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Currency Unions, Economic Fluctuations, and Adjustment: Some New Empirical Evidence

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Abstract

This paper examines the sources of disturbances to output in the United States and a set of EU countries and analyzes labor market adjustment mechanisms in these two economic areas. Comparable datasets comprising 1-digit sectoral data for eight U.S. regions and eight European countries are constructed and used to compare the degree of industrial diversification and the relative importance of different sources of shocks to output growth. Both areas are found to be subject to similar overall disturbances although a disaggregated perspective reveals some important differences. The major difference, however, is in labor market adjustment. Interregional labor mobility appears to be a much more important adjustment mechanism in the United States, which has a more integrated labor market than the EU.

Keywords: Currency unions, economic fluctuations, labor market adjustment

JEL Classification Numbers:
E32, F33, J61

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Summary

Proposals for a European currency union have generated considerable interest in behavior across regions within the United States. Under EMU, European countries will face many constraints similar to those faced by U.S. regions. Regional behavior in the United States could thus shed some light on the potential effects of EMU. This paper provides new empirical evidence on this issue. Parallel data sets comprising disaggregated data on real output, employment, and productivity are constructed for the United States and eight European countries since the early 1970s. Two criteria for an optimum currency area are examined using these data. The first is the level of industrial diversification and the relative importance of different sources of disturbances in economic fluctuations. The second is the degree of labor market integration.

The relative contributions of aggregate, industry-specific, and country- or region-specific disturbances to total output growth fluctuations are found to be roughly similar in Europe and the United States. However, a disaggregated analysis reveals many important differences. Region-specific disturbances in the United States are more important in nontraded goods sectors, while in the EU country-specific disturbances are more prevalent in traded goods sectors.

The major difference between the two economic areas is in labor market adjustment. Productivity trends are dominated by industry-specific factors in the United States and by country-specific factors in the EU, indicating that the United States has a more integrated labor market, with interregional flows of labor constituting an important adjustment mechanism. In Europe, while labor flows across sectors within countries may be important, labor flows across countries do not appear to facilitate adjustment. This implies that large wage differentials across countries could remain after EMU. Unless labor mobility across European countries is enhanced, these differentials will have to remain flexible if significant disruptions from country-specific disturbances are to be avoided under EMU.

I. Introduction

The issue of whether Europe constitutes an optimum currency area increases in significance as the Maastricht process for moving to a single currency progresses. There are many ways of approaching this question, one of which has been to contrast behavior across U.S. regions with that across European countries.[1] By comparing behavior within the United States with that within Europe, researchers have attempted to provide information on how the behavior of European economies corresponds to that of an existing and successful currency union of similar economic size. If European countries do relinquish their own currencies, they will face many of the same constraints faced by U.S. regions. Hence, such a comparison could also shed light on the potential effects of a new currency in Europe.

This paper compares economic fluctuations in Europe and the United States using a more comprehensive data set than in previous literature. Parallel data sets comprising output, employment and productivity differentiated at the broadly defined one-digit sectoral level are constructed for U.S. regions and for eight European countries since the early 1970s. These data are used to look at two criteria for an optimum currency area. The first is the level of industrial diversification and the relative importance of region- and industry-specific disturbances in economic fluctuations. Exchange rate changes can mitigate the effects of disturbances which affect all industries in a given region. By contrast, the value of the exchange rate as a method of adjustment is diminished if disturbances are primarily industry-specific, particularly if the industrial structure is relatively diversified. Investigating sectoral diversification and the nature of underlying shocks is therefore an important ingredient in making an assessment about the suitability of a single currency.

The second issue we investigate is the level of labor market integration in the United States and Europe. Adjustment to underlying disturbances is as important an issue with respect to optimum currency areas as the nature of the disturbances themselves. Indeed, labor market mobility was the criterion that Mundell (1961) focussed upon in his seminal contribution to the literature on optimum currency areas.

The next section provides further motivation by reviewing recent work on regional adjustment, particularly in the United States. Section 3 describes the data and presents some results on industrial diversification in the United States and Europe. Section 4 discusses the econometric methodology. The results from our analysis of disturbances are reported in section 5, while section 6 presents the results on labor market adjustment. Section 7 concludes.

II. Regional Adjustment

Recent work on regional adjustment in the United States pertaining to EMU contains a number of strands. Blanchard and Katz (1992) examine U.S. state-level data on employment,

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[1]This literature is surveyed in Bean (1992), Eichengreen (1992), Melitz (1996) and Bayoumi and Eichengreen (1996).

wages, and unemployment and conclude that it is employment which bears the brunt of regional adjustment in the United States.[2] A negative disturbance that lowers employment in a given state produces relatively little real wage response. Rather, the labor market regains equilibrium as the excess labor moves to a new location within the United States. The implication is that in the United States interregional labor mobility is the major equilibrating force in the economy. In Europe, by contrast, the main equilibrating mechanism over the short run appears to be changes in the participation rate (see Decressin and Fatas, 1995).

Regional diversification of industries has also been examined. By comparing industrial diversification in the United States with that in the EU, possible effects of EMU on European economic geography can be inferred. Krugman (1991) concludes that the greater regional specialization exhibited by industries in the U.S. manufacturing sector relative to those in European countries is a function of the common currency and, hence, that over time EMU may imply significant regional dislocation.[3] A different perspective is provided by the Commission of the European Community (1990) which argues that increasing integration of the EU will make western Europe a better candidate for a currency union.

Finally, there have been a number of comparisons of the behavior of underlying disturbances that drive economic fluctuations in the European Union (EU) and the United States, but little consensus on the lessons to be learned from such a comparison. For example, Bayoumi and Eichengreen (1993) examine data on aggregate output by region and country and conclude that disturbances within the EU as a whole are less correlated than those within the United States, implying significant costs to monetary union. Bini Smaghi and Vori (1992) use data on output across 11 manufacturing industries and find that industry-specific shocks account for the majority of the explained variance in output in both the United States and Europe. As the exchange rate is not a potent instrument for dealing with industry-specific disturbances, they conclude that the exchange rate is not a particularly useful adjustment mechanism in Europe.[4]

This paper is concerned with industrial diversification and the nature of, and

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[2]An earlier study by Eichengreen (1990), which looks at the behavior of unemployment across U.S. regions, comes to similar conclusions.

[3]A number of authors have also investigated mechanisms which cushion the effects of economic disturbances within the United States, including federal fiscal policy (Sala-i-Martin and Sachs (1992), von Hagen (1992), and Bayoumi and Masson (1994)) and private capital markets (Atkeson and Bayoumi (1992)).

[4]This argument has been repeated by a number of other authors. See, for example, Melitz (1993, 1996).

adjustment to, underlying disturbances in the United States and EU. Before discussing our approach, a number of limitations in any comparison of the United States with the EU as a guide to the impact of EMU should be recognized. The institutional structures in the two regions are different. The United States has a much more important federal fiscal system, a single language, a unified cultural heritage, lower taxes, fewer state enterprises, and a weaker tradition of government intervention in the economy than most EU countries. In addition, the United States has operated with a common currency for over 200 years, so that the analysis will have little to say about the speed or difficulty of the economic transition implied by moving from separate monies to a currency union. Finally, the level of regional inequalities within the United States is somewhat lower than across EU countries.

At the same time, the similarities of the underlying economic structures in the United States and EU (outside the monetary field) should also be recognized. Both are continent-wide economies, with similar levels of development, population, and per capita income. Both are characterized by mature market-based economies and democratic political institutions. When aggregated into a single economy, the EU is, like the United States, relatively closed to international trade.[5] Hence, while not being the only factor at work, it is probably not unreasonable to attribute a significant portion of the observed differences in behavior to the existence of a unified currency in the United States and separate national currencies in the EU.

III. Industrial Diversification

Parallel data sets were constructed for the eight standard U.S. regions defined by the Bureau of Economic Analysis (BEA) and for seven EU countries plus Austria, which, although not in the EU during our sample period, has close economic ties to Germany and has recently joined the Union. The dataset consists of three variables--real output (value added), employment, and output per employee--and covers eight industrial classifications: primary industries (or mining, where data on agriculture were not available); construction; manufacturing; transportation; trade; finance; services; and government. The U.S. data come from the BEA regional data bank. The European data come from the OECD National Accounts, and the real output data were converted into U.S. dollars using 1985 purchasing

[5]This is particularly true if the EFTA countries are included in the European aggregate (Bayoumi and Sterne (1993)).

power parities, also obtained from the OECD.[6] The data are annual and generally cover the period 1970-89 for the United States and 1970-87 for the EU. However, some of the employment (and, hence, productivity) series were only available for a slightly shorter time period.

The United States and the OECD use somewhat different industrial classification systems, and it was necessary to amalgamate some series to produce industrial sectors that were more closely aligned. Table 1 shows the aggregation that was used, based on the major industrial classifications in each data set. Although some differences in classification still remain,[7] the result is a pair of data sets whose classifications are, we believe, compatible enough to be used for comparative work.

Table 2 reports some comparative statistics across the two data sets. It shows the average share of total output produced by each industry within the region or country, as well as the mean and the coefficient of variation of these industry output shares. The mean values illustrate the composition of output across different industries. Many industries have relatively similar mean ratios across the two data sets. However, the service sector is significantly more important in the United States than in Europe, while manufacturing is more important in Europe. Manufacturing has the largest share of output in both data sets.

The coefficient of variation is a measure of the degree of regional specialization of an industry. The larger the variation in the composition of output across regions, the larger the coefficient of variation. Primary industries and manufacturing in the United States are highly concentrated in particular regions, presumably reflecting the concentration of agriculture and mining in the Plains, South-Western, and Rocky Mountain regions and of manufacturing in the Great Lakes region. The European countries in our sample show less specialization in these two industries. In all other industries, however, the coefficient of variation is higher in the EU

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[6]State-level data were aggregated into the eight standard BEA regions in order to make the U.S. data more comparable to the EU data in terms of the number of regions and their economic size. The eight U.S. regions are: New England, Mid-East, Great Lakes, Plains, South-East, South-West, Rocky Mountains, and Far-West. The eight European countries are Austria, Belgium, Denmark, Germany, Greece, Italy, Netherlands, and the United Kingdom. Constraints on data availability led us to exclude other important European countries such as France.

[7]For instance, hotels are classified in the service sector in the regional U.S. data and in the trade sector in the European data.

Table 1. Comparison of the Industrial Classifications

Classification	United States Regions	European Countries
Primary	Agriculture, Forestry and Fisheries plus Mining	Agriculture, Hunting, Forestry and Fishing plus Mining and Quarrying
Construction	Construction	Construction
Manufacturing	Manufacturing	Manufacturing
Transportation	Transportation and Public Utilities	Transport, Storage and Communication plus Electricity, Gas and Water
Trade	Wholesale Trade plus Retail Trade	Wholesale and Retail Trade, Restaurants and Hotels
Finance	Finance, Insurance and Real Estate	Finance, Insurance, Real Estate and Business Services
Services	Services	Community, Social and Personal Services
Government	Government	Government Services

Table 2. Output Shares

U.S. Regions	Industry								Total
	PRM	CTN	MFR	TSP	TRD	FIN	SVC	GVT	
New England	.01	.05	.26	.08	.16	.17	.17	.11	.06
Mid East	.01	.05	.21	.10	.16	.17	.17	.13	.20
Great Lakes	.03	.04	.31	.09	.16	.14	.13	.09	.18
Plains	.10	.05	.21	.10	.17	.15	.13	.10	.07
South East	.09	.06	.21	.09	.16	.13	.12	.13	.20
South West	.22	.06	.15	.09	.14	.12	.11	.10	.11
Rocky Mts.	.15	.07	.13	.11	.15	.14	.13	.13	.03
Far West	.05	.05	.19	.08	.17	.16	.17	.13	.15
Mean	.08	.05	.21	.09	.16	.15	.14	.12	
Coeff. var.	.87	.15	.28	.11	.06	.12	.17	.14	

EU Country	Industry								Total
	PRM	CTN	MFR	TSP	TRD	FIN	SVC	GVT	
Austria	.04	.09	.29	.09	.17	.15	.04	.15	.04
Belgium	.03	.07	.23	.11	.19	.07	.16	.14	.05
Denmark	.08	.07	.19	.09	.16	.17	.05	.20	.03
Germany	.03	.07	.35	.08	.11	.12	.12	.12	.36
Greece	.16	.05	.20	.13	.13	.08	.13	.12	.03
Italy	.05	.08	.24	.11	.19	.12	.09	.13	.24
Netherlands	.13	.06	.20	.08	.13	.16	.11	.13	.08
U.K.	.07	.06	.26	.10	.13	.19	.05	.15	.18
Mean	.06	.07	.28	.09	.14	.14	.09	.13	
Coeff. var.	.67	.19	.22	.17	.21	.32	.48	.20	

Notes: The totals in the last column indicate the average share of each region (or country) in total U.S. (or EU) output. The means and the coefficients of variation for industry output shares are reported in the last two rows of each panel.

than in the United States.[8]

Based on an examination of manufacturing sector data, Krugman (1991) concluded that the United States is a significantly more specialized economy than Europe. He therefore argued that the introduction of a single currency in Europe would create an impetus towards greater specialization and, consequently, lead to significant reallocation of labor and other factors following EMU. The results in Table 2 do not support this argument. Our measure of specialization indicates that, if anything, EU countries are somewhat more specialized than U.S. regions in industries other than manufacturing and primary goods, at least at the 1-digit SITC level. Manufacturing may, therefore, not necessarily provide an adequate basis for comparing the structure of the United States and EU economies.[9] Outside of manufacturing, the pertinent concern for EMU may not be Krugman's argument that greater specialization will create changes in industrial structure. To the contrary, the greater homogeneity in industrial structure engendered by EMU could well be a more potent factor.

More generally, the lack of any clear pattern in the results in Table 2, in terms of the relative specialization of Europe and the United States implies that industry-specific disturbances are likely to have broadly similar effects in these two economic areas. Hence, if there is a significantly different economic impact from underlying disturbances, it must come from the nature of the disturbances themselves. It is to this topic that we now turn.

IV. Econometric Methodology

This section presents the econometric methodology that we employ to identify the sources of disturbances: those that affect all industries within a given region or country (regional shocks); those that affect industries across all regions or countries (industrial shocks); and those that affect all regions or countries and all industries simultaneously (aggregate shocks). Such a decomposition allows us to analyze the nature of the disturbances affecting the United States and the EU, and how these two economic areas adjust to these disturbances.

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[8]The results in the text are based on data for the full sample period. To examine whether factors such as increasing European integration could affect our conclusions, we also constructed our measures of specialization for the first and last five years of the sample for both datasets. There were no important differences relative to the results for the full sample.

[9]Some of the apparent specialization within the EU may reflect problems in making industrial classifications consistent across countries. However, it is more likely to result from the wide diversity of regulations and practices across EU countries, which could mean that similar tasks are often carried out by different industrial sectors.

Our datasets contain observations on output, employment, and productivity over time disaggregated by U.S. region or EU country and by 1-digit industry. Since there are 8 industries and 8 regions or countries in each data set, this implies a panel with a maximum of 64 observations per time period, each identified by industry, location, and date. The sources of the underlying disturbances are measured using the following specification:

$$\Delta \ln(y_{i,j,t}) = \alpha_{i,t} + \beta_{j,t} + \Psi_t + \epsilon_{i,j,t} \qquad (1)$$

where $\Delta \ln(y_{i,j,t})$ is the change in the logarithm of output in industry i, region/country j, and period t; $\alpha_{i,t}$, $\beta_{j,t}$ and Ψ_t are the coefficients associated with dummy variables that are equal to 1 for industry i in period t, for region/country j in period t, and for all industries and regions in period t, respectively (and 0 otherwise), and $\epsilon_{i,j,t}$ is an error term.[10]

Researchers primarily interested in the propagation of business cycles have often used richer dynamic formulations as they wish to identify innovations to output (or employment) growth.[11] By contrast, our primary interest is in identifying the sources of observed output fluctuations rather than their propagation, so as to assess the suitability of a single currency for Europe. Hence, we do not include additional dynamic terms in our specification, although we do later test for dynamic interactions across the identified disturbances.

In the specification above, if the $\alpha_{i,t}$ coefficients were calculated for all industries i, then a linear combination of these coefficients would be equal to the time-specific dummy variable Ψ_t. The same is true of the region/country dummies $\beta_{j,t}$, if summed over all j. Accordingly, one industry and one region need to be eliminated from the set of dummy variables to identify the model. The choice of the omitted industry and region/country does not affect tests of the significance and explanatory power of the industrial or regional effects. An F-test of the joint significance of the remaining $\alpha_{i,t}$ coefficients represents a valid test of the importance of industry-specific shocks in the regression, as does a similar test of the joint significance of the $\beta_{j,t}$ coefficients.

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[10] $\Delta \ln(y_{i,j,t})$ is measured as the deviation from the mean growth rate of the series as a whole in industry i, country/region j at time t, thereby controlling for individual fixed effects. The specification assumes that region- or country-specific disturbances have the same effect on the growth rate of output in all industries. To control for differences in cyclical sensitivities across industries within each region/country, output growth rates for each industry i in each region/country j were divided by the sample standard deviation of output growth for that series. The decomposition is similar to that used by Stockman (1988), except that we include time-specific dummies Ψ_t. Hence, in our setup, $\alpha_{i,t}$ and $\beta_{j,t}$ can be directly interpreted as the orthogonal components of the industry-specific and region- or country-specific shocks, respectively.

[11] Norrbin and Schlagenhauf (1988, 1994) and Altonji and Ham (1990).

Since the industry-specific and region-specific dummy variables are orthogonal by construction, the explanatory power of these variables can also be calculated from the reduction in the R^2 statistic caused by excluding them from the original regression. Any variation that is explained by the regression but that is not specifically attributable to either set of dummy variables can be attributed to the aggregate disturbance.[12]

The exclusion of one of each of the $\alpha_{i,t}$ and $\beta_{j,t}$ coefficients is of more importance when the estimated coefficients are used to construct a series which represents the underlying disturbances of industry i or region/country j. As estimated, the series α_i (made up of $\alpha_{i,1}$, $\alpha_{i,2},\ldots,\alpha_{i,T}$) represents the shock to industry i relative to the shock to the industry which was excluded from the estimation. Similarly, the series β_j represents the shock to region/country j relative to the excluded region/country, while the series Ψ represents the sum of the aggregate disturbance plus the shocks to the excluded industry and excluded region/country. To distinguish the aggregate disturbance from that experienced by the excluded industry and region, a further restriction is necessary. The restriction employed here is that the sum of all of the $\alpha_{i,t}$ disturbances (including the region excluded from the estimation) is equal to zero in each period t; a similar restriction was imposed on the sum of the $\beta_{j,t}$ disturbances. The rationale is that the industrial and regional shocks represent deviations from an underlying aggregate disturbance and the aggregate impact of these deviations should then sum to zero. The aggregate disturbance itself was then calculated as the value Ψ minus the implied shocks to the industry and region excluded from the estimated set of dummy variables.

In addition to decomposing short-term sources of fluctuations in output, we also consider the nature of labor market adjustment to these disturbances. Average rates of growth of output, employment, and output per worker over several years are used to calculate the relative importance of regional and industrial factors in labor market adjustment using the following cross-sectional regression:

$$\Delta\ln(y^*_{i,j}) = \alpha_i + \beta_j + \epsilon_{i,j} \qquad (2)$$

where $\Delta\ln(y^*_{i,j})$ is the average change in output for industry i in region j. Since there is no time dimension, it is not possible to identify an aggregate disturbance. The analysis is therefore limited to the relative importance of regional and industrial factors in medium-term adjustment. If productivity trends are largely industry-specific, this indicates a relatively high level of labor market integration, as such integration is needed to reduce productivity differentials across regions. Decomposing long-run employment growth into region- and industry-specific factors helps us to identify whether labor or capital is the main source of factor mobility.

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[12]These dummy variables are exactly orthogonal only when all data points are available. In other cases, there is a small residual value which is unattributable across the three types of disturbances.

V. SOURCES OF DISTURBANCES

The U.S. data cover the period 1972-89, implying that there are 1152 observations (8 industries times 8 regions times 18 data points). The European data cover the period 1971-87, and contain 1088 observations.

5.1 U.S. Results

Table 3 reports the overall explanatory power of equation (1) and the importance of industry-specific, region-specific, and aggregate disturbances in this total.[13] Equation (1) explains 73 percent of the variation in disaggregated U.S. output growth. The aggregate disturbance is the most important factor, explaining 29 percentage points of the variance, while the industrial and regional dummy variables explain a further 25 and 19 percentage points of the variance, respectively. F-tests of the significance of the dummy variables (not reported) indicate that all of the elements of the model (the industry, region, and time dummies) are highly significant. In short, the model as a whole explains three-quarters of the variance of output growth and all three types of disturbances are significant, with the aggregate disturbance explaining the largest fraction, industrial factors being almost as important, and regional factors accounting for a smaller share.

Table 3 also reports the overall R^2 and the decomposition between the different factors for each industry, calculated using the estimated coefficients from the full regression but limiting each calculation to only those observations which involve that industry. Regional disturbances turn out be relatively unimportant for the manufacturing industry; indeed, using this approach, the impact on the R^2 is negligible.[14] This suggests that sectoral factors are more important than regional factors in explaining variation in the growth of output in manufacturing. Thus, our aggregate results for U.S. manufacturing are consistent with the more disaggregated results, using 2-digit industry classifications, obtained by Bini Smaghi and Vori (1992). A similar result is obtained for transportation. By contrast, regional disturbances explain a significant part of the variance in construction, finance, services, and government, four industries which make up almost half of total output in the United States. Finally, the trade and primary sectors are an intermediate case, with results between these two extremes. These differences appear relatively intuitive. Manufacturing and transportation,

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[13]As discussed earlier, to avoid collinearity, dummies for one industry (government) and one region (far-west region) were excluded in the U.S. regressions. Similarly, dummies for one industry (services) and one country (Italy) were excluded from the EU regressions. All of our results were quite robust to the choice of excluded industry and country/region.

[14]Since we are looking at a subset of the original data set, it is possible for the independent variables to lower the variance of the dependent variable (of course, this is not possible for the full data set). In rare instances, this resulted in a small negative contribution for a factor. We set these R-squared contributions to zero.

Table 3. Decomposition of Short-Term Fluctuations

Estimating Equation: $\Delta \ln(y_{i,j,t}) = \alpha_{i,t} + \beta_{j,t} + \Psi_t + \epsilon_{i,j,t}$

	United States Regions					European Countries			
	R^2 due to various shocks:					R^2 due to various shocks:			
	Total	Agg.	Ind.	Reg.		Total	Agg.	Ind.	Cou.
All	**.73**	**.29**	**.25**	**.19**		**.52**	**.19**	**.18**	**.16**
Industries									
Primary	.43	.00	.39	.17		.26	.00	.31	.08
Construct	.80	.36	.11	.34		.51	.17	.19	.16
Manufact.	.83	.67	.24	.00		.71	.38	.15	.19
Transport	.81	.45	.31	.06		.69	.28	.13	.28
Trade	.94	.41	.37	.16		.62	.28	.07	.28
Finance	.61	.13	.16	.33		.56	.34	.07	.15
Services	.85	.49	.11	.26		.27	.00	.20	.09
Gov'nment	.54	.00	.33	.28		.55	.21	.32	.02
Regions/Countries									
New Eng	.70	.30	.08	.31	Austria	.53	.20	.23	.10
Mid East	.75	.26	.22	.27	Belgum	.54	.19	.19	.16
Grt Lakes	.77	.39	.30	.08	Denmrk	.50	.11	.27	.12
Plains	.69	.29	.33	.08	Germny	.62	.33	.20	.09
South E	.80	.43	.32	.04	Greece	.57	.27	.11	.19
South W	.68	.16	.18	.34	Italy	.45	.22	.13	.10
Rocky Mts	.72	.15	.26	.31	Nthlnd	.49	.21	.22	.07
Far West	.73	.33	.32	.08	U.K.	.48	.00	.06	.41
Sub-periods (Aggregate results)									
1972-79	.72	.31	.26	.15		.53	.18	.14	.21
1980-87	.76	.29	.26	.21		.51	.14	.24	.13

which produce goods that are easily traded across regions, are dominated by non-regionally differentiated shocks. Industries whose products are less easily traded geographically, such as construction, finance, services, and government, are more prone to regional disturbances

The same decomposition can be carried out across regions. The results (lower panel of Table 3) indicate that the relative importance of the three types of disturbances also vary by region. Regional disturbances are most important in the South-West and Rocky mountain regions, presumably reflecting the importance of raw material production in the local economies. The Mid-East and New England, which are relatively specialized in finance and other service industries, also have relatively large regional disturbances. By contrast, regional disturbances are the least important factors in the Great Lakes and Plains regions, which are among the most specialized in manufacturing.

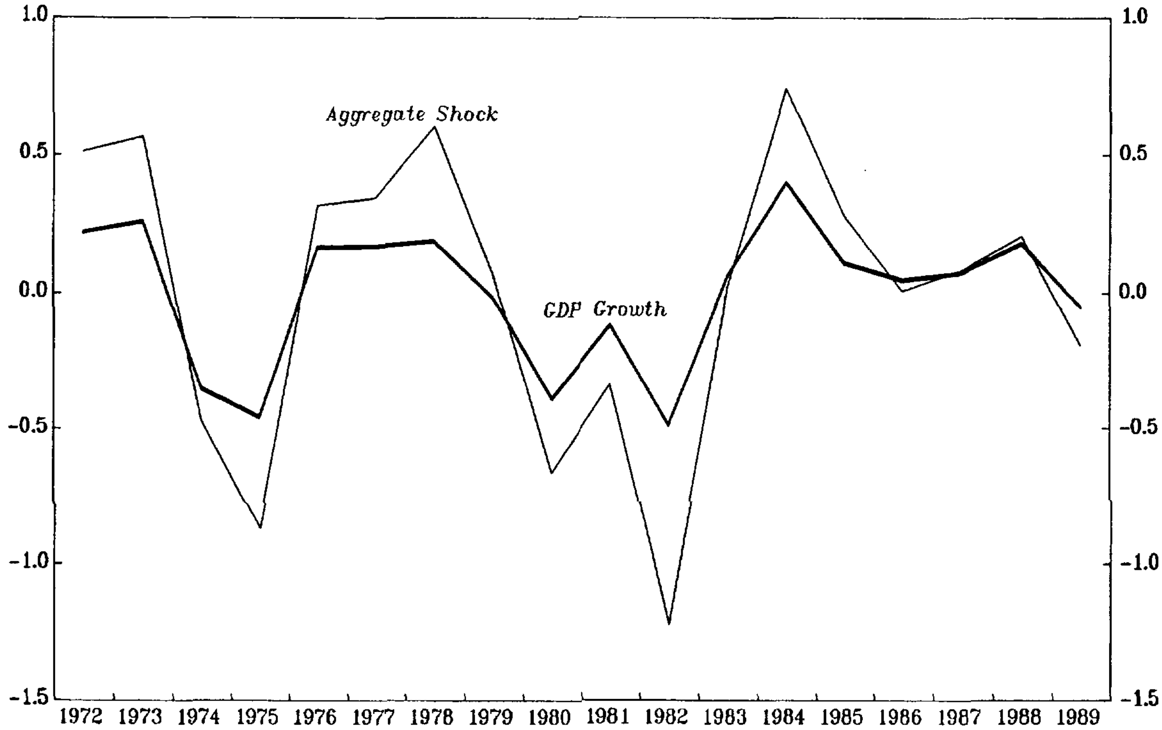
As discussed earlier, it is also possible (by putting the relevant $\alpha_{i,t}$ and $\beta_{i,t}$ coefficients into a time series) to derive individual series for the underlying disturbances to the 8 regions, the 8 industries, and the aggregate disturbance. The upper panel of Figure 1 plots the growth in total output and the aggregate disturbance for the United States. The two series are clearly highly correlated, indicating that our methodology has yielded a reasonable measure of the aggregate shock. The aggregate disturbance is negative after the oil price hikes in the 1970s and positive through much of the late 1980s. Visual inspection indicated that the other disturbances also appear sensible. For example, the disturbance for primary industries showed a positive impact from the oil price hikes and a negative pattern in the late 1980s, while the disturbance for New England vividly illustrated the rise and fall of the "Massachusetts miracle". In this regard, the results for the EU also appear reasonable, as illustrated by the lower panel of Figure 1 which plots the aggregate disturbance and total output growth for this area.

Table 4a shows the correlation between the aggregate disturbance and the disturbances for individual industries, with statistically significant correlations marked with an asterisk. The disturbances for manufacturing and finance are significantly positively correlated with the aggregate disturbance, indicating that the cyclical effects of aggregate shocks are amplified in these two industries. By contrast, the disturbances associated with services and primary goods are negatively correlated with the aggregate. In the case of services, this presumably reflects the fact that aggregate fluctuations are dampened by this industry. For primary industries, it appears more likely that it illustrates the opposite impact of commodity price changes (particularly in oil prices) on the fortunes of the industry and of the economy as a whole. Inter-industry correlations (not reported) reinforce these results. In particular, disturbances between manufacturing and both services and primary goods are highly negatively correlated.

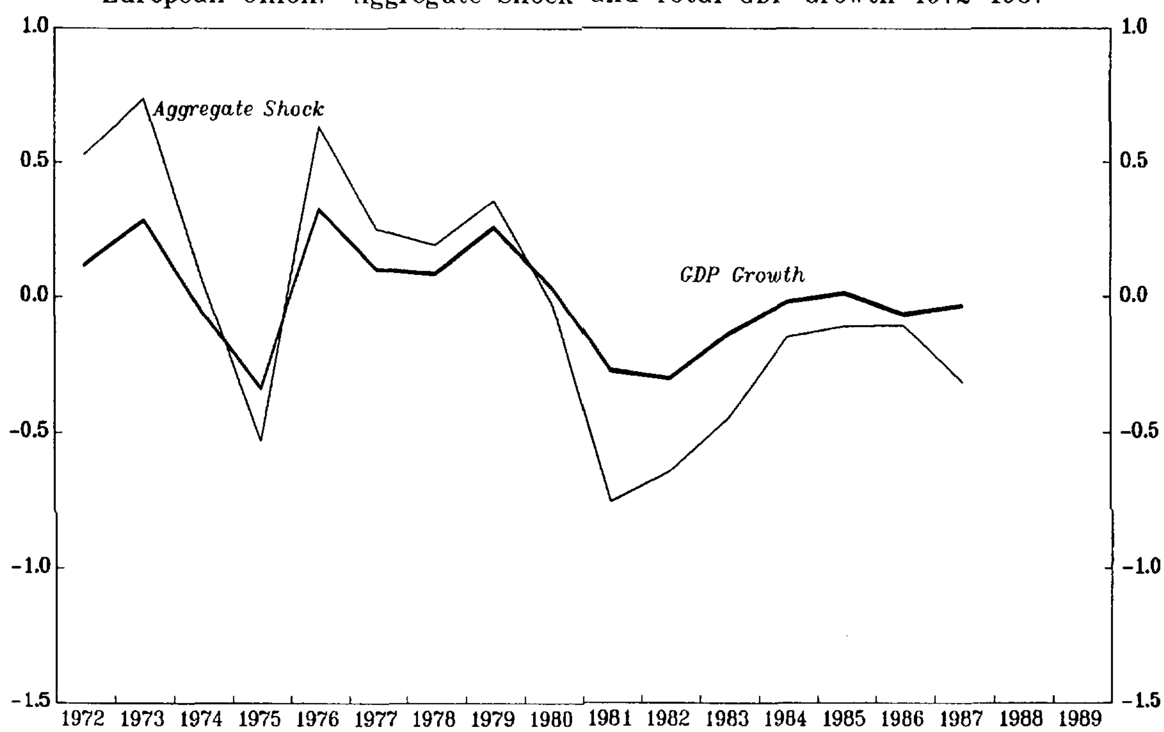
The correlation coefficients between the regional disturbances and the aggregate (Table 4b) are generally smaller than those associated with industrial disturbances, and the only significant correlation is the positive one between the South East and aggregate disturbances. Interregional correlations (not reported) indicate that New England and the

Figure 1.

United States: Aggregate Shock and Total GDP Growth 1972-1989



European Union: Aggregate Shock and Total GDP Growth 1972-1987



Note: To make the series compatible, the rate of growth of total output in each economic area was divided by 10, and its mean was subtracted.

Table 4a. Correlations with the Aggregate Disturbance		
Industry	U.S.	EU
Primary	-0.62*	-0.66*
Construction	0.20	-0.07
Manufacturing	0.73*	0.56*
Transportation	0.18	0.30
Trade	-0.38	0.39
Finance	0.59*	0.65*
Services	-0.59*	-0.49*
Government	0.27	0.04

Table 4b. Correlations with the Aggregate Disturbance			
U.S. Regions		EU Countries	
New England	0.02	Austria	0.05
Mid East	-0.05	Belgium	-0.02
Great Lakes	0.35	Denmark	-0.27
Plains	0.00	Germany	0.53*
South East	0.63*	Greece	0.20
South West	-0.21	Italy	0.12
Rocky Mountains	-0.23	Netherlands	0.09
Far West	0.12	United Kingdom	-0.34

Notes: An asterisk (*) indicates that the correlation coefficient is significant at the 5 percent level. Under the null hypothesis that the true correlation coefficient is zero, the approximate standard error of these coefficients is 0.24.

Mid East face very similar disturbances, as do the South West and Rocky Mountains, but that disturbances between these two pairs of regions are large and negative. The U.S. economy appears to be divided into three distinct regions: the North East, the raw material producing central states, and the remainder.[15]

As noted earlier, we are more interested in identifying types of disturbances rather than the mechanisms through which these disturbances are propagated. However, we did examine the dynamic properties of the estimated disturbances. In general, the shocks did not display significant persistence over time, with most of the first-order autocorrelation coefficients being small and insignificant. We also used bivariate Granger-causality tests (with two lags) to examine if there were important feedback effects among the various disturbances. We found that the null hypothesis of no Granger-causality could be rejected at the 5 percent significance level in only 7 percent (18/256) of the cases, suggesting that our methodology adequately captures the important dynamic properties of the data.

5.2 EU Results

A similar decomposition of output growth fluctuations was carried out for the eight European economies. The second panel of Table 3 shows that equation (1) explains about half of the total variation in the growth of disaggregated output in the EU, with the aggregate, industry-specific, and country-specific disturbances accounting for 19 percent, 18 percent, and 16 percent, respectively. Comparing the results for the United States and the EU, the relative importance of the different disturbances is strikingly similar. In both cases, industry-specific shocks contribute about a third of the explained variance in output growth, with aggregate shocks contributing slightly more and country/region shocks slightly less. At the same time, it should be noted that the relative contribution of country-specific shocks is slightly larger in Europe than in the United States (31 percent of the explained variance in the EU versus 26 percent in the United States).

There are a number of differences from the United States results at the industry level. Country-specific factors account for more than a quarter of the 71 percent of variance explained for manufacturing.[16] Country-specific factors are also more important than industry-specific factors in transportation and trade, possibly reflecting the higher spatial concentration of these industries in the EU relative to the United States (see Table 2). In

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[15]Bayoumi and Eichengreen (1993) also find that the raw material producing regions face distinctly different underlying disturbances. However, they do not find the same dichotomy between the North-eastern regions and the rest of the economy.

[16]The relative importance of country-specific factors in manufacturing is similar to the findings of Stockman (1988), who uses 2-digit manufacturing data. However, the results are different from those obtained by Bini Smaghi and Vori (1992), who conclude that sectoral factors account for a substantial fraction of variation in this sector's output growth in the EU.

construction and services, two nontraded goods sectors, industry-specific factors have more explanatory power than country-specific factors in the EU, the reverse of the result for the United States.

When the decomposition is carried out for each country (lower panel of Table 3), large variations are seen in the relative importance of the three types of disturbances. Aggregate factors are most important in Germany, Greece, and Italy. Industry-specific factors are more important than country-specific factors in most countries, the exceptions being Greece and the United Kingdom. In the United Kingdom, country-specific factors appear to dominate output growth fluctuations, suggesting that aggregate factors that affect other European countries have little impact.

Table 4a reports the correlations between the aggregate disturbance and the disturbances for individual industries in the EU. As in the case of the United States, the disturbances for manufacturing and finance amplify the aggregate shock, while the disturbances to the primary and service sectors are significantly negatively correlated with the aggregate disturbance. The correlation coefficients between the country-specific disturbances and the aggregate disturbance (Table 4b) are generally not statistically significant. The notable exception is Germany which has a strong positive correlation with the aggregate, presumably reflecting the importance of the German economy in the EU. There are few significant correlations among the inter-industry disturbances (not reported here).

As in the case of the disturbances for the United States, the disturbances for the EU did not generally reveal significant persistence. Further, bivariate Granger causality tests again confirmed the absence of important dynamic effects across disturbances.

We also examined the possibility of structural changes leading to variation over time in the relative importance of disturbances. For both datasets, we ran the regressions separately over identical sub-periods, 1972-79 and 1980-87. The aggregate results are reported in the bottom panel of Table 3 and show that the results are quite similar over the two sub-periods. One interesting feature of these results is that, for the EU, industry-specific shocks are more important and country-specific shocks are less important in the 1980s relative to the 1970s. The industry results (not reported here) reveal a similar picture. This is consistent with the notion that trade flows and financial market integration have led to a greater degree of integration among European economies in the 1980s, thereby enhancing the suitability of a single currency for Europe (Commission of the European Communities, 1990).

In summary, the results for the United States and the EU reveal a similar aggregate picture of the relative importance of various sources of disturbances. However, a disaggregated perspective reveals an interesting difference. In the United States, region-specific disturbances are most prevalent in nontraded goods sectors such as services and construction. By contrast, country-specific disturbances in the EU are important in traded goods sectors, although in all sectors the relative importance of country-specific disturbances has declined in the 1980s.[17]

VI. Labor Market Adjustment

Thus far, we have analyzed the nature of disturbances to disaggregated output growth. An equally important issue is how economies respond to such disturbances. In particular, we focus on the degree of integration and nature of adjustment of labor markets in the United States and the EU by considering the determinants of long-term trends in output, employment, and productivity. These trends are decomposed into sectoral and regional components. If labor markets are highly integrated across regions, implying an absence of wage differentials, the levels of productivity should be independent of regional effects (assuming, as seems reasonable, that the same technology is used in a given industry across all regions). Hence, if trends in productivity primarily reflect the fortunes of particular industries, this would imply relatively more integrated labor markets. By contrast, if such underlying productivity trends are primarily regional, this would imply a low level of labor market integration.[18]

The relative importance of regional and industrial disturbances in employment trends, on the other hand, indicates the degree to which labor markets equilibrate through firms moving to regions of excess labor supply (region-specific effects) or labor moving to expanding industries (industry-specific effects). Hence, the productivity regressions measure the integration of labor markets, while the employment regressions measure how the labor market adjustment that does occur is achieved.

The underlying econometric approach is similar to that used to examine disturbances, except that the time dimension is excluded. The sample averages for each of the relevant variables (level of productivity and rates of growth of output, employment, and productivity) were calculated for each region and sector.[19] For each of these variables, equation (2) was then estimated over the full sample (1972-89 for the United States and 1971-87 for the EU) and then over two sub-samples: the 1970s and the 1980s.

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[17]Although an analysis of the causes of this pattern of shocks is beyond the scope of this paper, we did run some simple regressions of the disturbances on various measures of real exchange rate changes. Our preliminary results indicate no clear evidence of any relation between exchange rate changes and the estimated disturbances.

[18]Further evidence on the behavior of European labor markets can be found in Decressin and Fatas (1995).

[19]Levels of productivity were measured as the average of the logarithm of output per worker.

Table 5 reports the results from the full sample. In the United States, the full regression explains over 80 percent of the variation in average rates of output growth over the 1972-89 period. Four-fifths of the explanatory power comes from the industrial dummies and one-fifth from the regional dummies. The performance of an industry within a region appears much more closely related to the overall performance of that industry rather than the performance of that region. In short, industrial structure can go a long way in explaining relative performance across regions in the United States.

The results for both levels and changes in productivity indicate that the contribution of the regional dummies to the overall regression is very small and, hence, that U.S. labor markets are highly integrated, at least over long time spans. Of the 97 percent of variation explained by the regression for productivity levels, the industrial dummy variables account for 94 percentage points, regional dummy variables a mere 2 percentage points, with the remaining 1 percentage point being unallocatable.[20] Despite the low level of explanatory power, an F-test indicates that the regional dummies are jointly significant at conventional significance levels.

The regressions for productivity growth show a similar pattern. Of the total explanatory power of 89 percentage points, the contributions of the industrial and regional dummy variables are 83 percentage points and 1 percentage point, respectively. Unlike the productivity levels regressions, however, the regional dummy variables are not jointly significant in this case.

The regressions using employment growth indicate a larger, although still subsidiary, role for regional factors. Slightly over one quarter of the total explanatory power in the regression comes from the regional dummy variables, with the remainder being attributable to their sectoral counterparts. The implication is that the majority of economic adjustment occurs through movements of labor to regions with expanding industries, rather than movements of expanding industries to regions with excess labor. In short, regional labor market migrations of the type emphasized by Blanchard and Katz (1992) do appear to be the predominant form of regional adjustment in the United States.

The results from the regressions for output and productivity growth for the EU are strikingly different. Although the regression for average output growth has about the same explanatory power as in the case of the United States, the relative contribution of country-specific factors is about four times that of the industry dummies, the reverse of the result for

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[20]Because there are some missing values, the two sets of dummy variables are not exactly orthogonal. Hence, some of the variance can be explained by either. The reported values are the marginal contributions of each set of dummy variables to the overall explanatory power, measured as the increase in the R-squared that occurs when these variables are included in a regression already containing the other explanatory variables.

Table 5. Long-Term Adjustment: 1972-89
Estimating Equation: $\Delta \ln(z_{i,j}) = \alpha_i + \beta_j + \epsilon_{i,j}$

	United States Regions				European Countries		
	R^2 due to:				R^2 due to:		
	Total	Ind.	Reg.		Tot.	Ind.	Cou.
Output	.82	.66	.16		.77	.15	.61
Output per Worker	.89	.83	.01		.83	.19	.64
Level of Output per Worker	.97	.94	.02		.75	.50	.25
Employment	.89	.63	.24		.69	.61	.08

Table 6. Long-Term Adjustment: Sub-Samples
Estimating Equation: $\Delta \ln(z_{i,j}) = \alpha_i + \beta_j + \epsilon_{i,j}$

	United States Regions				European Countries		
	R^2 due to:				R^2 due to:		
	Total	Ind.	Reg.		Tot.	Ind.	Cou.
	1972-79						
Output	.80	.43	.37		.59	.07	.52
Output per Worker	.90	.88	.01		.75	.20	.55
Level of Output per Worker	.95	.93	.03		.78	.38	.40
Employment	.85	.23	.52		.50	.44	.06
	1980-89						
Output	.62	.34	.28		.69	.26	.43
Output per Worker	.82	.74	.05		.70	.13	.58
Level of Output per Worker	.98	.96	.02		.72	.62	.10
Employment	.79	.70	.09		.74	.64	.11

Note: For the European countries, the sample ends in 1987. All dependent variables are used in growth rates in the regressions except for the productivity level regressions (level of output per worker).

the United States. In the EU, the correlation of average output growth is much higher across industries within a given country than across countries for a particular industry.

The productivity regressions suggest that labor markets are far less integrated in the EU than in the United States. The regression using productivity levels shows that country-specific factors have a far more important role in this regression than in its U.S. counterpart. In the regression using the growth in productivity, more than three-quarters of the total explanatory power of the regression is attributable to country-specific dummies. Unlike in the United States, long-term trends in productivity in the EU appear to be overwhelmingly determined by national performance, rather than industrial factors.

The employment regression shows that country-specific factors play a very small role in explaining differences in long-term employment growth. As in the case of the United States, this implies that long-term trends in employment are primarily determined by industrial factors. However, as the productivity growth regressions indicate that labor markets in the EU are not highly integrated across national borders, the interpretation of these results is different. Unlike in the United States, inter-sectoral reallocation of labor appears to operate only within, not across, EU countries.

Finally, we examine whether the patterns that exist over the full 1972-89 period can also be identified over somewhat shorter periods by repeating the analysis for two sub-periods, 1972-79 and 1980-89.[21] The results are reported in Table 6. In the United States, the regressions over shorter time periods confirm the lack of importance of regional factors in explaining either levels or changes in productivity. On the other hand, regional factors are generally more important in explaining changes in output and employment over these sub-periods than over the full time period. This may well reflect the slow pace of labor market adjustment. If labor market adjustment is a gradual process, then the importance of regional factors would decline over time. For the EU, the sub-sample results were very similar to the full sample results, suggesting that, from 1970 to 1987, there were no significant structural changes that affected the degree of integration of labor markets.

VII. Conclusions

This paper has analyzed the effects of a currency union on the relative importance of different types of shocks to output growth and also the labor market mechanisms by which economies adjust to these shocks. We constructed two comparable datasets for United States regions and eight European countries with data on output, employment, and productivity at the 1-digit sectoral level. Although the two datasets are similar in many respects, an

[21]Other shorter sub-periods, not reported, showed broadly similar results. For the EU, data availability limited the analysis in the second sub-period to 1980-87.

important difference is the fact that the U.S. regions are part of a currency union while the European countries are not.

For the full sample, the relative importance of aggregate, industry-specific, and country- or region-specific shocks in explaining output growth fluctuations is roughly similar in Europe and the United States, with each of these types of shocks playing an important role.[22] A more disaggregated analysis of the sources of disturbances at the sectoral level, however, indicates that region-specific disturbances in the United States are more important in nontraded goods sectors while in the EU country-specific disturbances are more prevalent in traded goods sectors. In addition, the relative importance of country-specific disturbances has declined in the EU in the 1980s, plausibly reflecting moves toward economic integration over this period.

The major difference between the United States and the EU, however, is in the nature of labor market adjustment to shocks. Our results indicate that productivity trends are dominated by industry-specific factors in the United States and by country-specific factors in the EU. These results appear to confirm other evidence that the United States has a much more integrated labor market, either because of, or reflecting, the single currency.

Our regressions for long-term employment growth in the United States produced results consistent with the findings of earlier authors that interregional flows of labor constitute a more important adjustment mechanism in the U.S. labor market, but that in Europe labor flows across countries do not seem to be an important adjustment mechanism. This implies that large wage differentials across European countries could remain after EMU. In addition, unless labor mobility across European countries is enhanced, wage differentials across countries will have to remain flexible if significant disruptions from country-specific disturbances are to be avoided in EMU.

[22]The importance of regional disturbances even in the U.S. implies that the exchange rate could continue to be a potentially important tool in mitigating the effects of such disturbances.

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