

OPTIMUM CURRENCY AREAS AND EUROPEAN MONETARY UNIFICATION

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This paper examines the European experience from optimum currency areas perspective with a focus on the correlation of underlying aggregate shocks within a structural vector autoregression (VAR) framework. Appropriately identifying supply shocks, real fiscal shocks, and nominal shocks, the paper investigates the correlations of shocks and tries to evaluate the likely adjustment and other problems that may take place with the introduction of a single currency in Europe. Using data for 20 European market economies, the paper compares original members of the European Community to new members and non-members. Shocks are mostly country-specific, particularly for newer members and non-members, suggesting the importance of alternative adjustment mechanisms other than national monetary policies after the introduction of a single currency.

I INTRODUCTION

The process of European unification took a new turn in December 1991, when political leaders approved the Maastricht Treaty, which committed the European Community (EC) to a single currency and a common Central Bank in three steps. First, members would coordinate their monetary policies. Second, a European Monetary Institute would be set up to study the convergence in macroeconomic indicators and act as a precursor of a common European Central Bank. The third step would involve creating a single currency starting January 1997 if convergence criteria are met; otherwise a single currency would be issued in January 1999 by countries that meet the convergence criteria.

There are several potential benefits of currency union membership. First, it

would bring maximum credibility to exchange rate stability by eliminating risks and transaction costs stemming from exchange rate operations inside the currency union. Such stability would enhance specialization and optimal allocation of capital. Second, members might obtain some efficiency gains by avoiding negative externalities associated with beggar-thy-neighbor type policies. Finally, as stressed recently by Bofinger (1993), a currency union might enable monetary authorities to pursue monetary control more effectively as a result of money demand becoming more stable in a wider area under open capital markets and full financial liberalization. While these and other potential benefits might dominate for a particular country or region, costs of membership mostly involve reduced *policy independence*.

Policy independence is crucial if a given country faces idiosyncratic disturbances.

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ABBREVIATIONS

AD. Aggregate Demand
AS Aggregate Supply
EC European Community
EMS European Monetary System
ERM Exchange Rate Mechanism
EU European Union
VAR. Vector Autoregression

Particularly, if countries that comprise the European Union (EU) show inadequate symmetry in their business cycle, individual countries would be better off retaining their ability to conduct monetary/exchange rate, and/or fiscal policies. Eventually if unification proceeds without adequate macroeconomic convergence, a centralized decision making might result in "average performance" while a competitive approach might allow convergence to the best practice.

Thus an important empirical question is whether Europe is a region where country-specific, idiosyncratic shocks prevail or whether it is a region where shocks affect all countries in a rather similar way. Another related question is whether European countries have significantly different macroeconomic policy practices, which among other things, might have important implications for the single currency in terms of seigniorage. Recall that one advantage of a national money is that it enables the policymaker to raise revenue through the inflation tax. Cohen and Wyplosz (1989), Bayoumi and Eichengreen (1992), Chamie et al. (1994), and Whitt (1995) recently addressed the first question.

This paper's main objective is to re-examine monetary unification in Europe from an optimum currency areas perspective. The paper follows Blanchard and Quah (1989) by distinguishing between supply shocks, real fiscal (demand) shocks, and nominal shocks and analyzes the symmetry and incidence in order to assess possible adjustment problems of a single currency. Moreover, "identification" of real fiscal impulses has an important bearing on another aspect of monetary unification, namely the ability to use the inflation tax. The literature on exchange rate regimes alludes to fixed rates as providing discipline to policymakers (Giavazzi and Pagano, 1988; Aghevli et al., 1991; Frenkel et al., 1991). Accordingly, fixing the exchange rate against a country committed to low inflation can be viewed as a pledge not to make heavy and discretionary use of the seigniorage tax. De Kock

and Grilli (1989; 1993) show that the losses associated with participating in a monetary union increase with the variance of government spending shocks. This stems from the fact that higher variability of government spending in a flexible exchange rate system allows the use of seigniorage to smooth the time profile of distortionary taxes. A permanently fixed rate system limits such smoothing; hence countries with higher incidence of fiscal shocks may incur additional losses if they participate in a monetary union. This paper measures the incidence of the shocks by their standard deviations. Moreover, variance decompositions typical of Vector Autoregressions (VARs) can shed light on whether a higher incidence of fiscal impulses is associated with greater variation in the price level.

The sample in this study covers 20 major market economies in Europe including Turkey and Cyprus. The study compares original members of the EC to newer members and non-members. In addition, the paper looks at all possible bilateral correlations among sample countries instead of focusing on correlations of shocks with a given "anchor region."

II THEORETICAL FRAMEWORK

Mundell's (1961) original formulation of the optimum currency area stresses the importance of retaining exchange rate flexibility in countries facing asymmetric demand shocks, particularly if these countries are unable to adjust otherwise due to wage rigidity and limited labor mobility. Subsequent work by McKinnon (1963) and Kenen (1969) emphasize the importance of "openness" and "product diversification" in a currency area. Although Niehans (1984) labeled the question of optimum currency areas as a "prohibitively difficult problem," it returned to the forefront of research in the early nineties. This new approach stresses weighing costs and benefits of membership in the monetary union and the importance of political decision making.

The commonly cited potential benefits of a single currency are reduced transac-

tion costs, benefits associated with exchange rate stability, efficiency gains by avoiding negative externalities associated with beggar-thy-neighbor policies, and possibly more effective monetary control (due to the possibility of a more stable money demand in a wider area, and a more "prudent" monetary authority). Costs include loss of policy autonomy, particularly inability to adjust in case of asymmetric shocks. Moreover, these are costs associated with (i) different preferences about macroeconomic policy goals, (ii) different labor market institutions, (iii) different growth rates, (iv) different fiscal systems and seigniorage practices (see Bean, 1992 for a discussion).

The costs of monetary union associated with losing monetary autonomy and having different macroeconomic policy goals have been well studied (e.g., Corden, 1972; Giersch, 1973). Theoretical work on rational public finance and seigniorage implies that rational governments will use different revenue sources such that the marginal cost of raising revenue through different means is equalized (Fischer, 1982; Mankiw, 1987). Monetary union limits the use of seigniorage as a source of revenue. De Kock and Grilli (1989; 1993) develop a framework on the use of seigniorage in alternative exchange rate regimes. This framework views exchange rate arrangements as alternative forms of commitment on future inflation tax policies. In a flexible exchange rate system, the policymaker in each period chooses the income tax rate and inflation rate to minimize the costs of taxation, taking as given government spending and private sector money holdings. In this well known Nash solution, equilibrium money holdings are inefficiently low and the inflation rate is inefficiently high. A government with the ability to design surprise inflations will have an incentive to do so as a way of imposing a levy on money balances. This is the time-consistency problem analyzed by Kydland and Prescott (1977).

In this model, joining a monetary union is a commitment not to use the inflation tax, which enables the policymaker to fix

private sector expectations of inflation (say, at zero) and raise real money balances to socially optimal levels at the cost of relinquishing revenues that could be generated by inflation. From this perspective, the cost of floating is increasing in average government spending as a percent of GNP, since higher spending implies higher inflation in a float. On the other hand, the cost of monetary union is increasing in the variance of government spending, since in this case the policymaker is unable to spread the excess burden of distortionary taxes over taxes and seigniorage. This result is similar to that of Barro (1983), who stresses the value of inflationary finance when alternative methods of raising revenue entail distortions. Moreover, De Kock and Grilli show that monetary union is less preferable the greater the revenue of fully anticipated inflation, and the smaller the cost of inflation. (Dornbusch, 1988, criticizes this theory of "optimal inflation," which views inflation as a conscious choice of taxation, on the grounds that it rules out inflation as a coordination problem—e.g., inflation arising from negative supply shocks. Variance decomposition results below can give an idea about price level variation that is attributable to supply shocks.)

This paper aims to evaluate whether Europe is an optimum currency area by focusing on the monetary union's cost aspects. The paper follows the original Mundell formulation and re-examines the symmetry of shocks. In addition, it presents standard deviations of structural shocks and variance decompositions to measure the incidence of the shocks and their relative importance in explaining output and prices. The incidence of fiscal shocks may give indirect evidence on the "tax-smoothing theory" of seigniorage highlighted above. The paper also reports recent estimates of seigniorage revenues for selected countries.

III METHODOLOGY

Although there is no unique way to identify different shocks affecting a given

economy, economic theory can provide a guide in isolating certain effects in the sample. As in Bayoumi and Eichengreen (1992), the basis for this paper's identification strategy is a simple aggregate supply/aggregate demand (AS/AD) model with a positively sloped short run, and a vertical long run AS curve. Analysis of the transmission of macroeconomic disturbances and of the design of optimal policies in open economies extensively uses the model (e.g., Artis and Currie, 1981; Turnovsky, 1983). In this framework, endowment, technology, institutional factors, etc., determine the long run AS curve so that demand shocks have only transitory effects on output.

Consider three types of orthogonal shocks that are the sources of variation in domestic output y_t , government spending g_t , and the price level p_t , where measurement of all variables is in logarithms: a supply shock, ϵ_{st} , a real fiscal shock ϵ_{ft} and a nominal shock, ϵ_{nt} . Focusing on the orthogonal shocks is important, since working directly with observed data does not allow for distinguishing disturbances from responses to these disturbances. One can interpret significantly positive correlations of the structural shocks as indicating symmetry of impulses that affect individual economies.

Assuming the variables are unit root processes, the vector $\Delta X_t = [\Delta y_t, \Delta g_t, \Delta p_t]'$ is stationary and can be written as an infinite moving average process:

$$(1) \quad \begin{bmatrix} \Delta y_t \\ \Delta g_t \\ \Delta p_t \end{bmatrix} = \begin{bmatrix} a_{11}(L) & a_{12}(L) & a_{13}(L) \\ a_{21}(L) & a_{22}(L) & a_{23}(L) \\ a_{31}(L) & a_{32}(L) & a_{33}(L) \end{bmatrix} \begin{bmatrix} \epsilon_{st} \\ \epsilon_{ft} \\ \epsilon_{nt} \end{bmatrix} \\ = \sum_{i=0}^{\infty} A_i \epsilon_{t-i} = A(L) \epsilon_t$$

where $a_{ij}(L)$ are polynomials, and A_i are matrices in the lag operator, L . The coefficients of the polynomials $a_{ij}(L)$ give time paths of the effects of various shocks on the growth rates of output, government

spending and prices. Moreover, coefficient $a_{ij}^{(k)}$ in the $a_{ij}(L)$ polynomial is the response of variable i to a unit shock in ϵ_{jt} after k periods while $a_{ij}(1)$ is the sum of all the moving average coefficients and gives the cumulative effect of ϵ_{jt} on variable i over time. For illustrative purposes assume that the shocks are normalized such that

$$(2) \quad E(\epsilon_t \epsilon_t') = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

In order to identify this model, one can estimate a finite order trivariate VAR. (Consistent with findings of the authors, this specification assumes that the variables are not cointegrated.)

$$(3) \quad \Delta X_t = B_1 \Delta X_{t-1} + \dots + B_k \Delta X_{t-k} + e_t$$

where the maximum lag length k is chosen such that residuals e_{it} ($i=1, 2, 3$) approximate white noise, and

$$(4) \quad E(e_t e_t') = \sum = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{bmatrix}$$

Since the elements of ΔX_t are stationary, the system can be inverted to obtain the moving average representation:

$$(5) \quad \Delta X_t = e_t + C_1 e_{t-1} + C_2 e_{t-2} + \dots \\ = \sum_{i=0}^{\infty} C_i e_{t-i} = C(L) e_t$$

The contemporaneous relationship between the orthogonal (pure) innovations ϵ_t and the composite innovations e_t is

$$(6) \quad e_t = A_0 \epsilon_t$$

Thus the following relationship exists between the variance-covariance matrices:

$$(7) \quad E(e_t e_t') = A_0 E(\varepsilon_t \varepsilon_t') A_0'$$

and

$$(8) \quad \Sigma = A_0 A_0'$$

Since Σ is a symmetric matrix with known elements (or it can be estimated consistently), it imposes six restrictions on the matrix of contemporaneous effects A_0 , which has nine elements. Identifying A_0 requires three additional restrictions so that equation (6) can recover the orthogonal shocks ε_{it} . The traditional method is to pick A_0 as the Choleski factorization of Σ , which has been criticized on the grounds that it imposes an arbitrary structure on the orthogonal ε_{it} sequences. Blanchard and Quah (1989) propose an interesting way to circumvent the problem of arbitrary identification. One can see this from the relationship between the matrices of long term effects. Evaluating the polynomials embedded in equations (1) and (5) at $L=1$ and noting the relationship in equation (6) yields:

$$(9) \quad A(1) = C(1)A_0$$

where $C(1)$ contains known elements. In order to identify the shocks, this study imposes the three restrictions on the long run matrix $A(1)$. First, nominal and real fiscal shocks are restricted to have no long run effects on output, which is equivalent to setting $a_{12}(1) = a_{13}(1) = 0$ in equation (1). (This paper recognizes that government spending might have non-trivial supply side effects. For identification purposes, attention is restricted to aggregate demand effects of government spending.) Second, nominal shocks are restricted to have no long run effect on real government spending. This corresponds to $a_{23}(1) = 0$ in equation (1) and provides the third restriction needed to recover the elements of A_0 . Once A_0 is identified, orthogonal shocks can be recovered using equation (6). In addition, one can construct the A_i matrices of equa-

tion (1) as $A_i = A_0 C_i$, $i = 1, 2, \dots$ and conduct innovation accounting exercises to investigate the dynamic effects of the shocks.

IV DATA AND EMPIRICAL RESULTS

This study uses annual data from 15 current members of the EU—Germany, France, Italy, the Netherlands, Belgium, Luxembourg, the United Kingdom, Denmark, Ireland, Greece, Spain, Portugal, Austria, Sweden, and Finland—and five non-members—Switzerland, Norway, Iceland, Turkey, and Cyprus. In most cases the sample covers the 1950–1994 period except for Cyprus (1952–94), Portugal (1953–93), Luxembourg (1950–92), and Turkey (1950–93). The data are from the International Financial Statistics, except for several cases where missing data are from OECD National Accounts, and Mitchell (1992). The measures of real output is real GDP, and real government spending is real government consumption, both in 1990 prices, while the GDP deflator is the measure for the price level. Data for Germany pertain to West Germany.

Before proceeding with the identification strategy, it is important to determine the order of the VAR. The likelihood ratio and residual diagnostics indicate that two lags are sufficient to capture the dynamics, except for Austria, Norway, and Spain where four lags are used in the VAR. Moreover, since the data sample covers a period of possible structural change (such as the breakdown of the Bretton Woods system, and the forming of the Exchange Rate Mechanism, ERM), this paper divides the sample and performs Chow tests for structural stability due to the transition to floating exchange rates in 1973. In half of the cases, one cannot reject a structural break hypothesis. However, when including a dummy variable for the two exchange rate periods, one can reject the structural break hypothesis except for Iceland and Cyprus. The paper also tests the significance of a dummy variable representing the European Monetary System (EMS) for the original eight members of the ERM—France,

Germany, Italy, Belgium, Denmark, Ireland, Luxembourg, and the Netherlands. The dummy variable is insignificant for all countries except for Italy and France. In the final model, the authors carry out the estimation with a dummy variable representing the switch to floating rates in 1973 in all VARs and include an additional dummy variable representing the ERM period for the VARs pertaining to Italy and France.

After specifying the appropriate VARs, the analysis follows the identification strategy outlined above. Table 1 presents all bilateral correlation coefficients for the supply shocks. The first 15 countries in the table are current EU members. Asterisks indicate significantly positive correlation coefficients at the 5% level. Supply shocks do not seem to be highly correlated among current EU members, although the numbers reveal positive but low correlations for some members, particularly ERM countries. However, these correlations do not suggest a coherent group of correlated countries. Note that the correlation between the supply shocks of Germany and Belgium, Belgium, and Luxembourg are insignificant at the 5% level. The correlations of supply shocks between Spain, Portugal, Greece, Austria, Belgium, Italy, the UK, Ireland and the rest of the members are particularly low or negative. Among recent members, Finland and Sweden share some significant correlations but these tend to be low and show no geographical pattern. As for non-members, there are few correlations with the rest of the sample.

Table 2 presents correlations of real fiscal shocks and nominal shocks. Correlations of real fiscal shocks above the diagonal, and correlations of nominal shocks are below. The table indicates that real fiscal shocks are mostly asymmetric for any base country, and have no pattern. Moreover, correlations of real fiscal shocks reveal no major difference distinguishing members from non-members.

More interesting are the correlations of nominal shocks. Despite monetary cooperation arrangements after the collapse of

the Bretton Woods system such as the "snake" in the 1970s and the EMS, correlations among EU members are low, even negative. The correlations clearly do not indicate a pattern for members of the EU vs. non-members. One might find these results troubling since relatively more efforts have focused on monetary policy coordination than on other policy issues. Recently Hafer and Kutun (1994) found similar results indicating inadequate convergence of monetary policies in the EMS period.

The low correlations of fiscal and nominal impulses might indicate different preferences about macroeconomic goals and policies, and monetary union might entail some costs in terms of achieving domestic policy objectives. For example, a decision by a high inflation country to join the monetary union entails losses in terms of unemployment. However, if the "natural rate hypothesis" is valid these losses are likely to be transitory; when inflationary expectations adjust, the economy settles at the long run "natural" rate of output.

One might argue that asymmetric demand shocks will be less frequent once the monetary union is complete. Although this seems plausible for nominal demand shocks, economic integration (including monetary union) might not completely eliminate differential real demand shocks arising from exogenous shifts in demand because of the likely regional concentration of industrial activity. Krugman (1991) notes that in an integrated European market, as in the U.S., regional concentration of industrial activities is likely to occur due to economies of scale. Industry specific shocks might then become country specific shocks, and retaining some exchange rate flexibility might be desirable to deal with these shocks.

A. Incidence of Shocks and Variance Decompositions

One measure of the incidence of shocks that countries have experienced is their standard deviations. A high incidence of

TABLE 1
Correlations of Supply Shocks

	FR	IT	NE	BE	LU	UK	DE	IR	GR	SP	PO	AU	SE	FI	SW	NO	IC	TU	CY
GF	0.37*	0.35*	0.45*	0.21	0.49*	0.36*	0.42*	0.07	0.13	0.01	-0.02	0.26	0.20	0.12	0.41*	-0.25	0.15	0.33*	-0.14
FR	---	0.39*	0.44*	0.56*	0.25*	0.27*	0.53*	0.30*	0.00	0.11	0.09	-0.02	0.33*	0.52*	0.53*	0.07	0.18	0.06	0.07
IT	---	---	0.21	0.35*	0.17	0.38*	0.13	0.24	-0.03	0.06	-0.13	-0.13	0.15	0.22	0.22	0.03	-0.04	0.09	0.24
NE	---	---	---	0.39*	0.51*	0.05	0.34*	0.30*	0.11	-0.08	0.19	0.03	0.13	0.21	0.44*	-0.16	0.18	0.08	0.02
BE	---	---	---	---	0.10	0.07	0.18	0.29*	0.15	-0.04	0.04	-0.10	0.16	0.15	0.31*	0.04	0.04	0.17	-0.12
LU	---	---	---	---	---	0.15	0.34*	0.24	0.22	0.01	0.06	0.09	0.25*	0.25*	0.43*	0.09	0.05	0.74	-0.11
UK	---	---	---	---	---	---	0.22	0.16	0.11	0.46*	-0.17	-0.02	0.10	0.07	0.13	-0.05	0.06	0.24	0.02
DE	---	---	---	---	---	---	---	0.23	0.01	-0.02	0.38*	-0.13	0.36*	0.33*	0.26*	0.24	0.11	-0.07	-0.31
IR	---	---	---	---	---	---	---	---	0.06	-0.32	0.04	0.22	0.02	0.25*	0.16	0.18	-0.09	0.06	0.03
GR	---	---	---	---	---	---	---	---	0.06	-0.12	0.06	-0.15	0.34*	0.25*	0.07	-0.04	-0.04	-0.06	0.01
SP	---	---	---	---	---	---	---	---	---	---	-0.16	-0.25	-0.24	-0.18	-0.07	-0.07	0.11	0.09	-0.00
PO	---	---	---	---	---	---	---	---	---	---	---	0.00	0.30*	-0.16	-0.03	0.13	-0.23	-0.02	-0.11
AU	---	---	---	---	---	---	---	---	---	---	---	---	-0.12	0.14	-0.03	0.12	0.10	0.14	0.07
SE	---	---	---	---	---	---	---	---	---	---	---	---	---	0.57*	0.33*	0.07	-0.07	-0.08	-0.03
FI	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.14	-0.20	0.21	0.08	0.03
SW	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.16	0.00	-0.16	-0.11
NO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.05	0.13	0.02
IC	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-0.08	-0.12
TU	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.09

Notes: *Denotes positively significant coefficients at the 5% level. Country names are abbreviated by the first two letters, except for Sweden (SE)

TABLE 2
Correlations of Real Fiscal and Nominal Shocks

	GE	FR	IT	NE	BE	LU	UK	DE	IR	GR	SP	PO	AU	SE	FI	SW	NO	IC	TU	CY
GE	—	0.37*	0.38*	0.05	0.20	0.26*	0.01	-0.13	0.12	0.08	-0.01	-0.07	0.12	-0.01	0.00	0.24	0.16	0.05	-0.13	-0.16
FR	0.07	—	0.12	0.26*	0.16	0.03	0.11	0.25*	0.08	0.21	0.24	0.18	-0.13	0.19	-0.09	0.17	-0.11	-0.15	-0.07	0.00
IT	0.09	0.29*	—	0.27*	0.19	0.14	0.09	-0.12	0.04	0.17	-0.22	0.02	-0.15	0.19	-0.08	0.11	0.10	-0.14	0.04	-0.06
NE	0.32*	0.33*	0.34*	—	0.30*	-0.05	0.25*	0.09	0.15	0.26*	-0.02	0.22	-0.18	0.12	-0.10	-0.07	-0.03	-0.20	0.16	0.26*
BE	0.04	0.13	0.19*	0.30*	—	-0.01	0.12	0.00	0.16	0.37*	-0.13	0.21	-0.06	-0.22	-0.01	-0.05	0.05	0.29*	0.01	-0.17
LU	0.35*	0.51*	0.42*	0.43*	0.42*	—	-0.08	-0.25	-0.25	0.30	0.03	-0.26	0.49*	-0.11	-0.04	0.20	0.19	0.21	-0.04	-0.29
UK	0.00	0.01	0.13	0.39*	-0.02	0.01	—	0.37*	0.26*	0.22	-0.07	0.07	0.23	0.16	-0.10	-0.01	-0.22	0.00	-0.27	0.25*
DE	-0.04	0.41*	-0.01	0.26*	0.15	0.09	-0.07	—	-0.01	0.13	-0.07	0.12	-0.03	0.41*	-0.16	0.04	-0.31	0.14	-0.00	0.27*
IR	-0.09	0.23	-0.05	0.05	-0.06	-0.04	-0.10	0.22	—	0.30*	-0.03	-0.04	0.07	0.16	0.30*	-0.20	-0.09	-0.07	-0.06	0.05
GR	0.15	-0.07	0.17	0.12	0.36*	0.15	0.19	-0.24	-0.06	—	-0.07	0.26*	-0.27	0.04	0.03	-0.14	0.19	-0.04	0.32*	0.14
SP	-0.12	0.18	-0.04	0.04	0.02	0.03	-0.03	0.04	0.10	-0.05	—	-0.02	0.17	0.12	-0.09	-0.00	-0.12	0.23	0.13	0.13
PO	-0.02	0.08	0.31*	-0.00	-0.01	0.00	0.10	-0.11	0.02	-0.17	0.02	—	-0.17	-0.16	0.15	0.02	-0.06	0.29*	-0.07	-0.07
AU	0.17	-0.10	0.22	0.07	-0.09	0.30*	0.03	0.15	0.12	-0.05	-0.07	-0.04	—	0.09	0.09	0.26*	-0.29	0.22	-0.37	-0.10
SE	0.26*	0.36*	0.23	0.36*	0.00	0.22	0.29*	0.28*	0.15	-0.02	0.00	-0.03	0.24	—	-0.22	0.12	-0.36	-0.28	0.10	0.25*
FI	0.11	0.26*	0.14	0.00	0.12	0.37*	-0.05	-0.07	0.25	-0.08	-0.02	0.15	-0.00	-0.07	—	0.06	-0.11	0.21	-0.09	0.05
SW	0.26*	0.28*	0.27*	0.43*	0.20	0.40*	0.16	-0.14	0.02	0.29*	0.13	-0.04	-0.18	0.14	0.11	—	-0.06	0.06	0.06	-0.25
NO	0.22	0.22	-0.14	0.14	0.02	0.16	0.21	-0.13	0.27*	0.09	-0.37	0.13	0.08	-0.36	0.04	0.20	—	-0.04	0.27*	-0.24
IC	0.27*	0.23	0.10	0.12	0.11	0.32*	-0.01	0.19	0.08	-0.17	-0.26	0.37*	0.32*	0.22	0.19	0.15	0.38*	—	-0.19	-0.05
TU	-0.11	0.02	-0.10	-0.05	-0.02	-0.05	-0.08	0.07	0.23	-0.07	0.08	-0.07	-0.02	-0.15	-0.09	0.16	-0.14	-0.23	—	0.02
CY	-0.02	-0.07	0.24	0.01	-0.22	0.02	0.27*	-0.05	-0.01	0.16	0.12	0.17	0.36*	0.37*	0.24	0.02	0.04	0.17	-0.26	—

Note: Correlations of real fiscal shocks are above the diagonal, and correlations of nominal shocks are below the diagonal

TABLE 3
Standard Deviations of Structural Shocks

Country	Supply Shock	Real Fiscal Shock	Nominal Shock
GE	0.028	0.036	0.014
FR	0.061	0.032	0.035
IT	0.020	0.041	0.087
NE	0.023	0.036	0.042
BE	0.022	0.048	0.024
LU	0.025	0.055	0.040
UK	0.023	0.040	0.115
DE	0.016	0.063	0.044
IR	0.027	0.060	0.067
GR	0.023	0.045	0.049
SP	0.038	0.046	0.069
PO	0.026	0.039	0.054
AU	0.019	0.042	0.015
SE	0.016	0.043	0.023
FI	0.028	0.022	0.042
SW	0.015	0.025	0.025
NO	0.030	0.018	0.027
IC	0.059	0.033	0.300
TU	0.072	0.094	0.166
CY	0.064	0.189	0.052

asymmetric supply shocks might make adjustment costly in a monetary union, hence providing a compelling argument for retaining the ability to conduct independent macroeconomic policy. Table 3 presents standard deviations of the structural shocks. The table indicates that countries mostly experienced a somewhat divergent incidence of supply shocks. Note that since the data are in logarithms, a standard deviation of 0.028 implies a growth rate of 2.8% per year. France and Spain seem to have experienced the largest supply shocks. Moreover, non-members of the EU seem to have higher incidence of supply shocks except for Switzerland. Even if countries face supply shocks of the same magnitude, different wage and price responses are likely, particularly if countries have different labor market institutions and wage bargaining processes. Calmfors and Driffill (1988) show that European economies have different degrees of centralization of wage bargaining and consequent different implications in terms of wage claims and coping with supply shocks.

The incidence of real fiscal shocks seems even less uniform among members of the EU. Germany, France, the Netherlands, Portugal and Finland experienced relatively lower variability in their fiscal impulses while the rest of members experienced higher variability. Note that Turkey and Cyprus stand as the countries with the highest incidence of fiscal shocks. The differences in the incidence of nominal shocks seem to be pronounced as well. This is not surprising since individual members are known to have different price accommodating monetary policies. Particularly, the UK, Italy, Spain, and Ireland stand as the countries with the highest incidence of nominal shocks. Notice also that the Bundesbank's conduct of monetary policy is evident in the lowest standard deviation of nominal shocks. Among non-members of the EU, Iceland, Turkey, and Cyprus all seem to have higher variability of fiscal as well as nominal shocks.

The seigniorage model cited above predicts that the costs of monetary union are increasing in the variability of fiscal

shocks. Denmark, Ireland, and Luxembourg seem to have the highest variability of fiscal impulses. Examining the variance decompositions can provide evidence on whether a high incidence of government spending shocks is behind the variation in prices.

Examining the variance decompositions offers the best way to understand the relative importance of each shock. Variance decompositions also might give an idea about "structural" differences in those economies. This paper's primary focus is on output growth and price stability. Table 4 gives the decomposition of the forecast error variance of real output and prices at one, four, and 10 year forecasting horizons. Examining the table reveals that the three shocks affect output in European countries in fundamentally different ways. Supply shocks explain the preponderance of the forecast error variance of output at all forecasting horizons in France, the Netherlands, Ireland, Portugal, Austria, Sweden, and Finland among member countries. Supply shocks seem to play a relatively small role in explaining output at short term forecasting horizons in the UK, and Spain. Real fiscal shocks do not seem to be important in explaining output except for the UK, Greece, and Spain. Nominal shocks seem to be dominant in explaining output in the short run for the UK, Luxembourg, and Italy. As for non-members, real fiscal shocks seem to play no role while nominal shocks have some impact on output variability. Overall, the results indicate that supply shocks are important in explaining output variability for most countries, which highlights the importance of examining the symmetry of supply shocks in identifying an optimum currency area.

Variance decompositions of the price level indicate that various shocks explain different portions of the price level movements across countries. Real supply shocks explain the bulk of price movements in the short run in the UK, Spain, Portugal, and play a strong role in Switzerland and Germany. At longer forecast horizons, supply shocks explain a greater

portion of price level movements. Thus, a somewhat important proportion of price level movements arise as a response to supply shocks. This shows that movements in the price level might arise as coordination problems, which has some implications for seigniorage theories that allude to an "optimal" level of inflation. Real fiscal shocks seem to be important in explaining price movements in all countries except for Luxembourg, Greece, and Portugal. This seems to provide partial support for the tax smoothing approach where countries with high variability of government spending shocks tend to have greater incentives to resort to the inflation tax. However, one should interpret the evidence with caution since the use of fiscal policy to achieve price stability might explain why real fiscal shocks explain a sizable portion of the price level. Overall, variance decomposition results indicate no general pattern among members and non-members alike concerning the sources of output and price movements.

Another cost of joining the monetary union for European countries will be the relinquished seigniorage revenues. Seigniorage theories predict that *ceteris paribus* countries with a high variability of government spending shocks tend to lose the most, since they will be unable to smooth out the financing of government outlays between seigniorage and distortionary taxes. Results presented above indicate that countries are different in terms of the variability of their real fiscal shocks. Although there is evidence that seigniorage revenues have declined significantly in the EU member countries, seigniorage still accounted for 1.5% of GNP in Greece, and nearly 2% of GNP in Portugal in the 1986-90 period (Gros, 1990). Although the trend towards lower seigniorage revenues seems to have continued, the authors' calculations show that seigniorage revenues accounted for 1.2% of domestic output in the Netherlands, 2.8% in Sweden, 1.5% in Finland, and 1.9% in Greece in the 1992-94 period. (The authors follow the usual practice of calculating seigniorage revenues as the change in

TABLE 4
Variance Decompositions of Real Output and the Price Level

step	percentage of variance of real output due to			percentage of variance of prices due to														
	supply shocks	fiscal shocks	nominal shocks	supply shocks	fiscal shocks	nominal shocks												
GE	80.5	96.7	99.9	9.8	1.2	0.0	9.7	2.0	0.0	25.4	11.2	73.2	29.6	56.3	54.7	44.9	22.2	22.1
FR	98.0	98.9	98.7	18	0.2	0.3	0.2	0.9	1.0	8.6	0.1	0.0	10.4	24.2	23.4	81.0	76.8	76.5
IT	70.6	98.8	97.7	0.0	0.3	0.5	29.4	0.9	1.8	4.8	8.2	17.6	35.7	39.8	40.9	59.3	51.9	41.5
NE	98.4	99.3	99.9	1.3	0.0	0.0	0.3	0.6	0.0	5.1	16.7	23.8	11.6	21.9	25.8	83.2	76.7	50.3
BE	69.1	99.2	99.9	16.6	0.4	0.0	14.3	0.2	0.0	7.5	15.8	40.2	24.0	17.6	26.5	68.4	66.6	33.3
LU	75.5	95.1	96.8	0.0	3.2	1.7	24.5	1.6	1.4	11.1	4.9	1.9	0.1	7.1	5.6	88.7	87.9	92.4
UK	2.3	32.9	88.4	56.8	33.9	6.0	40.8	33.1	5.5	95.2	80.6	66.8	0.1	12.6	18.9	4.6	6.7	14.3
DE	84.2	95.6	98.8	1.7	4.4	0.9	14.0	0.0	0.3	0.9	29.2	34.4	50.9	55.2	51.5	48.1	15.0	14.0
IR	94.4	99.9	99.9	4.9	0.0	0.0	0.7	0.0	0.0	0.6	3.3	22.7	10.3	67.6	59.6	89.1	28.9	17.5
GR	62.0	99.3	99.9	29.7	0.1	0.0	8.1	0.0	0.0	5.9	0.0	1.3	0.4	0.7	2.6	93.7	99.3	96.1
SP	6.6	10.0	36.1	88.9	81.0	40.9	4.5	8.8	22.9	74.5	86.2	74.4	27.3	6.1	17.0	28.9	7.6	8.5
PO	98.0	99.9	99.9	0.2	0.0	0.0	1.8	0.0	0.0	53.8	29.7	28.7	1.3	4.1	3.7	44.8	66.0	67.5
AU	99.4	90.6	97.7	0.4	8.4	1.7	0.3	1.0	0.6	1.7	17.9	27.4	89.8	62.9	62.2	8.4	19.0	10.3
SE	98.6	98.7	99.9	0.4	0.5	0.0	1.0	0.7	0.0	1.3	34.9	29.4	35.8	17.4	23.4	62.9	47.6	47.3
FI	98.8	99.7	99.9	0.5	0.1	0.0	0.6	0.1	0.0	0.6	33.7	38.9	13.3	27.5	27.2	86.0	38.7	33.8
SW	84.7	98.6	99.9	11.7	0.0	0.0	3.5	1.3	0.0	43.6	2.1	0.9	3.0	27.3	27.5	53.4	70.6	71.6
NO	83.3	99.4	99.3	0.4	0.4	0.2	15.5	0.2	0.5	1.6	33.1	75.3	38.4	45.4	14.3	59.9	21.4	10.4
IC	69.1	89.7	98.4	7.4	0.0	0.0	23.4	10.2	1.5	9.9	51.3	61.3	22.3	1.4	0.8	67.8	47.1	37.8
TU	57.3	93.6	99.8	3.2	0.0	0.0	39.4	6.3	0.2	2.0	17.6	28.1	41.1	21.9	15.2	56.8	60.4	56.6
CY	96.5	98.9	99.9	3.3	1.8	0.0	0.2	1.0	0.0	0.0	2.2	2.5	27.7	23.8	22.9	72.2	73.9	74.5

the monetary base normalized by GDP. Seigniorage revenues for Sweden for the 1989-94 period account for 1.5% of GDP.) Aside from tax smoothing motives, governments tend to resort to seigniorage when they experience difficulties in raising revenue through taxation. In this regard, countries with a relatively underdeveloped tax system and/or with public pressure constraints are more likely to rely on seigniorage.

B. Alternative Adjustment Mechanisms

The importance of being able to conduct independent monetary/exchange rate policies becomes more apparent when one considers the limits to alternative forms of adjustment in Europe, such as labor mobility and wage flexibility. Empirical work on wage rigidity shows that real wages in Europe respond less to unemployment than in the United States (Grubb et al., 1983, Bruno and Sachs, 1985). Using dispersion of unemployment as an indicator of labor mobility, Masson and Taylor (1994) show that labor mobility in the United States is roughly two to three times higher than in Europe. Moreover, De Grauwe and Vanhaverbeke (1991) show that the yearly flow of migrants between the EC countries is less than one tenth of the yearly flow of migrants between regions within the same country. This implies that there may be limits to Europe's ability to rely on wage flexibility or labor mobility to absorb the negative real shocks. Sala-i-Martin and Sachs (1992) emphasize that establishing a central fiscal authority with redistributive functions can overcome adjustment problems of this nature. However, some argue that current rigidities in the EU are conditional on existent structures, which may fade once the unification process is complete.

V CONCLUSIONS

This study examines the European economies from an optimum currency areas perspective using the structural VAR methodology. Identifying the shocks as supply, real fiscal, and nominal shocks, it

focuses on the bilateral correlations of the shocks for 20 European market economies, including Turkey and Cyprus.

The results suggest that the shocks are mostly country-specific, and countries seem to have experienced a different incidence of these shocks. Despite the efforts towards macroeconomic policy coordination, real fiscal and nominal shock correlations seem to be quite low. If one overlooks the asymmetry of nominal and fiscal shocks (since these may disappear with the formation of common institutions in the union), the supply shocks indicate that adopting a single currency for the entire EU may entail some adjustment costs. Moreover, the data do not seem to support the existence of large groups of countries with mutually correlated supply shocks. Although the analysis reveals significant correlations of supply shocks among traditional members of the EU, except for Switzerland, newer members and non-members seem to share little common supply shocks with traditional members of the EU. Thus, the extent of differential real shocks suggests that alternative adjustment mechanisms such as wage flexibility, labor mobility, and redistributive policies will be more important for the EU after the introduction of a single currency.

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