50	28.07	.37	22.5	10.1	12.4
1990	16.04	40.67	.40	29.8	7.4	22.4
U. K.						
1983	12.13	8.54	.24	16.8	8.2	8.6
1990	8.05	13.35	.45	17.1	4.2	12.9

Source: EUROSTAT.

(1) Coefficient of Variation

List of Regions:

W. Germany
Schleswig-Holstein
Hamburg
Niedersachsen
Bremen
Nordrhein-Westfalen
Hessen
Rheinland-Pfalz
Baden-Wuerttemberg
Bayern
Saarland
Berlin (West)

France
Ile de France
Bassin Parisien
Nord-Pas-de-Calais
Est
Ouest
Sud-Ouest
Centre-Est
Mediterranée

Italy
Nord Ovest
Lombardia
Nord Est
Emilia-Romagna
Centro
Lazio
Campania
Abruzzi-Molise
Sud
Sicilia
Sardegna

Netherlands
Noord-Nederland
Oost-Nederland
West-Nederland
Zuid-Nederland

Spain
Galicia
Asturias
Cantabria
Pais Vasco
Navarra
Rioja
Aragon
Castilla-Leon
Castilla-La Mancha
Extremadura
Cataluna
Comunidad Valenciana
Balears
Andalucia

U. K.
North
Yorkshire and Humberside
East Midlands
East Anglia
South East
South West
West Midlands
North West
Wales
Scotland
Northern Ireland

Table 11

Distribution of US federal grants-in-aid

	Grants (1)		Grants in relation to:				State Population(3)
	1981	1990	Total US Grants (2)	1981	1990	State Personal Income (2)	
FED1	4.1	7.2	6.0	6.1	6.1	2.8	544
FED2	6.7	12.9	9.8	10.9	10.9	3.2	717
FED3	5.1	9.2	7.5	7.8	7.8	2.2	454
FED5	2.5	4.8	3.6	4.0	4.0	2.2	439
FED6	6.1	9.5	9.0	8.0	8.0	3.0	415
FED7	8.3	15.3	12.3	12.9	12.9	2.8	434
FED8	9.8	14.6	14.4	12.3	12.3	2.6	429
FED9	3.1	4.7	4.6	4.0	4.0	3.1	425
FED10	2.3	3.7	3.4	3.1	3.1	3.5	570
FED10	3.0	4.9	4.4	4.1	4.1	2.5	443
FED11	3.6	7.3	5.3	6.2	6.2	2.1	392
FED12	13.3	24.3	19.6	20.5	20.5	2.9	516
Mean	5.7	9.9	8.3	8.3	8.3	2.7	481
Variance	11.4	36.2	24.8	25.9	25.9	0.2	8455

Sources: US Department of Commerce, BEA and Bureau of the Census.

(1) Billions of dollars.

(2) Percentage points.

(3) Dollars per capita.

Table 12

Distribution of Community budgetary payments and receipts

	Payments in relation to:				Receipts in relation to:							
	Total Payments (1)		State Personal Income (1)		State Population(2)		Total Receipts (1)		State Personal Income (1)		State Population(2)	
	1981	1990	1981	1990	1981	1990	1981	1990	1981	1990	1981	1990
B	3.9	2.7	0.7	0.7	68	126	5.5	4.3	1.2	1.3	112	225
DK	3.7	3.2	1.3	1.4	125	297	2.0	1.9	0.8	0.9	77	192
D	16.1	13.0	0.5	0.5	46	97	28.1	25.0	0.9	1.0	91	209
GR	2.5	8.2	2.1	6.4	46	381	1.4	1.4	1.4	1.2	29	71
E		14.6		1.6	...	176		8.9		1.1		120
F	22.5	17.0	0.8	0.8	71	142	19.4	19.5	0.8	1.0	71	182
IRL	4.6	6.1	5.1	8.5	232	822	0.9	0.9	1.1	1.4	51	134
I	18.1	15.4	0.9	0.8	56	125	14.0	14.7	0.8	0.8	50	135
L	0.1	0.04	0.2	0.2	26	49	0.1	0.2	0.7	0.9	82	250
NL	8.3	8.1	1.1	1.5	100	254	7.1	6.3	1.1	1.3	100	223
P		3.0		2.5		133		1.2	...	1.1		61
UK	20.2	8.6	0.8	0.5	61	70	21.5	15.8	1.0	1.6	77	145
Mean	10.0	8.3	1.4	2.1	83	223	10.0	8.3	1.0	1.1	74	162
Variance	69.4	31.5	2.0	6.8	3540	45059	101.3	71.0	0.05	0.06	632	3726

Source: EC Official Journal, various issues.

(1) Percentage points.

(2) Dollars per capita.

APPENDIX

To assess the relative importance of sector-specific and state-specific components of industrial production we estimate, as in Stockman (1987), a statistical model:

$$d \ln IP (i,s,t) = m(i,s) + f(i,t) + g(s,t) + u(i,s,t)$$

$i = \text{sector} \quad s = \text{state} \quad t = \text{time}$

which allows to disaggregate the variance in the growth rate of the index of industrial production (ip) for a number of countries into three main components:

- 1) $m(i,s)$ is the average output growth in sector i in state s ;
- 2) $f(i,t)$ represents the component of output growth common to sector i , for time t , across countries;
- 3) $g(s,t)$ represents the component of output growth common to state s , for time t , across sectors.

$u(i,s,t)$ is an idiosyncratic disturbance to sector i in state s at time t , assumed to be an i.i.d. random variable.

The sector effect is intended to account for disturbances to production functions, input prices, or product demand that would affect production in sector i and are common across states. The state effect represents state-specific disturbances, such as changes in policy, that affect output differently in different countries.

Estimation of the model is performed using OLS; $m(i,s)$ is a constant term specific to sector i in state s ; $f(i,t)$ is a vector of dummy variables specific to sector i and to time t but common to all states; $g(s,t)$ is a vector of

dummy variables specific to state s and to time t but common to all industries.

To identify the model a set of normalizations must be made, otherwise some combination of the dummy variables are perfectly collinear. The normalizations imposed in the paper are similar to those used in Stockman (1987). First $g(s^*,t)=0$ for one specific nation: in the case of estimation for the EC countries, the US has been taken as benchmark. The state effects for the other countries can be interpreted as the difference between the state-specific components of industrial output variation in state s and in the US. The second normalization imposes that $f(i,T)=g(s,T)=0$ for $T = 1$, the first time period of the sample for all i and s (e.g., 1976 or 1981, depending on the time range of the estimation). Differences in output growth across industries and nations in the first period are reflected in the estimated constant terms $m(i,s)$. Estimation for the US regions was also performed relative to the whole US taken as normalization.

The results reported in Table 3 refer to estimation of the model with data on indices of industrial production for the following 11 sectors (in parenthesis, the ISIC division number):

- 1) food, beverages and tobacco (031);
- 2) textiles, clothing and leather (032);
- 3) wood and wood products (033);
- 4) paper and paper products (034);
- 5) chemicals and chemical products (035);
- 6) non metallic mineral products (036);
- 7) basic metals (037);
- 8) metal products, except machinery and equipment (381);
- 9) machinery, except electrical (382);
- 10) electrical machinery (383);
- 11) transport equipment (384).

Estimation was performed for the EC countries (Luxembourg is excluded from all aggregates due to lack of complete data) regrouped in three different aggregates (EC,

EC10 and EC6) for the period 1976-90 and 1981-90; data source is OECD. For the 12 US Federal Reserve districts, we used data on State GDP, disaggregated according to the same classification above, made available by the BEA, US Department of Commerce.

In the Table we report the total sum of squares, the sum of squares explained by the model and the sum of squares attributable to the sector and the state factors taken together. Since the state- and sector-specific effects, $f(i)$ and $g(s)$, are correlated, in the first two columns we report the fractions of the output growth variations explained by the orthogonal components of f and g .

In Table 6 we computed the correlation between the state- and sector-specific components of manufacturing production variability. To do so, we built two different estimated indices of aggregate manufacturing production for each country; these have been computed considering for each observation first only the sector-specific estimated components of the model fitted to explain manufacturing output growth, then only the state-specific estimated components, and weighing them according to the relative weights of each sector in manufacturing output composition in the reference year (1985; the weights are from OECD).

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