IS THERE A CONFLICT BETWEEN EC ENLARGEMENT
AND EUROPEAN MONETARY UNIFICATION?

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ABSTRACT

Recent proposals for enlarging the European Community to
include the EFTA countries raise the question of whether the new
members should participate in a European Monetary Union.   In
part, the issue hinges on the incidence of aggregate supply and
demand disturbances. We use data on prices and output and a VAR
decomposition to analyze this issue empirically, grouping
economies according to the magnitude of the disturbances, their
cross-country correlation, and speeds of response. This leads us
to distinguish an EC "core" (made up of Germany and its immediate
neighbors) and an EC periphery (made up of the UK and the
Southern European members of the Community). Austria, Sweden and
Switzerland behave more similarly to the EC core than do Norway,
Finland and Iceland. This suggests that the case for EMU
participation is stronger for Austria, Sweden and Switzerland
than for the other EFTA countries.

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I. Introduction

The European Community faces many bumps on the road to monetary unification. At the time of writing, debate centers on the degree of policy convergence that is a prerequisite for EMU. Germany and its immediate neighbors, such as the Netherlands, insist that economic policies must be closely harmonized before nations form a monetary union. In contrast, the countries of Southern Europe, led by Italy, maintain that policy convergence can be deferred to the period following the transition to EMU. This dispute has given rise proposals for a two-speed EMU, in which countries whose policies are already closely harmonized form a monetary union immediately, but the others initially remain outside.[1]

If the problem were not already complicated enough, there is the issue of EC enlargement. Austria's application for full EC membership, outstanding since 1988, has received a "fundamentally positive" evaluation from the EC Commissioner for External Affairs.[2] Sweden applied for membership in July 1991, and its application has also been greeted favorably. Thus, the European Community will probably have at least two new members by 1995.[3] Finland is likely to submit its application in the spring of 1992, and Norway, Switzerland and Iceland cannot be far behind.[4]

The implications for EMU are far from clear. Does the prospect of EC enlargement strengthen the North's case for two-speed EMU or the South's argument for moving establish a single currency for the entire Community? If the two-speed option is to be pursued, should the former EFTA countries

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[1] See for example Dornbusch (1990).

[2] See Lodge (1991).

[3] Economist Magazine (1991), p.56.

[4] Admittedly, Norway, Switzerland and Iceland remain deeply divided over the issue. EC membership was the dominant issue in Norway's September 1991 local elections, in which the Center Party and Left Socialist Party, both anti-EC, scored significant gains. The position of the Nordic EFTA countries and of Iceland are discussed by Hamilton (1990) and Gylfason (1990), respectively.

join at the first or second stage?

Discussion of this question should weigh the benefits of EMU membership against the costs. The benefits, about which we have little to say in this paper, take the form of the convenience and efficiency of transacting in one rather than several national currencies. The costs are associated with the need for the members of a monetary union to run identical monetary and similar fiscal policies.[5] The weight that should be attached to this imperative depends on, among other things, the incidence of shocks. If disturbances are distributed symmetrically across countries, symmetrical policy responses will suffice. In response to a negative aggregate demand shock, for example, that is common to all EMU countries, a common policy response in the form of a simultaneous monetary and fiscal expansion would suffice. Only if disturbances are distributed asymmetrically across countries will there be occasion for an asymmetric policy response and may the constraints of monetary union bind.[6]

In a previous paper (Bayoumi and Eichengreen, 1991), we analyzed output and price data for EC member nations in order to extract information on aggregate supply and demand disturbances. We used this information to examine the correlation of disturbances across EC member countries, and compared that correlation with that exhibited by disturbances to different regions within an existing monetary union (the United States).[7] In this paper we extend the analysis to the EFTA countries as a first step toward exploring the implications of EC enlargement for EMU.

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[5] The extent to which fiscal convergence is a necessary corollary of monetary union remains a debated point. See Eichengreen (1990a), Bayoumi and Russo (1991) and Goldstein and Woglom (1991).

[6] This point has been widely understood since the seminal work on the theory of optimum currency areas by Mundell (1961).

[7] We found that aggregate supply shocks to U.S. regions are smaller than shocks to EC countries, and that they are more closely correlated. Our results also indicated that U.S. regions adjust to shocks more quickly than do EC countries, despite the lack of the exchange rate instrument, plausibly reflecting greater factor mobility in the U.S. than in Europe. These findings suggest that the EC may find it more difficult than the U.S. to run a monetary union.

We use the structural vector autoregression approach to isolating
disturbances developed by Blanchard and Quah (1989), who examined the time-
series behavior of output and unemployment. But as in Bayoumi (1991), we
instead use data on output and prices, which allows us to interpret the
results in terms of the familiar aggregate-demand-aggregate-supply diagram.
Supply disturbances are distinguished from demand disturbances by imposing
the identifying restriction that aggregate demand disturbances have only a
temporary impact on output, while aggregate supply disturbances have a
permanent effect (both have permanent effects on the level of prices). In
addition to identifying the underlying disturbances, our methodology allows
us to look at the response to these disturbances, and hence allows us a
measure of the speed of of the economy's adjustment to such shocks.

The remainder of this paper is organized as follows. Section II sets
out the framework used to identify supply and demand disturbances. Section
III describes our data and its properties, while Section IV reports the
results of the statistical analysis. Section V summarizes our findings and
the light they shed on EC enlargment and EMU.

II. Methodology

Our methodological point of departure is the familiar aggregate
demand and aggregate supply diagram, reproduced as the top panel in Chart
1. The aggregate demand curve (labelled AD) is downward sloping in the
price output plane, reflecting the fact that lower prices, by raising money
balances, boost demand. The short run aggregate supply curve (SRAS) is
upward sloping, reflecting the assumption that wages are sticky and hence
that higher prices imply lower real wages. The long run supply curve
(LRAS) is vertical, since real wages adjust to changes in prices in the
long run.[8]

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[8] Although often thought of as a closed economy model, the analysis
can be easily extended to include trade and the exchange rate. Textbook
descriptions include Dornbusch and Fischer (1986) Ch. 11, and Hall and
Taylor (1988) Ch. 4-5.

Chart 1

The Aggregate Demand and Supply Model

(a) The Model
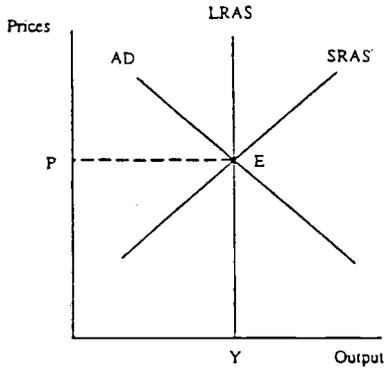
(b) A Demand Shock
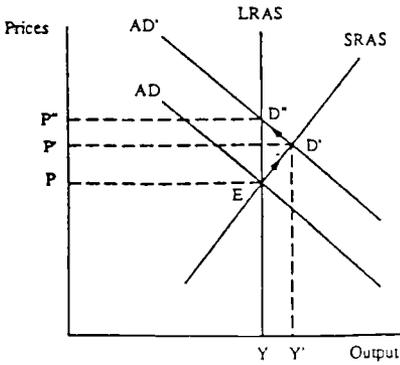
(c) A Supply Shock
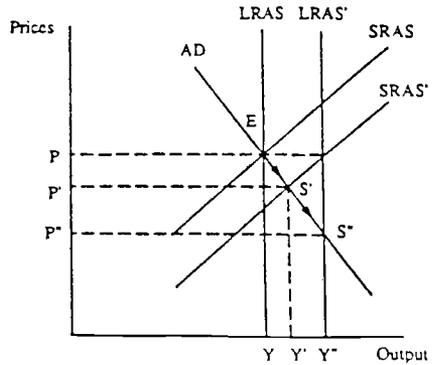
The effect of a shock to aggregate demand is shown in the left half of the lower panel. The aggregate demand curve shifts from AD to AD', resulting in a move in the equilibrium from initial point A to the new intersection with the short run curves, D'. This raises both output and prices. As the aggregate supply curve becomes more vertical over time, the economy moves gradually from the short run equilibrium D' to its new long run equilibrium, D''. This movement along the aggregate demand curve involves the return of output to its initial level, while the price level rises to a level which is permanently higher. (Depending on the price mechanism, there could be some cycling around the new long rum equilibrium.) Hence the response to a permanent (positive) demand shock is a short term rise in output followed by a gradual return to its initial level, and a permanent rise in prices.

The effect of a supply shock is shown in the right-hand bottom panel of the chart. Assume that the long run level of potential output rises, say because of a favorable technology shock. The short- and long-run supply curves move rightwards by the same amount, as shown by SRAS' and LRAS'. The short run effect raises output and reduces prices, shifting the equilibrium from A to S'. As the supply curve becomes increasingly vertical over time, the economy moves from S' to S'', implying further increases in output and reductions in prices. Unlike demand shocks, supply shocks result in permanent changes in output. In addition, demand and supply have therefore different effects on prices; positive demand shocks raise prices while positive supply shocks reduce them.

This framework is estimated using a procedure proposed by Blanchard and Quah (1989) for decomposing permanent and temporary shocks to a variable using a VAR, as extended by Bayoumi (1991).[9] Consider a system where the true model can be represented by an infinite moving average

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[9] Quah (1991) discusses the issue of identifying restrictions for VARs. An important assumption which is required to ensure uniqueness of the decomposition is that the underlying series (growth and inflation in this case) are fundamental in a Wold sense, as pointed out by Lippi and Reichlin (1990).

representation of a (vector) of variables, X_t, and an equal number of shocks, ϵ_t. Formally, using the lag operator L, this can be written as:

$$X_t = A_0 \epsilon_t + A_1 \epsilon_{t-1} + A_2 \epsilon_{t-2} + A_3 \epsilon_{t-3} \cdots$$
$$= \sum_{i=0}^{\infty} L^i A_i \epsilon_t \qquad\qquad (2.1)$$

where the matrices A_i represent the impulse response functions of the shocks to the elements of X.

Specifically, let X_t be made up of change in output and to the change in prices, and let ϵ_t be demand and supply shocks. Then the model becomes

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \epsilon_{dt} \\ \epsilon_{st} \end{bmatrix} \qquad\qquad (2.2)$$

where y_t and p_t represent the logarithm of output and prices, ϵ_{dt} and ϵ_{st} are independent supply and demand shocks, and a_{11i} represents element a_{11} in matrix A_i.

The framework implies that while supply shocks have permanent effects on the level of output, demand shocks only have temporary effects. (Both have permanent effects upon the level of prices.) Since output is written in first difference form, this implies that the cumulative effect of demand shocks on the change in output (Δy_t) must be zero. The model implies the restriction,

$$\sum_{i=0}^{\infty} a_{11i} = 0. \qquad\qquad (2.3)$$

The model defined by equations (2.2) and (2.3) can be estimated using a vector autoregression. Each element of X_t can be regressed on lagged values of all the elements of X. Using B to represent these estimated coefficients, the estimating equation becomes,

$$
\begin{aligned}
X_t &= B_1 X_{t-1} + B_2 X_{t-2} + \ldots + B_n X_{t-n} + e_t \\
&= (I - B(L))^{-1} e_t \\
&= (I + B(L) + B(L)^2 + \ldots) e_t \\
&= e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + \ldots
\end{aligned}
\tag{2.4}
$$

where e_t represents the residuals from the equations in the vector autoregression. In the case being considered, e_t is comprised of the residuals of a regression of lagged values of Δy_t and Δp_t on current values of each in turn; these residuals are labeled e_{yt} and e_{pt}, respectively.

To convert equation (2.4) into the model defined by equations (2.2) and (2.3), the residuals from the VAR, e_t, must be transformed into demand and supply shocks, ϵ_t. Writing $e_t = C\epsilon_t$, it is clear that, in the two-by-two case considered, four restrictions are required to define the four elements of the matrix C. Two of these restrictions are simple normalizations, which define the variance of the shocks ϵ_{dt} and ϵ_{st}. A third restriction comes from assuming that demand and supply shocks are orthogonal.[10]

The final restriction, which allows the matrix C to be uniquely

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[10] The conventional normalization is that the two variances are set equal to unity, which together with the assumption of orthogonality implies $C'C = \Sigma$. Where Σ is the variance covariance matrix of the shocks e_y and e_p. However, when we wish to calculate the variance of the shocks themselves, we report results using the normalization $C'C = \Gamma$, where Γ is the correlation matrix of e_y and e_p. These two normalizations gave almost identical paths for the shocks, except for a scaling factor, and hence are used interchangeably.

defined, is that demand shocks have only temporary effects on output.[11]
As noted above, this implies equation (2.3). In terms of the VAR it
implies,

$$\sum_{i=0}^{\infty} \begin{bmatrix} d_{11i} & d_{12i} \\ d_{21i} & d_{22i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} = \begin{bmatrix} 0 & . \\ . & . \end{bmatrix} \qquad (2.5)$$

This restriction allows the matrix C to be uniquely defined and the demand
and supply shocks to identified.[12]

Note that this restriction affects the response of output to the two
shocks, but says nothing about their impact on prices. The aggregate-
demand-aggregate-supply model implies that demand shocks should raise
prices in both the short and long run, while supply shocks should lower
prices. Since these responses are not imposed, they can be thought of as
over-identifying restrictions useful for testing our interpretation of the
results.[13]

III. Data

Annual data on real and nominal GDP spanning the period 1960-88 were
collected from the OECD Annual National Accounts for each of the 12 members
of the EC and for six EFTA members: Sweden, Switzerland, Austria, Finland,

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[11]This is where our analysis, based on the work of Blanchard and Quah
(1989), differs from other VAR models. The usual decomposition assumes
that the variables in the VAR can be ordered such that all the effects
which could be attributed to (say) either a_t or b_t are attributed to
whichever comes first in the ordering. This is achieved by a Choleski
decomposition (Sims, 1980).

[12]Note from equation (2.4) that the long run impact of the shocks on
output and prices is equal to $(I-B(1))^{-1}$. The restriction that the long run
effect of demand shocks on output is zero implies a simple linear
restriction on the coefficients of this matrix.

[13]Blanchard and Quah use output and unemployment in their VAR, with the
same identifying restrictions on the effect of shocks on output. Since
unemployment would be expected to move in the same direction in response to
both demand and supply shocks, their implied over-identifying restriction
has less power than the one used in this paper.

Norway and Iceland (data on Lichtenstein, the seventh member of EFTA, were unavailable).[14] For each country growth and inflation were calculated as the first difference of the logarithm of real GDP and the implicit GDP deflator. The GDP deflator was used to measure prices since it reflects the price of output rather than the price of consumption.

Chart 2 displays the standard deviations of inflation and GDP growth over the sample period for each of the countries.[15] Countries located toward the bottom, left-hand corner of the box have relatively low output and inflation variability, and are therefore obvious candidates to join in a monetary union. In addition to Germany, which would undoubtedly form the focal point for any such union, the corner includes her EC neighbors, France, Belgium, the Netherlands and Denmark. It also contains several EFTA countries, Austria, Sweden, Norway and, arguably, Switzerland.

Table 1 reports some summary measures of the correlation across EC countries of inflation and output growth. As in our earlier paper, we divide the EC into a "core" comprised of Belgium, Denmark, France, Germany, the Netherlands and Luxembourg, and a "periphery" comprised of Ireland, Italy, Greece, Portugal, Spain and the U.K. Table 1 reports the share of the variance of output growth and inflation explained by the first principal component (the orthogonal component most correlated with the underlying series) for the two subgroups of EC countries and for the six EFTA members.

On the basis of the raw data, the EFTA countries look more like the EC periphery than the EC core. For the full period, the first principal

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[14] This same source provided an aggregate measure of output and price performance for the EC as a whole. Two different measures of the EC aggregate are available from the OECD, one based on conversions of local currency data using 1985 dollars, and a second based on a weighting of EC real GDP and GDP deflator indices. Since the two data sets gave very similar results, only those based on 1985 dollar exchange rates are reported.

[15] Iceland is excluded from the chart because the variance of both growth and inflation, at 0.042 and 0.131, are so much larger than any of the other countries.

Chart 2 - Standard Deviations of
Inflation and Growth
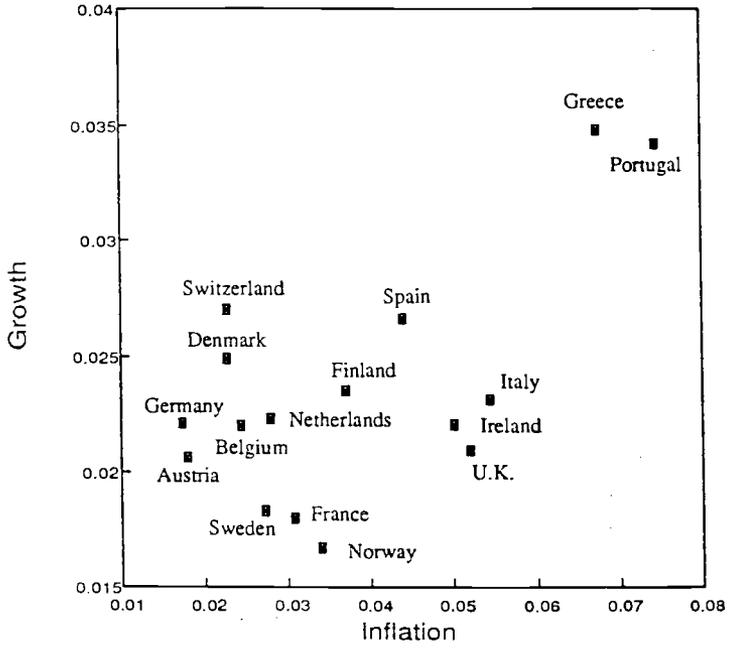
Table 1.   Percentage of Variance Explained by the First
Principal Component Across Different Groups of Countries:
Raw Data

	EC Core	EC Periphery	EFTA
Growth			
Full Period	73	49	43
1963-71	73	35	51
1972-79	82	49	43
1980-88	54	42	42
Inflation			
Full Period	64	70	53
1963-71	46	38	42
1972-79	58	52	44
1980-88	82	69	68

Notes: The EC core comprises Germany, France, the Netherlands, Belgium,
Denmark and Luxenburg. The EC periphery contains the UK, Italy, Spain,
Portugal, Ireland and Greece. EFTA contains Switzerland, Austria, Sweden,
Norway Finland and Iceland.

component explains slightly under half of the variance of output in both EFTA and the EC periphery, while almost three quarters of this variance is explained in the case of the EC core. The results for inflation over the full period are more difficult to interpret. For the period as a whole, EFTA have the lowest share of the variance in their inflation rates explained by the first principal component.

To illustrate trends over time, Table 1 also reports the percentage of the overall variance explained by the first principal component for three distinct time periods. For both the EC and EFTA the largest share of inflation is explained in the 1980s, presumably reflecting the extent to which price-level trends were dominated by disinflation after 1979. In the case of output, for the EC countries the first principal component explains the largest share of the variance of output in the 1970s, the smallest share in the 1960s. The unusual coherence of output fluctuations in the 1970s presumably reflects the fact that all countries experienced an unusually severe recession following the first oil shock. Interesting, this is not the case for EFTA, perhaps because it includes an energy exporter (Norway) as well as net energy importers.

From these comparisons of the unprocessed data, it would appear that whatever criteria are used to determine whether the countries of the EC periphery are included from the start in EMU should also be applied to the EFTA countries when they join the Community.

IV. Results

Bivariate VARs were estimated for each EC and EFTA country in order to identify their aggregate demand and supply disturbances and associated impulse response functions. The number of lags was set to two in all the VARs since the Schwartz Bayesian information criterion indicated that all

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of the models had an optimal lag length of either one or two.[16] A uniform
lag of two was chosen in order to preserve symmetry of specification across
countries. For all countries the estimation period was 1963-88.[17]

In almost every case the estimation and simulation results accord
with the aggregate-supply-aggregate-demand framework discussed in Section
II. The "over-identifying restriction" that positive aggregate demand
shocks should be associated with increases in prices while aggregate supply
shocks should be associated with falls in prices was generally observed.
In only two of the 18 cases considered here, namely Norway and Iceland, was
it impossible to interpret the results using the aggregate-demand-
aggregate-supply framework.

By way of illustration, Chart 3 shows the impulse response functions
for output and prices obtained from the EC aggregate data. These
illustrate the identifying restriction. Positive demand shocks produce a
temporary rise in output, which then gradually returns to its baseline
level, while a positive supply shocks produces a steady rise in output to a
new higher equilibrium level. Both aggregate supply and aggregate demand
shocks have long-run effects on the price level, with (positive) demand
shocks producing a gradual rise in prices over time and supply shocks
producing a steady decline in prices. This is exactly the pattern
predicted by the aggregate-supply-aggregate-demand framework sketched
above.

The estimated aggregate demand and supply shocks for the EC aggregate
are shown in Chart 4. Large negative disturbances to supply are evident in

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[16] We also estimated VARs with three lags because, in contrast to the
Schwartz Bayesian statistic, the Akaike information criterion showed the
optimal lag to be above two in some models. This specification produced
very similar results which consequently are not reported here.

[17] This period includes an obvious change in regime, namely the break-
up of the Bretton Woods fixed-exchange-rate system in the early 1970s.
Chow tests for structural stability produced no evidence, however, of a
structural break in the early 1970s. Limited analysis using data sets
which excluded the Bretton Woods period produced similar results to those
reported.

Chart 3 - Impulse Response Functions for the E.C. and U.S.

Impulse Response of Output

European Community

Impulse Response of Prices

European Community
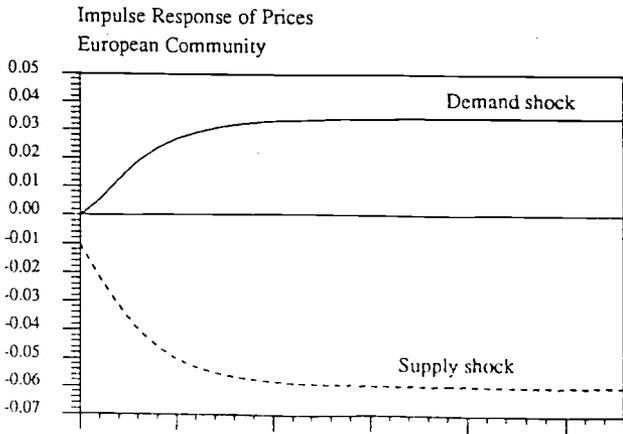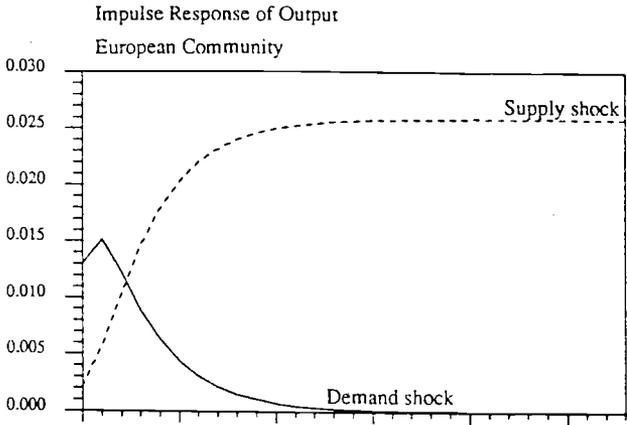
Chart 4. Aggregate Demand and supply shocks for the U.S and E.C

Aggregate Supply and Demand Disturbances for the European Community

Supply disturbance

Demand disturbance
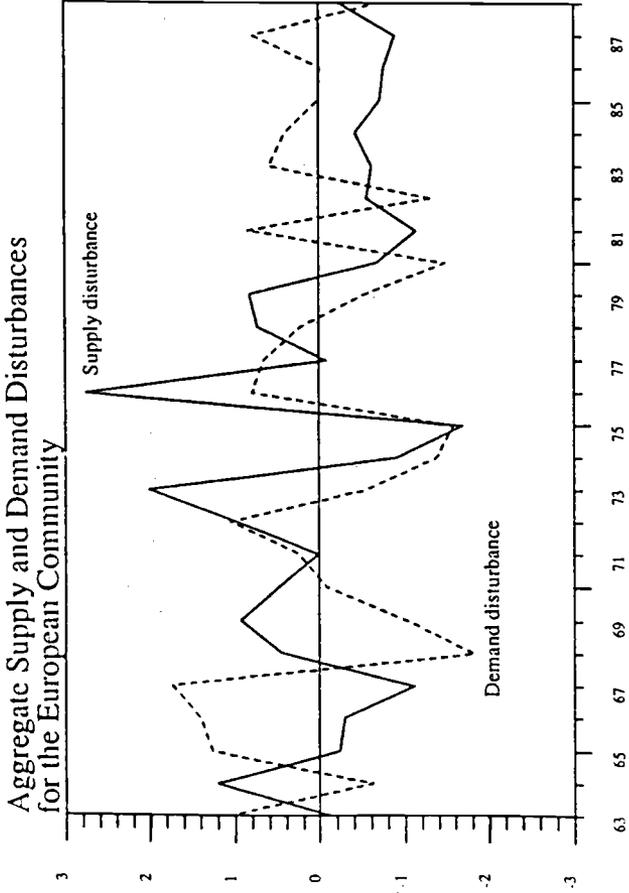
1973-75 and 1979-80, corresponding to the two oil shocks, together with a negative supply shock in 1968 which is more difficult to interpret. The demand disturbances illustrate the different response of the EC to the first and second oil crises; there is a large positive demand shock in 1977, while from 1980 onwards demand shocks are negative.

Having illustrated the nature of the estimation results, we now use the results to look at the relative performance of the EC core, the EC periphery and EFTA. We look first at the correlation of the underlying disturbances across countries, and then at the size of these shocks. Finally, we compare the spped of adjustment across countries.

1. Correlations

A major factor in determining the advantages of joining a common currency area is the correlation of underlying shocks. If shocks are highly symmetric across countries, then the loss of the exchange rate instrument is relatively unimportant, whereas if shocks are highly idiosyncratic the problem of adjustment may be more complicated, justifying different policy responses by different countries. Table 2 summarizes the cross-country correlations of demand and supply shocks for the EC core, the EC periphery and EFTA, again using principal components analysis. As in Table 1, the results are reported for the full sample and, to illustrate trends over time, for three successive subperiods.

For the period as a whole both supply and demand shocks are more highly correlated within the EC core than within the EC periphery or EFTA. The values for the EC periphery and EFTA are rather similar. This first bit of evidence suggests, then, that there may be special grounds for an EMU of the core countries not shared by either the EC periphery or EFTA.

When aggregate supply and demand disturbances are estimated separately for successive subperiods, the picture is complicated. The aggregate supply shocks indicate that the performance of the EFTA countries may have been moving away from that of the EC periphery and towards the EC

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Table 2. Percentage of Variance in Supply and Demand Shocks
Explained by First Principal Component

	EC Core	EC Periphery	EFTA
Supply Shocks			
Full Period	54	32	29
1963-71	39	40	36
1972-79	63	41	49
1980-88	62	41	45
Demand Shocks			
Full Period	53	36	36
1963-71	58	30	44
1972-79	50	49	44
1980-88	54	43	32

Notes: The EC core comprises Germany, France, the Netherlands, Belgium,
Denmark and Luxenburg. The EC periphery contains the UK, Italy, Spain,
Portugal, Ireland and Greece. EFTA/Germany contains Switzerland, Austria,
Sweden, Norway, Finland and Iceland

core. This plausibly reflects the growth of trade and financial relations between the leading EC economies and EFTA. For aggregate demand shocks, the opposite appears to be the case; shocks to EFTA seem to have grown increasingly heterogeneous over time, leading it to more closely resemble the EC periphery. This trend in demand shocks may reflect the convergence of EC monetary policies caused by the ERM and its earlier incarnation, the "snake," in contrast to the floating exchange rate policies followed by most members of EFTA since the break-up of the Bretton Woods fixed exchange rate regime in the early 1970s.[18]

These summary statistics disguise large divergences in behavior among countries within each group. Chart 5 displays the correlation coefficients for both demand and supply disturbances between individual EC/EFTA countries and Germany.[19] The correlation coefficient for demand shocks is on the vertical axis, while that for supply shocks is on the horizontal axis. Countries clustered near the top, right-hand corner of the box, which exhibit high correlations with Germany, are prime candidates for joining it in a monetary union. The correlations of aggregate supply disturbances are of particular interest, since demand shocks are more likely to reflect government policy and therefore to be endogenous to the exchange-rate regime.

Belgium, Denmark, France and the Netherlands all have supply disturbances which are highly correlated with Germany's. In addition, their demand disturbances are also reasonably highly correlated with Germany's. Two EFTA countries -- Austria and Switzerland -- are close behind these members of the EC core in the "race" toward the upper right-

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[18] More recently, the EFTA countries have tended to link their exchange rates to those of the ERM. Hence as more data become available, this trend may reverse itself.

[19] Germany is the largest economy in Europe and has played a leadership role in the ERM, making it the obvious standard for comparison. Here the results for Luxembourg are not reported, since it is such a small economy.

Chart 5 - Correlations of the Demand and Supply Disturbances with Germany
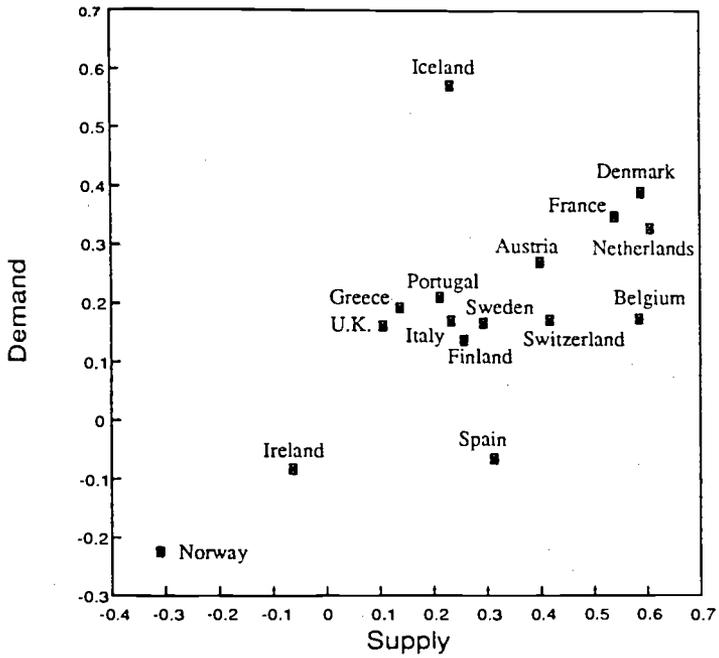
hand part of the box.[20] On the basis of these correlations, Austria and

Switzerland would seem to be prime candidates for monetary union.

The other four EFTA members, Sweden, Finland, Iceland and especially

Norway, would seem to be less promising candidates for monetary union.

Sweden and Finland are in the middle of the sample in terms of the

correlation of their disturbances with Germany's. For Norway, the energy

producer in our sample, both disturbances are negatively correlated with

those of Germany, while in the case of Iceland, the demand disturbances are

relatively highly correlated with those of Germany but the supply

disturbances are not.

Thus, the cross-country correlation of disturbances creates a

stronger presumption in favor of EMU participation for some EFTA countries

-- Austria and Switzerland -- than for others -- Sweden, Finland, Norway

and Iceland. Still, except for Norway, the case for EMU membership on

these grounds is at least as strong as that for such members of the EC

periphery as the UK, Greece and Spain.

2. Size of Shocks

In addition to looking at the symmetry or correlation of shocks

across regions, our methodology can be used, as described in Section II, to

estimate their relative size.[21] The larger the underlying shocks, the

more difficult it may be to maintain a fixed exchange rate, and the more

compelling may be the case for an independent policy response. This is

particularly true of supply shocks, which often require more painful

adjustment.

The standard deviations of the aggregate demand and supply

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[20] A surprising case is Iceland, whose supply disturbances are only
loosely correlated with Germany's, but whose demand disturbances exhibit a
high correlation over the sample period.

[21]These are calculated using the modification of the VAR decomposition
discussed in footnote 10.

disturbances are displayed in Chart 6.[22] Prime candidates for monetary
union are countries countries with small disturbances located toward the
bottom, left-hand corner of the box. The members of the EC core --
Germany, France, Belgium, the Netherlands and Denmark -- are all located
near that corner. All have supply shocks with standard deviations in the
range of 0.01-0.02 (1-2 per cent per annum). In contrast, the standard
deviations of the supply shocks for the EC periphery (the U.K., Italy,
Spain, Portugal, Ireland and Greece) range from 0.02 to 0.035 (2-3 1/2 per
cent per annum). Thus, as pointed out in Bayoumi and Eichengreen (1991),
the peripheral countries experience supply shocks twice as large on average
as the core countries.

The patterns exhibited by demand shocks are less coherent. Still,
demand shocks to the EC core appear to be distinctly smaller than those
experienced by some members of the EC periphery, notably Portugal and
Ireland.

Three EFTA members -- Austria, Sweden and Switzerland -- reside in
the same general neighborhood as the members of the EC core. Within this
group, Austria and Sweden have particularly low standard deviations.
Norway is an interesting case since while it has relatively small supply
disturbances, its demand disturbances are relatively large, making it
difficult to classify. Finland appears to be located in the EC core, while
Iceland has such large underlying disturbances that they have been excluded
from the diagram.

Thus, the magnitude of shocks as well as their correlation with
Germany's suggest that several EFTA members, namely Austria, Sweden and
Switzerland, are good candidates for EMU. Only in the case of Iceland does
this part of our analysis give rise to reservations. As with the
correlation of disturbances, the magnitude of shocks provides a generally

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[22] Since the variables are measured in logarithms a standard deviation
of (say) 0.012 implies a variation of 1.2 percent. Iceland is again
excluded because the standard deviations of its demand any supply shocks,
at 0.082 and 0.037, are so much larger than the other countries in the
analysis.

Chart 6. The Correlation and Size of the Underlying Disturbances

(a) Supply Disturbances
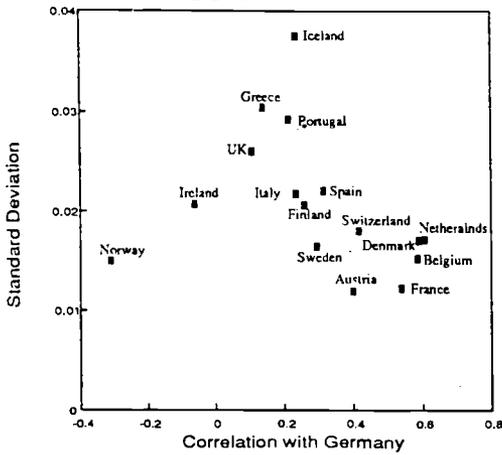
(b) Demand Disturbances
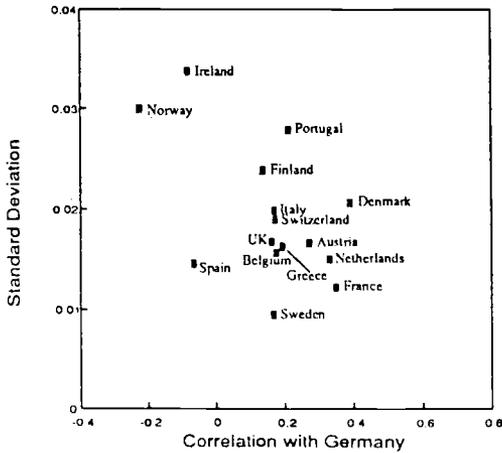
Table 3.   The Size of the Underlying
Aggregate Supply and Demand Disturbances
(Standard Deviations)

	Supply	Demand
EC Core		
Germany	.017	.014
France	.012	.012
Netherlands	.017	.015
Belgium	.015	.016
Denmark	.017	.021
EC Periphery		
UK	.026	.017
Italy	.022	.020
Spain	.022	.015
Portugal	.029	.028
Ireland	.021	.034
Greece	.030	.016
EFTA		
Switzerland	.018	.019
Austria	.012	.017
Sweden	.016	.010
Norway	.015	.030
Finland	.021	.024
Iceland	.038	.079

Notes: The data are in logarithms, hence a number such as .012 represents
a standard deviation of 1.2 percent.

stronger basis for EMU membership for the EFTA countries (excluding
Iceland) than for the EC periphery, the UK, Italy, Spain, Ireland and
Portugal.

It is illuminating to contrast the standard deviations of the supply
and demand shocks in Chart 6 with the standard deviations of inflation and
output growth in Chart 2. When countries are grouped as in Chart 2
according to the variability of inflation and output growth, most EFTA
countries appear to form part of the core of the EC, and thus would be
considered ready to enter any monetary union which was formed. When the
variability of aggregate supply and demand shocks, as in Chart 6, is taken
to measure suitability for entry, as we have argued is more appropriate,
the EFTA countries look considerably more mixed, with only Austria and
Sweden (the two countries who have formally applied to join the EC) firmly
in the core, Switzerland in an intermediate position and Norway and Finland
being grouped with the EC periphery.

3. Speed of Adjustment to Shocks

Our procedure also permits one to compare the reactions of economies
to shocks. This can be done by looking at the impulse-response functions
associated with the VARs. The slower the speed of adjustment to a given
disturbance, the greater the welfare costs. For a given configuration of
disturbances, then, countries with particularly slow speed of adjustment,
absolutely and relative to countries like Germany certain to participate
EMU, are the least plausible candidates for immediate membership.

Chart 7 displays the impulse-response functions for aggregate demand
shocks for the EC core, EC periphery and EFTA, respectively, while Chart 8
shows the impulse responses for aggregate supply shocks. To aid
comparison, we have superimposed on each chart the impulse-response
function for the EC aggregate.

Chart 7, which shows the response to a demand shock, is simple to
interpret: countries with impulse-response functions above and to the right

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Chart 7 - Impulse Response Functions to a Demand shock

Impulse response functions
EC demand shocks core Countries

Legend:
- HOLLAND
- BELGIUM
- FRANCE
- DENMARK
- GERMANY
- EEC

Impulse response functions
EC other countries

Legend:
- IRELAND
- GREECE
- ITALY
- PORTUGAL
- SPAIN
- EEC
- U.K.

EFTA countries

Legend:
- EEC
- Sweden
- Switzerland
- Austria
- Norway
- Finland
- Iceland
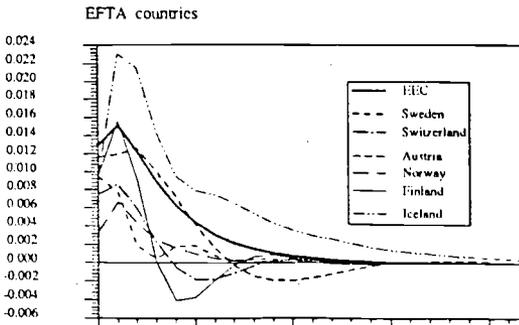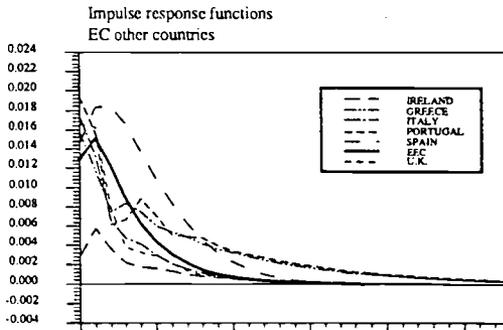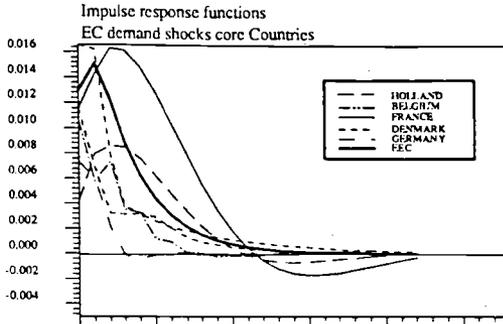
Chart 8 - Impulse response functions
Supply shocks

EC core countries

— —	HOLLAND
—·—·—	FRANCE
—··—··—	BELGIUM
- - -	DENMARK
—·—·—	GERMANY
▬▬▬	EEC

EC other countries

— —	IRELAND
—··—··	GREECE
—·—·—	ITALY
— —	PORTUGAL
—·—·—	SPAIN
▬▬▬	EEC
- - -	U.K.

EFTA Countries

▬▬▬	EEC	— —	Austria
- - -	Sweden	— —	Norway
—·—·—	Switzerland	——	Finland
—··—··		—··—··	Iceland
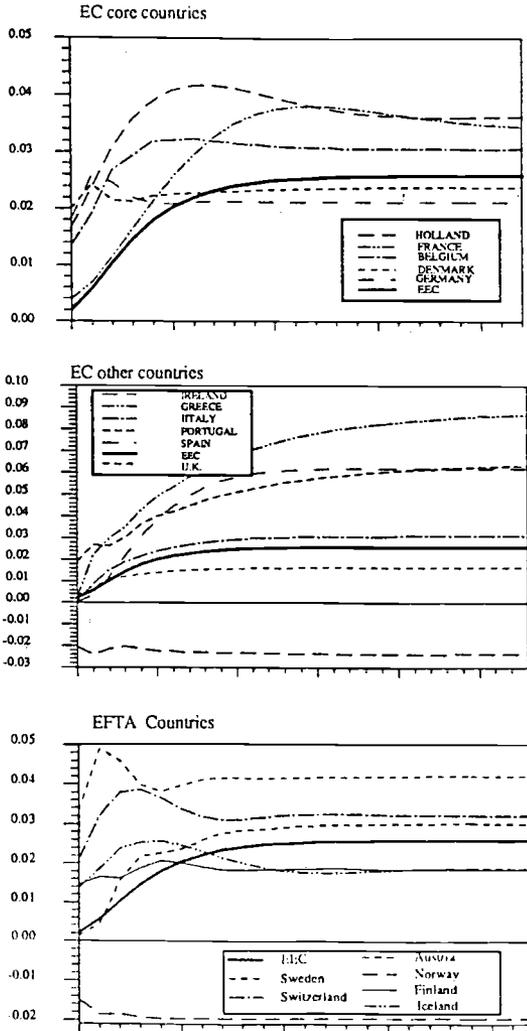
of the aggregate tend to adjust more slowly than average, while countries
with impulse-response functions below and to the left of the heavy line
respond more quickly. With the exception of France, all of the members of
the EC core show relatively fast response to demand shocks. The results
for the EC periphery are more mixed. While the UK, Italy and Ireland
respond slightly faster than the EC aggregate, Greece, Portugal and Spain
all respond more sluggishly. The responses of the EFTA countries resemble
the EC core more closely than the EC periphery, despite the cycling in the
estimated responses of Austria, Finland, and Switzerland. With the
exception of Iceland, their impulse-response functions are below those for
the EC aggregate, as are most of those for the EC core, although the
cycling indicates some temporary overshooting when output falls following a
positive demand shock, magnifying the transitional costs.

The impulse-response functions for supply shocks must be interpreted
differently. In contrast to the case of demand shocks, where output
returns ultimately to its initial level, in the case of supply shocks the
long-run change in output differs across countries. One measure of speed
of adjustment is the ratio of the impulse response of output in the third
year to its long-run level.[23] A high value indicates relatively fast
adjustment, a low value relatively slow adjustment. The average value for
this statistic is 0.72 for all EC countries, with the average for the EC
core (0.82) being considerably higher than that for the EC periphery
(0.63).[24] As might be expected from a comparison of Chart 8, in their
speed of adjustment to supply shocks the EFTA countries more closely
resemble the EC core than the EC periphery. Indeed, the average value for
EFTA countries (0.98) is actually somewhat larger than for the EC core.

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[23] While somewhat arbitrary, this measure is relatively simple and
intuitive. The same calculations, when undertaken for the fifth or seventh
year following the shock, pointed to essentially the same conclusions.

[24] Note that the EC average is a _weighted_ average of the figures for
the two subgroups, since there are different numbers of countries in the
two groups.

V. Summary and Implications

In this paper we have used structural vector autoregression to identify the incidence of aggregate supply and aggregate demand disturbances in Europe and to analyze the EC economies' response. Central to our analysis is a distinction, emphasized by Bayoumi and Eichengreen (1991), between aggregate supply and demand shocks to the countries at the center of the European Community -- Germany, France, Belgium, the Netherlands and Denmark -- and the very different shocks affecting other EC members. Supply shocks to the EC core are both significantly smaller and significantly more correlated across countries. The same is true of demand shocks. There is little evidence of convergence in the sense that this core-periphery distinction is becoming less pronounced over time. Moreover, the core-periphery distinction is reinforced by evidence that the core countries adjust more quickly to supply and demand disturbances alike.

The EFTA countries are not readily grouped with either the EC core or the EC periphery. In some respects they more closely resemble the core: this is true, for example, of their speed of response to both aggregate supply and aggregate demand shocks. In other respects they more closely resemble the EC periphery: this is true of the intra-group correlation of both supply and demand shocks. This last fact -- a low intra-group correlation -- highlights the extent of heterogeneity within EFTA. Some EFTA members (Austria, Sweden and Switzerland) display aggregate supply and demand disturbances that are both relatively small and relatively highly correlated with those of Germany. Finland and Norway display somewhat larger disturbances and, especially in the case of Norway, they are relatively poorly correlated with Germany's, making them more similar to some of the periphery countries in the EC. Finally, Iceland experie nces much larger underlying disturbances than any other country considered in the sample.

What are the implications of the findings reported in this paper for the debate over monetary union? Advocates of two-speed EMU will derive

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some comfort from our finding of a clear distinction between an EC core and an EC periphery, although the information reported here is obviously not sufficient to make or break their case. Those who believe that all 11 EC members can proceed rapidly toward completion of EMU will be reassured to learn that enlargement of the Community to include the EFTA countries does not pose an obvious challenge to their position. The EFTA countries as a whole exhibit behavior midway between that of the EC core and that of the EC periphery. If the U.K., Italy, Greece, Spain and Portugal are qualified to join the EMU, so too, judged in terms of the disturbances they experience and their capacity to respond, are Austria, Finland, Iceland, Norway, Sweden and Switzerland.

In a sense, however, our analysis suggests that the EC core, the EC periphery and EFTA are not the relevant categories for discussions of EMU membership. EFTA is more logically divided into two subgroups: Austria, Sweden and Switzerland belong with the EC core, while the same is not clearly true of Norway, Iceland and Finland. If the EC proceeds with two-speed EMU, this suggests, one should expect to see more vehicles in <u>both</u> the fast and slow lanes.

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