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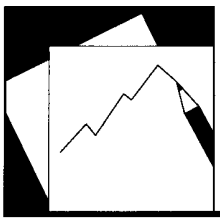

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France in the Global Economy: A Structural Approximate Dynamic Factor Model Analysis

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France in the Global Economy: A Structural Approximate Dynamic Factor Model Analysis

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Abstract

This study identifies the main shocks that cause fluctuations in French output and their channels of transmission. It uses a large-dimensional structural approximate dynamic factor model. There are three main findings. First, common shocks, especially demand shocks, which seem to originate from the U.S., play an important role in explaining French economic activity. While international trade, relative prices, and FDI flows are the main channels of transmission, the stock market, consumer confidence, and interest rates also matter. Second, France's integration with the rest of the world has increased over time. Third, there is some tentative evidence of regional components in explaining French output fluctuations; country-specific components also contribute. The predominance of exogenous factors affecting French output, the asymmetry in the transmission of shocks, and France's participation in a currency area, argue for making French goods, services, and labor markets as flexible as possible.

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I. INTRODUCTION

Global developments affect the French economy significantly. Standard sources of fluctuations in economic activity include economic developments in trading partners, monetary and exchange rate developments, oil price changes, domestic fiscal policy, ongoing structural reforms, and productivity shocks. Observers of the French economy note that a significant part of fluctuations in French economic activity can be attributed to external sources, though the channels of transmission sometimes defy standard models. For example, French and German consumer confidence indices and French and U.S. business confidence indices exhibit a significant comovement; similarly, there is a strong comovement between the national index of stock prices and the performance of the U.S. economy. Moreover, the role of foreign direct investment (FDI) flows seems sometimes downplayed in empirical work as a relevant additional avenue linking French activity with U.S. activity.

New statistical techniques allow a more reliable extrication of global factors and the identification of the channels via which they interact with the French economy. With recent advances in statistical technology, it has become possible to better assess the sources of comovement of economic activity across countries and the channels of transmission of country- or region-specific shocks. The main reason is that the new models allow the conditions to recover structural shocks to be satisfied more easily, in contrast to the often used small-size structural VARs, where such conditions were unlikely to be met (Hansen and Sargent, 1991; and Fernández-Villaverde and others, 2005). Large dynamic factor models permit the exploitation of the wealth of information included in large panels (Forni, Hallin, Lippi, and Reichlin, 2000; and Kose, Otrok, and Whiteman, 2003; Kapetanios and Marcellino, 2006) and a look inside the "black box" of factor models (Forni, Giannone, Lippi, and Reichlin, 2005; and Eickmeier, 2006). Accordingly, these factors can be related to economically meaningful shocks, and the type of large information sets that economic agents have access to can be taken fully into account. In this vein, two main novel approaches have recently been used: Eickmeier (2005) analyzed the transmission of business cycles from the United States to Germany; and Forni, Giannone, Lippi, and Reichlin (2005) revisited the VAR results of King, Plosser, Stock, and Watson (1991) to identify U.S. shocks on output, consumption and investment.

This paper continues empirical work using factor models and expands it so as to identify the structural shocks that drive French business cycles. Building on previous work using factor models to explain French economic activity and prices (e.g., Nadal De Simone, 2002 and 2005; and Kabundi, 2004), this paper follows Eickmeier's (2005) framework and uses a sign-restriction strategy to identify the main shocks that affect the French economy and the channels through which it interacts with the global economy. This paper fits in three strands of the literature: first, it relates to the study of the cyclical comovement of activity among countries (e.g., IMF, 2001; and Montfort, Rennee, Rüffer, and Vitale, 2004); second, it is part of studies that explore the channels of transmission of economic shocks across countries (e.g., Kose, Prasad, and Terrones, 2003; and Imbs, 2004); and third, it contributes to the structural VAR literature (Lumsdaine and Prasad, 2003; and Eickmeier and Breitung, 2005) as the structural shocks are identified using that approach.

This study contains three main findings. First, U.S. shocks, especially demand shocks, seem to play an important role in explaining French economic activity, as reflected in the share of the forecast error variance of French variables they account for. Trade in goods and services, relative prices, and FDI flows are the main channels of transmission for all shocks. The stock market and consumer confidence channels seem relatively more relevant for the transmission of U.S. supply shocks, while interest rates seem instead relatively more important for the transmission of demand shocks. Second, indicating France's increasing regional and global economic integration, the share of French GDP fluctuations explained by the common components has risen over time—a phenomenon also found in Germany. U.S. and G7 (excluding France) economic activity affect French output relatively more via demand shocks while euro area (excluding France) activity affects French output relatively more via supply shocks. Finally, there is some tentative evidence of a possibly small role for regional components, independent of the global common components, in explaining fluctuations in French economic activity. Idiosyncratic components also contribute to the explanation of French output fluctuations. Given the importance of exogenous factors for French economic activity and the fact that France is part of a currency area, French goods, services, and labor markets should be made as flexible as possible. This will reduce income volatility and increase welfare.

The remainder of the paper is organized as follows: Section II discusses the model and the economic conditions for the identification of structural shocks. Section III explains the data, data transformation procedures, and the estimation technique. Section IV discusses the econometric results on the source of the shocks and the channels of transmission. The last section concludes and discusses the policy implications of the paper.

II. METHODOLOGY

The methodology used in this paper comprises two main steps. First, estimating the common components of a large panel of data, and second, identifying a reduced number of structural shocks that explain the common components of the variables of interest. In a streamlined way, the estimation procedure requires the following:

- Use of a large panel of data fulfilling the condition that the number of time series is "much larger" than the number of observations (in a sense to be made clear below).
- Decompose each time series into two unobserved parts: its common component, driven by shocks common to all series, and its idiosyncratic component.
- Write the series' common components as a VAR of low order (often of order one) to represent the reduced form of the model.
- Estimate the VAR to obtain the coefficients matrix and the *reduced-form residuals*.
- Orthogonalize those residuals and obtain the impulse-response functions and forecast error variances.
- Assume that the orthogonalized residuals are linearly correlated to a vector of "fundamentals" driving the variable of interest via a matrix such that the first shock explains as much as possible of the forecast error variance of the common components; the second one explains as much as possible of the remaining variance, and so on.
- Concentrate on the first few *principal component shocks* (neglect others), e.g., the first two principal component shocks.

- Compute the impulse-response functions and the variance decomposition of the few principal component shocks.
- Recover the *structural shocks* that explain the principal component shocks by rotating a matrix such that orthogonal structural shocks produce impulse-responses satisfying a set of economically meaningful (sign) restrictions.
- Construct confidence intervals for the impulse-responses using bootstrapping so as to account for biases in the VAR coefficients and the agnostic nature of the model.

The estimation procedure is explained in detail below. The reader not interested in technical details can skip the remainder of this section.

A. The Model

This paper uses a large dimensional approximate dynamic factor model. As in Eickmeier (2005), this paper uses the static factor model of Stock and Watson (1998 and 2002). This model is closely related to the traditional factor models of Sargent and Sims (1977) and Geweke (1977), except that it admits the possibility of serial correlation and weakly cross-sectional correlation of idiosyncratic components, as in Chamberlain (1983) and Chamberlain and Rothschild (1983). Similar models have recently been used by Giannone, Reichlin, and Sala (2002); Forni and others (2005); and Eickmeier (2005).

The intuition behind the approximate dynamic factor model analysis is simple. A vector of time series $Y_t = (y_{1t}, y_{2t}, ..., y_{Nt})'$ can be represented as the sum of two latent components, a common component $X_t = (x_{1t}, x_{2t}, ..., x_{Nt})'$ and an idiosyncratic component $\Xi_t = (\varepsilon_{1t}, \varepsilon_{2t}, ..., \varepsilon_{Nt})'$

$$\begin{aligned} Y_t &= X_t + \Xi_t \\ Y_t &= CF_t + \Xi_t \end{aligned} \tag{1}$$

where $F_t = (f_{1t}, f_{2t}, ..., f_{rt})'$ is a vector of r common factors, and $C = (c_1', c_2', ..., c_N')'$ is a $N \times r$ matrix of factor loadings, with $r << N$. The common component X_t, which is a linear combination of common factors, is driven by few common shocks, which are the same for all variables. Nevertheless, the effects of common shocks differ from one variable to another due to different factor loadings. In this framework and in contrast to standard common component analysis, the idiosyncratic component is driven by idiosyncratic shocks, which are specific to each variable. The static factor model used here differs from the dynamic factor model in that it treats lagged or dynamic factors F_t as additional static factors. Thus, common factors include both lagged and contemporaneous factors.

The identification of the common components requires that the number of series be much larger than the number of observations. Stock and Watson demonstrate that by using the law of large number (as T, $N \to \infty$), the idiosyncratic component, which is weakly correlated by construction, vanishes; and therefore, the common component can be easily estimated in

a consistent manner by using standard principal component analysis. The first r eigenvalues and eigenvectors are calculated from the variance-covariance matrix $cov(Y_t)$.

$$X_t = VV'Y_t, \tag{2}$$

and since the factor loadings $C = V$, equation (1) becomes,

$$F_t = V'Y_t. \tag{3}$$

From (1), the idiosyncratic component is

$$\Xi_t = Y_t - X_t. \tag{4}$$

From all the more or less formal criteria to determine the number of static factors *r*, Bai and Ng (2002) information criteria was followed. As in Forni and others (2005), F_t was approximated by an autoregressive representation of order 1[3]:

$$F_t = BF_{t-1} + u_t, \tag{5}$$

where B is a $r \times r$ matrix and u_t a $r \times t$ vector of residuals. Equation (5) is the reduced form model of (1).

B. Economic Conditions for Shocks Identification

Once a decision is taken on the process followed by the common components, structural shocks have to be identified. The identification of structural shocks is achieved by focusing on the reduced form VAR residuals of (5). Following Eickmeier (2005), the identification scheme has three steps.

First, maximize the variance of the forecast error of the chosen variable and calculate impulse-response functions. As in Uhlig (2003), rather than identifying a shock as, say, a productivity shock, and calculate its contribution to the variance of the *k*-step ahead prediction error of, say, U.S. GDP, a few major shocks driving GDP are identified.[4] This implies maximizing the explanation of the chosen variance of the *k*-step ahead forecast error of GDP with a reduced number of shocks.[5] To this end, k-ahead prediction errors u_t are

[3] VAR(1) provides a dynamic representation which is parsimonious and quite general (for more details, see Gianonne, 2005). The residuals u_t were white noise and thus an autoregressive process of order 1 was chosen.

[4] Uhlig (2003) shows that two shocks are sufficient to explain 90 percent of the variance at all horizons of real U.S. GNP.

[5] If, for example, two orthogonal shocks are identified, it is incorrect to identify the first shock as the one corresponding to the first eigenvalue and the second orthogonal shock as the one corresponding to the second eigenvalue (see Uhlig, 2003). The two orthogonal shocks identified generate *together* the total variation which explanation is being maximized. However, there are multiple possible combinations of those orthogonal shocks all of which will still explain the total variation chosen: as an illustration, and measuring angles in degrees, the

(continued…)

decomposed into k mutually orthogonal innovations using the Cholesky decomposition. The lower triangular Cholesky matrix A is such that $u_t = Av_t$ and $E(v_t v_t') = I$. Hence,

$$\text{cov}(u_t) = AE(v_t v_t')A' = AA'. \tag{6}$$

The impulse-response function of y_{it} to the identified shock in period k is obtained as follows:

$$R_{ik} = c_i B^k A, \tag{7}$$

with c_i the *ith* row of factor loadings of C and with a corresponding variance-covariance matrix $\sum_{j=0}^{k} R_{ij} R_{ij}'$.

Second, the identified shocks are assumed to be linearly correlated to a vector of fundamentals. The fundamental forces $\omega_t = (\omega_{1t}, \omega_{2t}, ..., \omega_{rt})'$ behind U.S. GDP are correlated to the identified shocks through the $r \times r$ matrix Q. Thus,

$$v_t = Q\omega_t. \tag{8}$$

The intuition of the procedure is to select Q in such a way that the first shock explains as much as possible of the forecast error variance of the U.S. GDP *common component* over a certain horizon k, and the second shock explains as much as possible of the remaining forecast error variance. Focusing on the first shock, the task is to explain as much as possible of its error variance

$$\sigma^2(k) = \sum_{j=0}^{k} (R_{ij} q_1)(R_{ij} q_1)', \tag{9}$$

where i is, in our example, the U.S. GDP, and q_1 is the first column of Q. The column q_1 is selected in such a way that $q_1' \sigma^2 q_1$ is maximized, that is

$$\begin{aligned} \sigma^2(k) &= \sum_{j=0}^{k} (R_{ij} q_1)(R_{ij} q_1)' \\ &= q_1' S_{ik} q_1 \end{aligned}$$

where $S_{ik} = \sum_{j=0}^{k} (k+1-j) R_{ij}' R_{ij}$.

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pairings of orthogonal shocks with rotation angles {0,90} or {10,100} or {80,170} would be equally acceptable. The grid of the angle of rotation can be different, of course. So the number of possibilities is vast. This paper uses a grid of 30 degrees.

The maximization problem subject to the side constraint $q_1'q_1 = 1$, can be written as the Lagrangean,

$$L = q_1' S_{ik} q_1 - \lambda(q_1' q_1 - 1) \ , \tag{10}$$

where λ is the Lagrangean multiplier. From (10), q_1 is the first eigenvector of S_{ik} with eigenvalue λ and, therefore, the shock associated with q_1 is the first principal component shock. Q is the matrix of eigenvectors of S, ($q_1, q_2, \ldots, q_r$), where q_l ($l=1,...,r$) is the eigenvector corresponding to the l^{th} principal component shock. Along the lines of Uhlig (2003), Eickmeier (2005), and Altig and others (2002), it is posed: $k=0$ to $k=19$, i.e., five years, which covers short- as well as medium-run dynamics.

Finally, orthogonal shocks are identified by rotation. If two shocks are identified, following Canova and de Nicoló (2003), the orthogonal shocks vector $\omega_t = (\omega_{1t}, \omega_{2t})'$ is multiplied by a 2×2 orthogonal rotation matrix P of the form:

$$P = \begin{pmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{pmatrix},$$

where θ is the rotation angle; $\theta \in (0, \pi)$, produces all possible rotations and varies on a grid. If θ is fixed, and $q=5$, there are $q(q-1)/2$ bivariate rotations of different elements of the VAR. Following the insights of Sims (1998), and as in Peersman (2005); Canova and de Nicoló (2003); and Eickmeier (2005); the number of angles between 0 and π is assumed to be 12: this implies 6,191,736,421x10^{10} (12^{10}) rotations. Hence, the rotated factor $w_t = Pw_t$ explains in total all the variation measured by the first two eigenvalues. This way, the two principal components ω_i are associated to the two structural shocks w_i through the matrix P, and the impulse-response functions of the two structural shocks on all the fundamental forces can be estimated.

A sign-identification strategy is followed to identify the shocks. The method was developed by Peersman (2005). This strategy imposes inequality sign restrictions on the impulse response functions of variables based on a typical aggregate demand and aggregate supply framework.[6] Only those rotations among all possible $q \times q$ rotations that have a structural meaning are chosen. The text table displays the sign restrictions for the identification of shocks that are imposed contemporaneously and during the first year after the shock.[7]

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[6] See Peersman (2005), for more technical details.

[7] Notice that inequalities include zero responses, some of which are usually excluded in the VAR literature. As shown by Peersman (2005), this may sometimes be unduly restrictive. Peersman shows, for example, that oil prices do react within one quarter to demand and monetary policy shocks. In contrast, imposing the standard contemporaneous zero restriction on oil prices make them appear as exogenous rather than as endogenous responses of an asset price to demand disturbances and monetary policy shocks.

Identification Inequalities

	Positive Supply Shock	Positive Demand Shock	Monetary Policy Tightening
GDP	≥ 0	≥ 0	≤ 0
Prices	≤ 0	≥ 0	≤ 0
Interest rates	≤ 0	≥ 0	≥ 0

As in major standard macroeconomic models, a positive supply shock has a nonnegative effect on output and a nonpositive effect on prices during the first four quarters following the shock.[8] A positive demand shock has a nonnegative effect on both output and prices during the first four quarters following the shock. A monetary policy tightening has a nonpositive effect on both output and prices during the first four quarters following the shock.

III. Data and Estimation

A. Data Discussion

This paper uses a large data panel. The data panel comprises 482 quarterly series ($N = 482$) covering the period 1980:Q1–2003:Q4. This implies 96 observations ($T = 96$). The countries included in the sample are France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States. In addition to national variables, a set of global variables are included, such as a crude oil prices and a commodity industrial inputs price index. The variables cover the real sector of the economy including consumption, investment, international trade in goods and services, portfolio flows and FDI flows, prices, financial variables, and confidence indicators.

For comparison purposes, a shorter time period is also estimated. A data panel for a shorter time period but including the same macroeconomic time series plus a G7 (excluding France) and a euro area (excluding France) real GDP series, and two corresponding price series, is also used ($N = 486$). This data set covers the period 1991:Q1-2003:Q4, or 51 observations ($T = 51$). The complete list of variables used in this study is in Appendix I.

Variables were transformed, if necessary, to make them covariance stationary. All the variables are seasonally adjusted. The unit root test developed by Elliot, Rothenberg, and Stock (1996); was applied to all series to decide on the statistical transformation necessary to make them stationary, if needed. The unit root tests included a constant and a deterministic trend. The number of lags was chosen using the Schwarz information criterion and taking care that no serial correlation was left in the residuals. In a few cases, unit root test results were unclear. In those cases, a unit root test with the null hypothesis of stationarity proposed by Kwiatowski, Phillips, Schmidt, and Shin (1992); was used. The statistical treatment of the

[8] Clearly, a set of restrictions based on neoclassical model features would produce different results.

series is summarized in Appendix I. All series were standardized to have zero mean and unit variance.

B. Estimation

The first step of the estimation is the determination of the number of factors. The estimation was done assuming that the series follow an *approximate* dynamic factor model.[9] As discussed in Section II, the first step is to decide on the number of static factors r making up the common component. Using Bai's and Ng's (2002) selection criteria, five factors were retained. Not much can be concluded from the inspection of the factors and their loadings, however, because factors are identified only up to a rotation. Moreover, factors can be a linear combination not only of their contemporaneous values, but also of their lags.

Next, the identification of the structural shocks followed the approach of the structural VAR literature. No identification technology is completely foolproof, however. While the identification technology followed in this paper is flexible enough not to require special restrictions to disentangle *common shocks* from the *contemporaneous transmission of regional or country-specific shocks*, it does require additional work, for example, to confirm the source of shocks (e.g., that the shocks originate in the U.S. economy). In order to properly distinguish a global (common) shock from the transmission within the same period of a country- or regional-specific shock, following Eickmeier (2005), this paper does not restrict the impact effect of the shock. Moreover, after identifying two U.S. shocks and giving them an economic interpretation, this study performs the same analysis on a data set containing *only* U.S. variables. It finds that the impulse-responses of the U.S.-only data set and the broader data set are similar, bringing thus further comfort as to the identification of the source of the shocks. In addition, to test the relative importance of U.S. shocks as sources of disturbances that impact on French activity, the same identification restrictions are imposed on a G7 aggregate of economic activity (excluding France). Finally, the same approach is applied to a euro area aggregate of economic activity (excluding France) to probe the data for what could be a source of "regional" shocks.

Only two structural shocks could be identified. As explained in Section B, the identification procedure proposed by Uhlig (2003) was applied to the common components of U.S. GDP to find a reduced number of structural shocks that maximizes the explanation of its forecast error variance over 20 periods. The procedure was designed to identify three shocks, but could extract two shocks, which suffice to explain 98 percent of the forecast error variance of the common component of U.S. real GDP.

Sign restrictions on impulse response functions were used to provide economic meaning to the structural shocks. Following Peersman (2005), the angle rotations were applied to the first two principal component shocks taking as pairs a supply shock together with a monetary policy shock, a demand shock together with a monetary policy shock, and a supply and a demand shock together. The bootstrap was made up of 500 draws. In the case of the

[9] We are deeply grateful to Sandra Eickmeier for having provided us with the main code for the estimation and for her technical support and insights.

U.S. shocks, only the pair of demand and supply shocks could be identified; no pair containing a monetary policy shock could be identified.[10] The same results obtained when identifying G7 and euro area shocks.[11] The impulse-response functions are calculated for the first five years to display the cyclical pattern associated with the structural shocks. Both the median response and a 90 percent bootstrapped confidence band are estimated.

IV. Econometric Results

A. U.S. Shocks

In the tradition of the structural VAR literature, results are presented in the form of variance decomposition and impulse-response functions. Table 1 shows the variance shares of the common components of the data set, and the forecast error variance of the common components (henceforth, error variance) of U.S. and French variables explained by the two identified U.S. shocks.[12] For comparison purposes, Table 2 displays the error variance of German variables explained by the U.S. shocks. Figure 1 shows the impulse-response functions of the U.S. shocks and their impact on U.S. and French variables.

The supply and demand shocks account for 98 percent of the error variance of U.S. GDP common components. When the full sample period, i.e., $N = 482$ series and $T = 95$ observations is used, the supply and demand shocks from the United States account for 87 percent and 11 percent of the error variance of U.S. GDP over 20 quarters, respectively. The variance share of U.S. GDP common components is 54 percent.[13]

The U.S. supply shocks are relatively more important than demand shocks. The relatively larger importance of supply shocks is consistent with the literature on real business cycles that stresses these shocks (i.e., productivity-driven shocks) as the most significant source of U.S. business cycles. Consistently, supply shocks are far more persistent than demand shocks. The results are broadly in agreement with those of Eickmeier (2005).[14] Positive

[10] Before one can draw the conclusion that monetary policy contributes little to business cycle fluctuations, it would be advisable to work with a more elaborate sign restriction for monetary policy. This is clearly beyond the scope of this paper.

[11] The identification of the U.S. shocks required 524 draws, while 639 and 502 draws were necessary for the identification of the G7 and the euro area economic activity shocks, respectively.

[12] Technically, the variance shares of the common components are independent of the shocks identified.

[13] From a purely technical viewpoint, it is not correct to weigh the forecast error variance of a given variable by the variance share of its common components; the variance share of the common components is calculated for the *first difference* of the variable, whereas the forecast error variance refers to the *levels* of the variable (and specific forecast horizons). Similarly, the stochastic nature of the results should be kept in mind when relating the variance share of the common components to accounting identities based on data that comprises both the common and the idiosyncratic components.

[14] The impulse-response functions of short- and long-term interest rates are particularly sensitive to the procedure applied to make the series stationary; this is a problem likely related to the difficulty encountered by unit root tests in providing conclusive evidence on the order of integration of those same variables. Results

(continued…)

demand shocks result in increased investment and consumption, with the rise in the latter relatively less persistent (Figure 1). Following a mild initial increase, productivity declines after a few quarters as the strong effect of the shock on employment is relatively protracted. Given that the measure of capacity utilization used includes new hiring, and that investment, consumption and government net savings increase, demand shocks may be capturing investment-driven cycles (less likely, consumption-driven ones). In the same vein, interest rates rise, especially short-term interest rates, as monetary policy may be trying to offset the effects of the economic expansion on prices as reflected in the CPI. Consistently, the money stock (M1) falls. Finally, and in contrast to supply shocks, demand shocks have virtually no effects on stock prices after 6–8 quarters.

Indirect and direct evidence supports the U.S. origin of the shocks. First, it is noteworthy that the identification strategy followed in this study, by construction, extracts supply and demand shocks that maximize the explained forecast error variance of the common components of U.S. real GDP. Second, indirect and direct evidence suggesting that the source of the identified shocks is the United States is the following. Indirect evidence comes from a dataset containing only U.S. variables. The resulting impulse-response functions were similar to those of the full sample (not shown). Further indirect evidence results from the relatively low values of the common components share of some global variables (i.e., crude oil prices, 26 percent, commodity metal prices, 19 percent, and a commodity industrial input index, 33 percent); it seems unlikely that the identified shocks are global (common) as opposed to U.S.-specific.[15] Finally, indirect support for the result that the shocks originate in the United States can be gathered, as discussed below, from the observation that most effects of the U.S. shocks on French variables error variance are significantly smaller than on U.S. variables; given the relatively lower size and larger openness of the French economy, those features of the results are more consistent with a U.S. source than with a global source of the shocks. The direct evidence on the U.S. source of the shocks comes from the estimation of the cross-spectrum of the common components of U.S. and France's GDP (Figure 2, left side panels). The phase angle is clearly positive in periodicities between 2 and 8 years, the business cycle band, indicating that U.S. GDP common components lead French GDP common components at that frequency band.[16]

B. Channels of Transmission of U.S. Shocks to France

Broadly speaking, U.S. supply shocks are transmitted to France less forcefully than U.S. demand shocks, and transmission channels go beyond the traditional trade channel. U.S. demand shocks explain over ⅓ of the error variance of French GDP common components while U.S. supply shocks explain less than ¼. The variance shares of French variables suggest that foreign trade and relative prices—i.e., especially terms of trade, and much less so the real exchange rate—matter for the transmission of both U.S. shocks.

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displayed in the paper use differenced interest rate series. The short-term interest rate behavior is difficult to explain as it falls only marginally following the shock and during a very short period of time.

[15] Crude oil prices are a simple average of dated Brent, West Texas Intermediate and Dubai Fateh oil prices.

[16] Anticipating results, French GDP is led *exclusively* by U.S. GDP in periodicities between two and four years.

However, while U.S. supply shocks explain 3 percent and 12 percent of the error variance of French exports and imports, respectively, demand shocks explain about 90 percent and 45 percent, respectively. In addition, confidence indicators and interest rates variance shares are relatively high. Consumer confidence matters most for the transmission of U.S. supply shocks, while long-term interest rates matter most for the transmission of U.S. demand shocks. It is noteworthy that U.S. demand shocks explain over 80 percent of the error variance of French long-term interest rates, which supports the strong business cycles links between France and the U.S. found in earlier empirical work (Kose and others, 2003; Nadal De Simone, 2003).[17] Finally, while admittedly the variance share of the common components of stock prices is relatively low, their error variance following U.S. supply shocks is very large.

U.S. supply shocks seem to be transmitted negatively on French output. While French output seems negatively affected by U.S. supply shocks, with a median error variance of 23 percent over first five years, the outcome for that period is in fact statistically insignificant.[18] The large variance share of the current account highlights the role of the trade channel. The current account moves into surplus as, although exports of goods and services fall in the short run, exports increase over time relatively more than imports. The terms of trade improve somewhat, and the real effective exchange rate appreciates marginally, given that the U.S. CPI falls more than the French CPI. While there is no lasting significant change in the real effective exchange, the transient fall in competitiveness magnifies the transmission of U.S. supply shocks. In addition, notice the negative effect on consumption and consumer confidence, consistent with the decline in employment and wages. Stock prices are affected positively and in lasting manner, which mimics their U.S. pattern. The downward impact effect on interest rates (especially short-term interest rates), possibly as a result of an accommodating action on the part of Euro area monetary policy makers, is relatively short-lived. Outward FDI flows are relatively more important than inward FDI flows for the transmission of supply shocks. Given that outward FDI flows decrease and that inward FDI flows increase, the (moderate) negative transmission of U.S. supply shocks to France may be a case of inter-industrial specialization driving trade patterns.[19]

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[17] These results are consistent with IMF (2001) and other studies (e.g., Anderton, di Mauro and Moneta, 2004),which stress the role of financial variables and confidence channels in the transmission of macroeconomic disturbances across countries. While in the words of Keynes, "The state of confidence...is a matter to which practical men always pay the closest and most anxious attention," economist have mostly avoided the issue. The profession has accepted that mood swings are difficult to explain. This paper uses generally accepted measures of confidence as "channels" through which views of the world unfold and affect, for instance, business investment decisions by mechanisms not yet fully identified.

[18] This outcome is consistent with Eickmeier's (2004) results on the effects of the U.S. supply shock on German GDP; she finds a positive effect, which is nevertheless not statistically significant. The sign of output shocks transmission is controversial in the empirical literature: those who stress traditional trade channels of transmission posit that a supply shock, by boosting trading partners exports, is transmitted positively (e.g., Kose, Prasad, and Terrones, 2003). In contrast, those who stress inter-industrial specialization and FDI flows hypothesize a negative transmission (e.g., Imbs, 2004).

[19] The variance share of these variables common components is low. Eickmeier (2004) reports similar results (for Germany).

U.S. demand shocks get transmitted positively to France. Over the sample period, U.S. demand shocks of about 1 percent of GDP (over 20 quarters) have a significant positive impact on France's real GDP of about 0.5 percent. Exports of goods an services rise more than imports of goods an services in the first 4–6 quarters producing initially a small current account surplus, which turns into a deficit as imports remain high while the impulse on export fades. The terms of trade worsen, most likely due to the effect of the positive U.S. shock on global price variables such as oil and metal prices. The real effective exchange rate depreciates somewhat, especially during the first year, magnifying thereby the U.S. demand shocks' effects on activity (the counterpart of the U.S. real exchange rate appreciation). There is a lasting, albeit small, positive effect on both consumer and business confidence. Consumption and investment rise in response. Demand drives up French productivity, with benign effects on the price level. Both short- and long-term interest rates increase, most likely as a result of Euro area monetary policy trying to avoid that employment and wage growth translate into inflationary pressures. Stock prices matter relatively little. Finally, in contrast to supply shocks, outward FDI flows are relatively less important than outward FDI flows. In addition, and also in contrast to the effects of U.S. supply shocks, FDI inflows decline, which is difficult to rationalize.

U.S. shocks affect EU member countries asymmetrically.[20] A comparison of the variance shares and error variances of French and German variables reveals a few noteworthy points, several of them important to judge the relative flexibility of the two countries' product and labor markets. First, the variance share of the common components of German GDP is 78 percent against 43 percent in the case of France, a likely outcome of the relatively larger openness of the German economy. However, U.S. shocks affect French output more than German output: U.S. supply and demand shocks affect German GDP less than 1 percent and about 7 percent, respectively, against 23 percent and 34 percent, respectively, in the French case. Second, France responds relatively less to U.S. supply shocks than Germany, at least judging from the relatively lower error variance of prices, employment and productivity, and the real exchange rate. France's response to U.S. demand shocks is, in contrast, more pronounced than Germany's. This is illustrated by the relatively high error variance of wages and employment as well as the real exchange rate.[21] Third, while the consumer confidence channel seems to matter much more for the transmission of U.S. supply shocks to France than to Germany, stock prices matter more for the transmission of U.S. demand shocks to Germany. Finally, the variance share and the error variance of FDI inflows suggest that they

[20] The presence of asymmetries in business cycle behavior across countries is well known (e.g., Nadal De Simone, 2007, forthcoming).

[21] On the one hand, it is not immediately clear why the response of the French economy to U.S. supply and demand shocks differ. A possible reason may be the relatively more important role played by the real sector in the transmission of demand shocks, and the shorter duration of the required changes in the production structure than ensues. Those short-term adjustments to production can be undertaken without changes in capacity and long-term employment. On the other hand, in the literature on optimum currency areas, price and wage flexibility was one key mechanism by which the costs of losing the monetary policy tool by joining a currency area could be diminished. The shock often assumed in that strand of literature was a supply-side shock, i.e., a change in preferences or technology. On this vein, this paper results seem to suggest that the French economy has less price flexibility than the German economy. This is, however, an issue for further research.

matter relatively more for Germany than for France as channels of transmission of U.S. supply shocks.

C. Is There Evidence of Increasing Interdependence Among Countries?

French interdependence has increased over time. The results of the estimation of the model using the time period 1990:Q1–2003:Q4 show that, as might be expected, France experienced a strengthening of its linkages and interdependence with the rest of the world during the last decade or so. While the total error variance of French GDP explained by U.S. shocks in the full sample period is 57 percent, it increases to 82 percent when the reduced sample period is used (Table 3).[22] That increase basically took place through a significant relative rise in the role of U.S. demand shocks. The relative importance of channels of transmission also changed. Besides the enhanced role of the stock market channel in more recent times, confidence channels (notably business confidence) increased their significance.[23] Consistently, the impact of investment in explaining activity fluctuations in France also rose, albeit in tandem with the increase in the share of common components in the error variance of French GDP. Finally, it also seems that France's capacity to adjust to U.S. supply shocks improved somewhat while its capacity to adjust to U.S. demand shocks became more difficult. Note, in particular, the relatively higher (lower) variance of prices that U.S.-driven supply (demand) shocks explain in the reduced sample period. The error variances of the real effective exchange rate display similar changes. Seemingly, the observed increase in the error variances of wages was not sufficient.

Adjustment to U.S. shocks varies across countries. When France is compared with Germany, a few points merit stressing. First, it is noticeable that the error variance of French price variables is in general lower than German variables following U.S. (especially supply) shocks (e.g., compare the error variances of prices, wages and the real exchange rate on Table 3a for France and on Table 3b for Germany).[24] Consistently, employment does relatively more of the adjustment to U.S. supply shocks in France than in Germany. Second, the adjustment via short-term interest rates following U.S. demand shocks is more significant for Germany than for France. Finally, confidence channels matter for U.S. supply shocks relatively more in France and for U.S. demand shocks relatively more in Germany.

The predominant role played by U.S. shocks is also clear in the shorter sample period. With data available for 1991:Q1–2003:Q4 for broader aggregates of global and regional economic activity, the paramount role of U.S. shocks seems confirmed. When the shock is to G7 economic activity (excluding France), the error variance of French GDP explained increases to 82 percent (25 percentage points more than when shocks are from the United

[22] It also increases in the German case: it rises to about 96 percent from just 7 percent in the full sample. This is most likely the result of the significant output effects of German unification, which may have blurred the underlying forces of economic integration of the German economy into the world.

[23] These results are consistent with IMF (2001) that reports a growing importance of financial variables in the transmission of shocks across countries over time.

[24] Compared to wages behavior in the full sample, French wages variance following U.S. shocks increased somewhat.

States, in the period 1980–2003). These results further stress the large role played by U.S. shocks in international business cycles.

There is limited evidence of relatively minor "regional shocks." When the shock is to the euro area activity measure (excluding France), the error variance of French GDP explained also rises to 64 percent (Table 4). The cross-spectrum of EU and French GDP common components is broadly similar to the one of U.S. and French GDP common components (Figure 2), with one important caveat: only EU GDP common components lead France's common components in the very long run. In addition, the cross-spectrum of U.S. and EU GDP common components shows that the U.S. leads the EU (Figure 3) in periodicities ranging between 7 and 128 quarters. The results suggest there may be some role for "regional factors" in explaining the error variance of French GDP, but that role can be tentatively considered small. This finding is broadly consistent with several studies pointing to a relatively minor role to regional factors (e.g., Kose, Otrok, and Whiteman, 2003; and Nadal De Simone, 2003). Summarizing all cross-spectrum results, the analysis indicates: (1) *only* the U.S. leads France in periodicities ranging between 8 quarters and 15 quarters; (2) the EU and the U.S. *together* lead France in periodicities ranging between 16 and 128 quarters and; (3) the EU and France comove in the very long run.

Asymmetries in business cycle transmission persist during the shorter sample period. U.S. and G7 economic activity affect French output relatively more via demand shocks, while euro area activity affects French output relatively more via supply shocks. This is likely the outcome of the relatively richer vertical and horizontal integration between French and regional firms than between French and G7 firms—other than euro area. As an illustration, the supply shocks from the euro area aggregate explain a significantly larger share of the error variance of exports of goods and services than the G7 shocks or the U.S. shocks (i.e., 66 percent versus 6 percent and 16 percent, respectively). Similarly, the large increase in the error variance of French confidence variables (especially business confidence) when the shock is to euro area activity, further indicates the likely presence of a regional factor which, albeit seemingly small, deserves further analysis.

V. Conclusion and Policy Implications

While certainty about the sources of shocks is not easily achievable, there is strong evidence that French output behavior is significantly affected by U.S. shocks. This study found that U.S. shocks, especially demand shocks, seem to play an important role in explaining the behavior of French economic activity. International trade in goods and services, the terms of trade, the real effective exchange rate, and FDI flows are the main channels of transmission of U.S. demand and supply shocks. Financial variables, such as interest rates, are also important. The stock market and consumer confidence channels seem relatively more relevant for the transmission of U.S. supply shocks, with interest rates instead being relatively more important for the transmission of demand shocks. There still remains a significant role for idiosyncratic components to contribute to the explanation of French output fluctuations, but relatively less than in the German case, especially when the period considered excludes the 1980s. This indicates that French economic policies do matter.

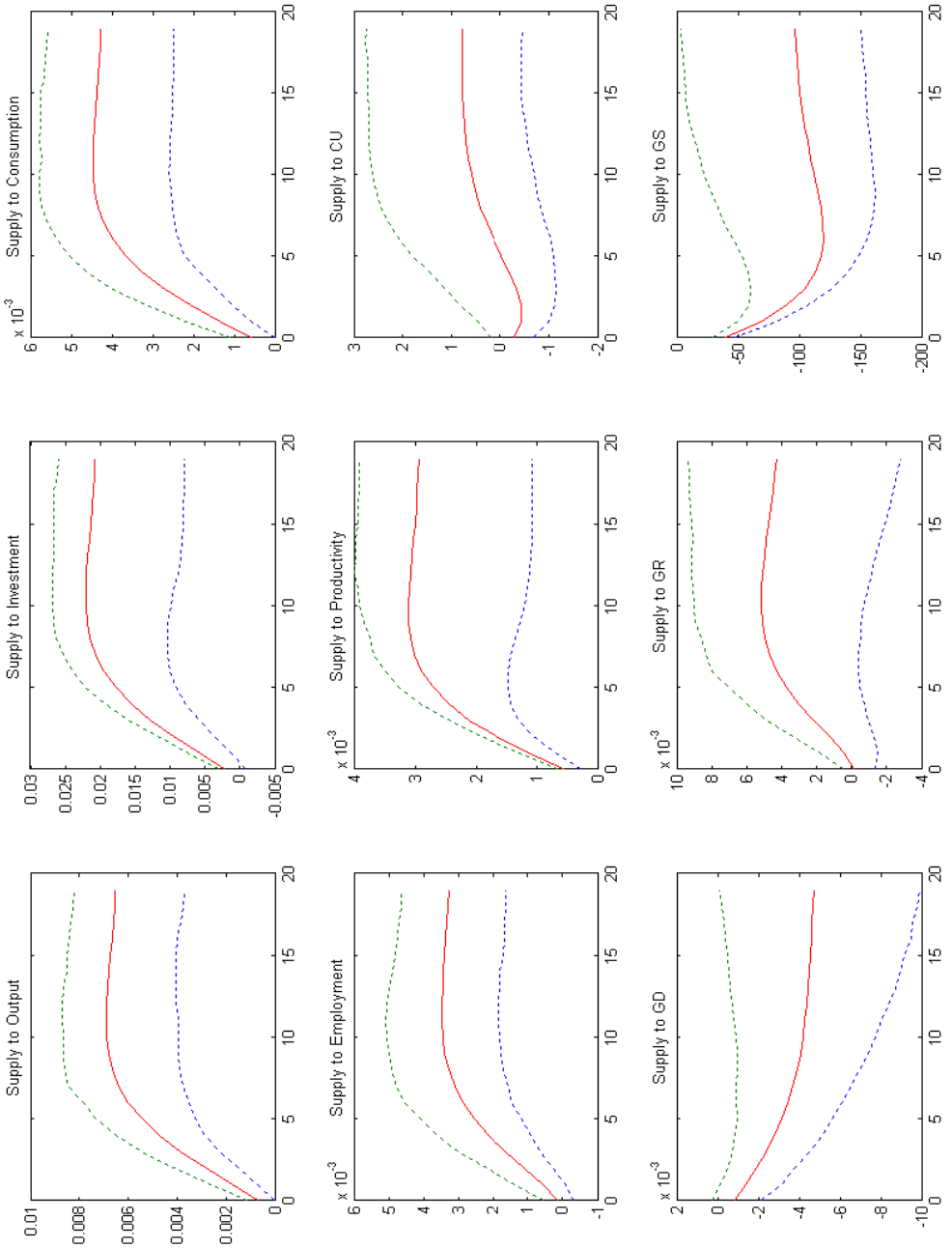
France has become more integrated to the world economy over time. The interdependence of the French economy has increased over time, and the role of financial variables as channels of transmission of shocks has become relatively more important. The increased importance of the business confidence channel is also noteworthy (at least judging from the increase in the variance share of the common components). In addition, and compared to Germany, the French economy reacts (especially) to U.S. supply shocks relying relatively more on employment and real exchange rate changes than on price changes.

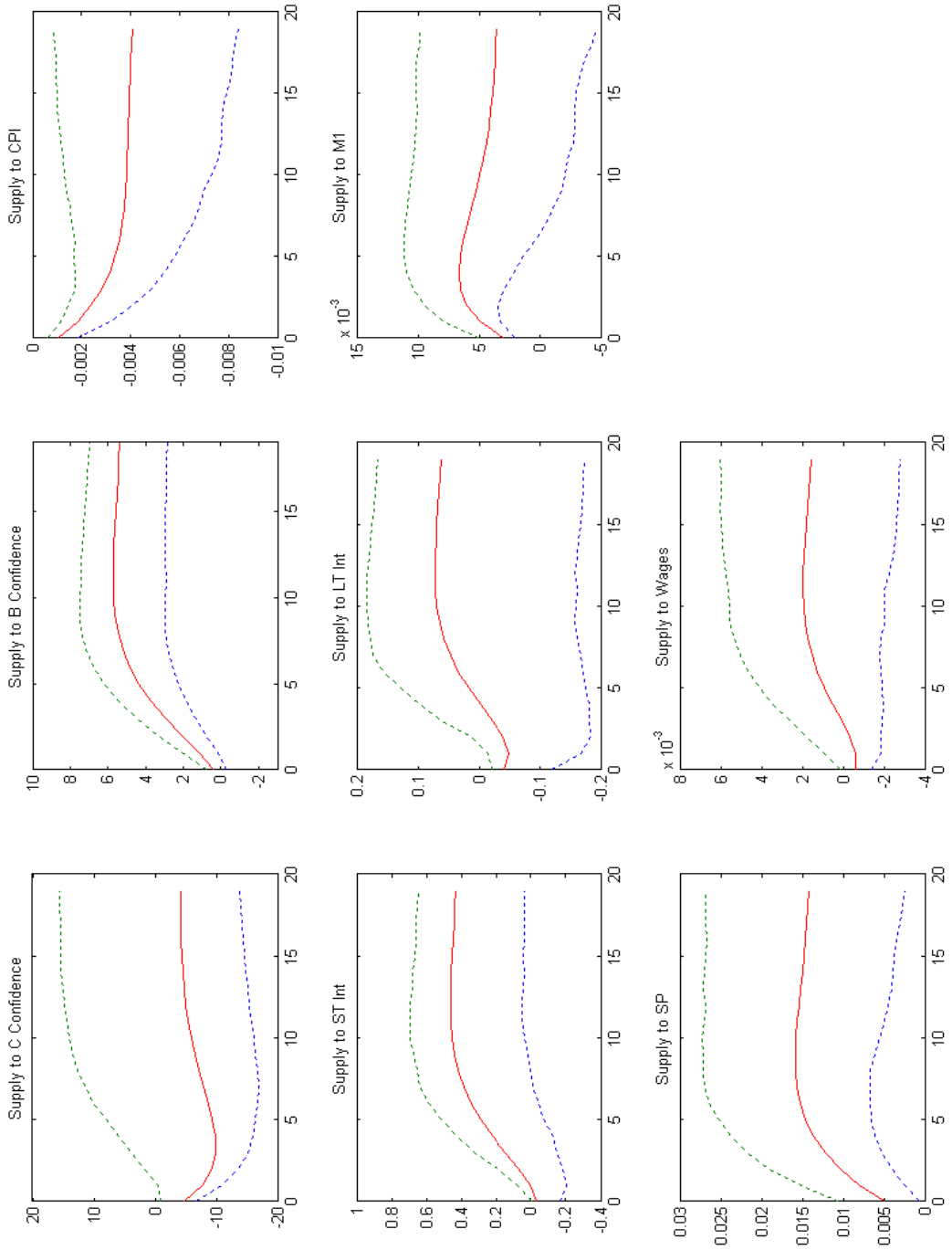
U.S. shocks explain a larger part of French output common components than a broader aggregate of economic activity. While the use of a broader aggregate of economic activity than just U.S. real GDP increases the importance of the common components in explaining French economic activity fluctuations, the bulk of output variance can already be captured by a pair of distinctively U.S. shocks. This seems especially the case for the post-1990 period. The results stress the important role played by fluctuations in U.S. economic activity in explaining French economic fluctuations.

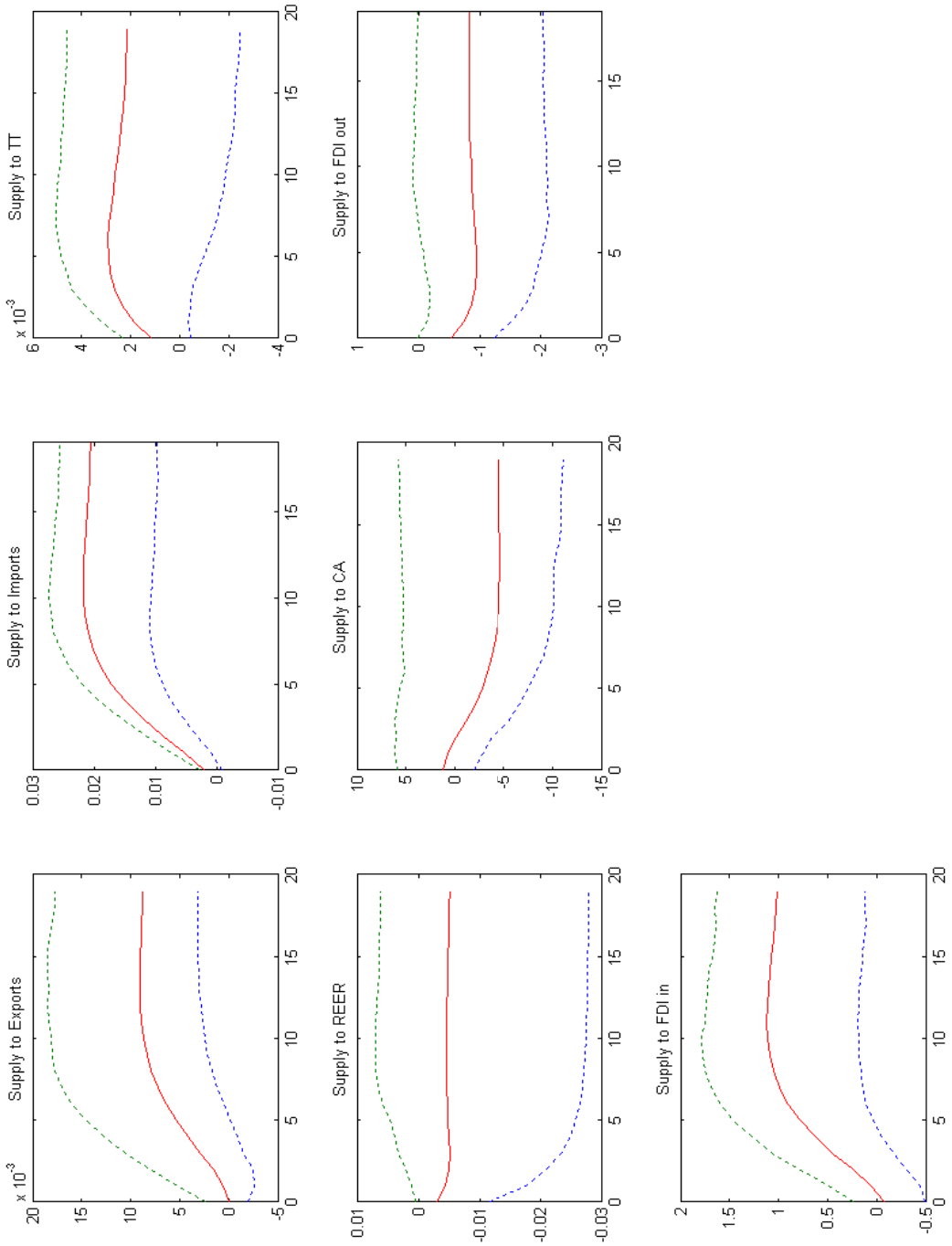
However, given that idiosyncratic components do matter in explaining French output fluctuations, the French economy would benefit from further structural reforms that increase its flexibility. The importance of trade flows and relative price changes in the international transmission of disturbances highlights the relevance of domestic price flexibility. As the results of the paper suggest, following U.S. supply shocks, the speed of adjustment of French prices relative to U.S. prices is lower. This will matter for the magnitude of the real effective exchange rate changes, trade flows, and the size of the current account balance that will be necessary to accommodate the given disturbance. Similarly, following shocks in the United States, it is likely that, ceteris paribus, the level of interest rates consistent with macroeconomic stability in France will be higher the less flexible the economy is; this seems to be the case given the larger variance share of long-term interest rates in France than in Germany. These conclusions are hardly unexpected, but the framework used in this paper has evinced, in a robust way, their policy relevance.

The asymmetry in the transmission of U.S. shocks to EU members further supports calls to increase market's flexibility. The asymmetry in the transmission of shocks across countries—illustrated here by comparing French and German variables' responses to U.S. shocks—together with the predominant role that exogenous factors play in the dynamics of French output, argue for domestic policies geared toward boosting goods, services, and labor markets flexibility in France.

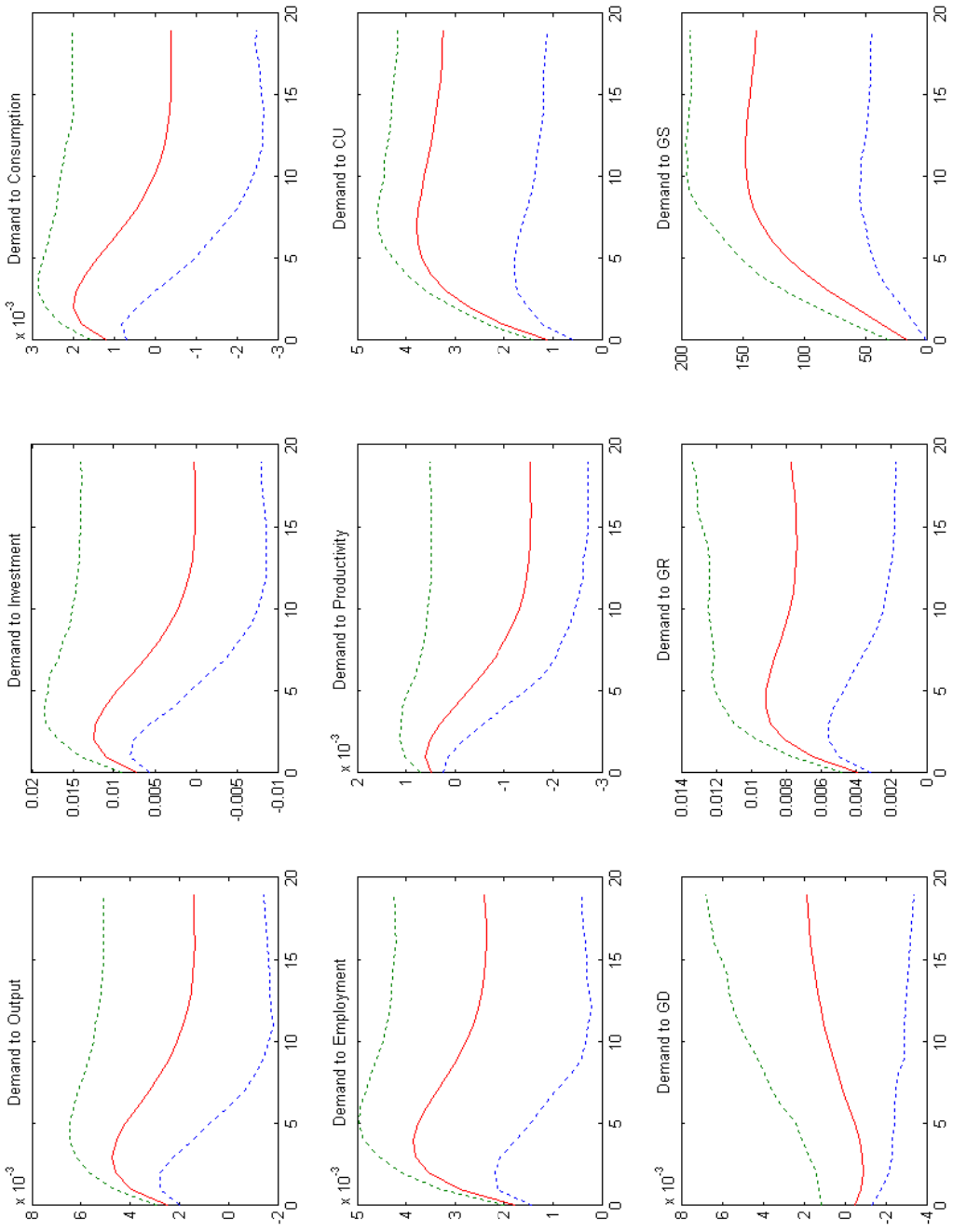
Figure 1. Impulse-Response Functions
Full sample—1980:Q1–2003:Q4 (482 series)
Supply Shock (USA)

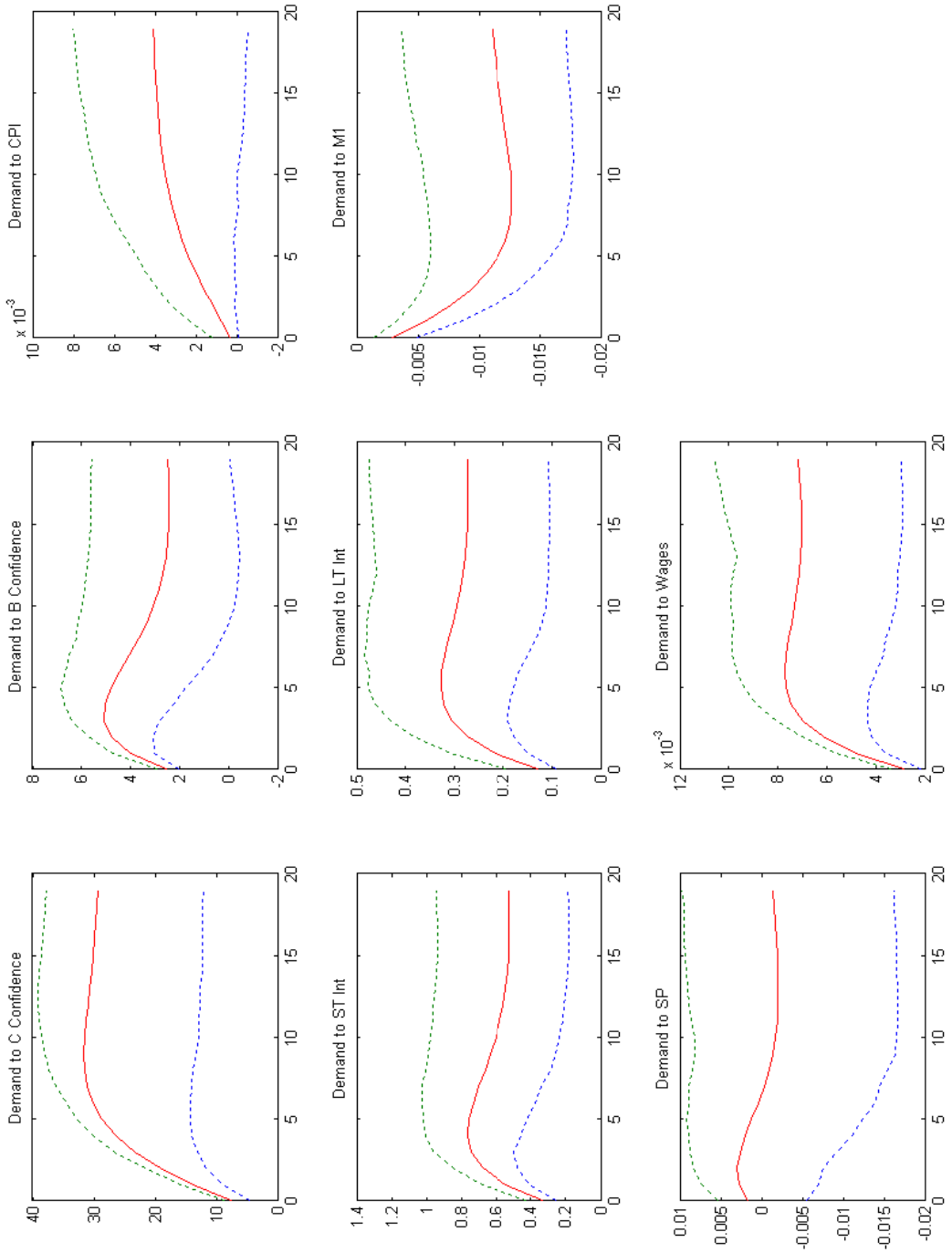


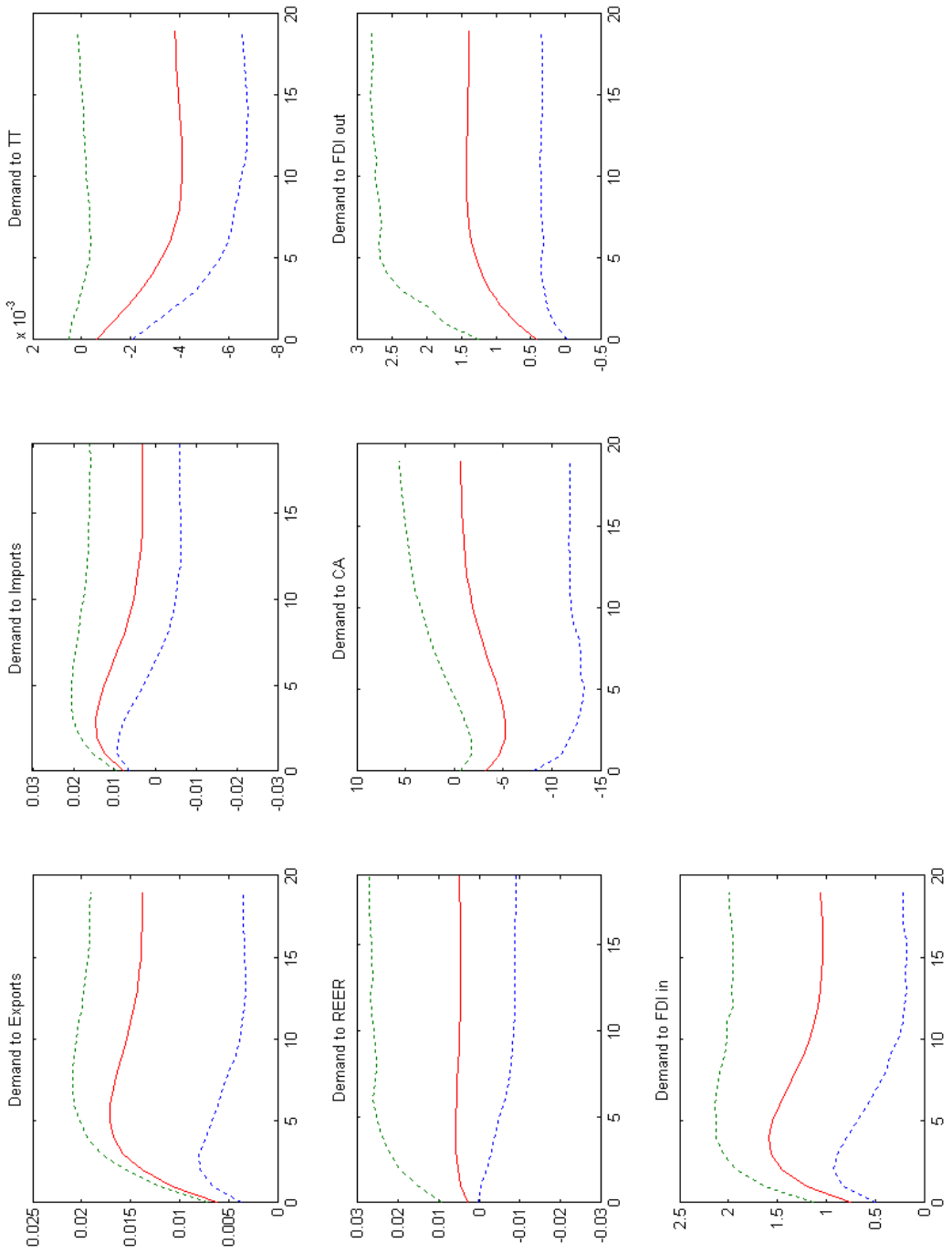

Supply to CPI
Supply to M1
x 10^-3
Supply to B Confidence
Supply to LT Int
Supply to Wages
x 10^-3
Supply to C Confidence
Supply to ST Int
Supply to SP


Supply to Exports
Supply to Imports
Supply to TT
Supply to REER
Supply to CA
Supply to FDI out
Supply to FDI in

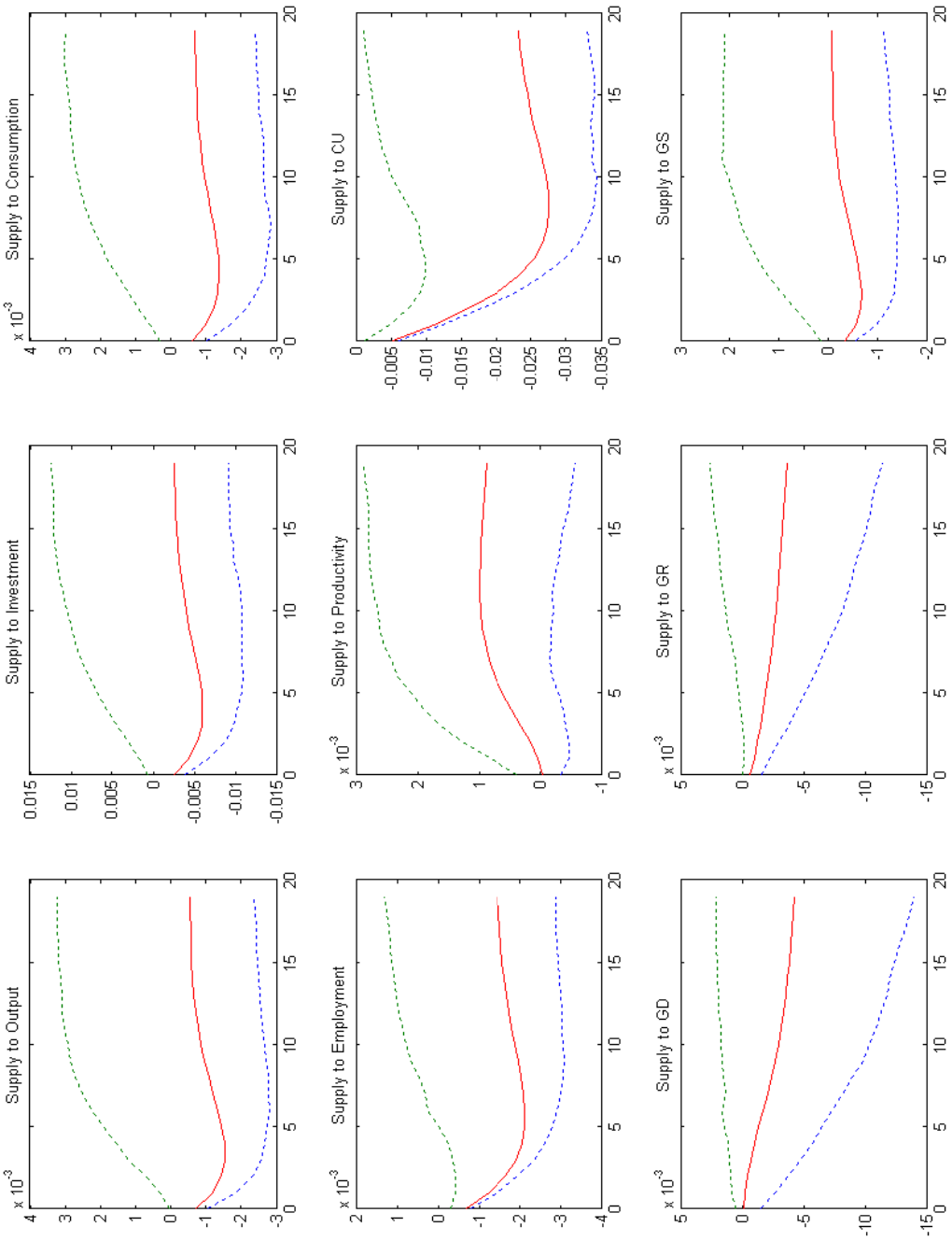
Demand Shock (USA)

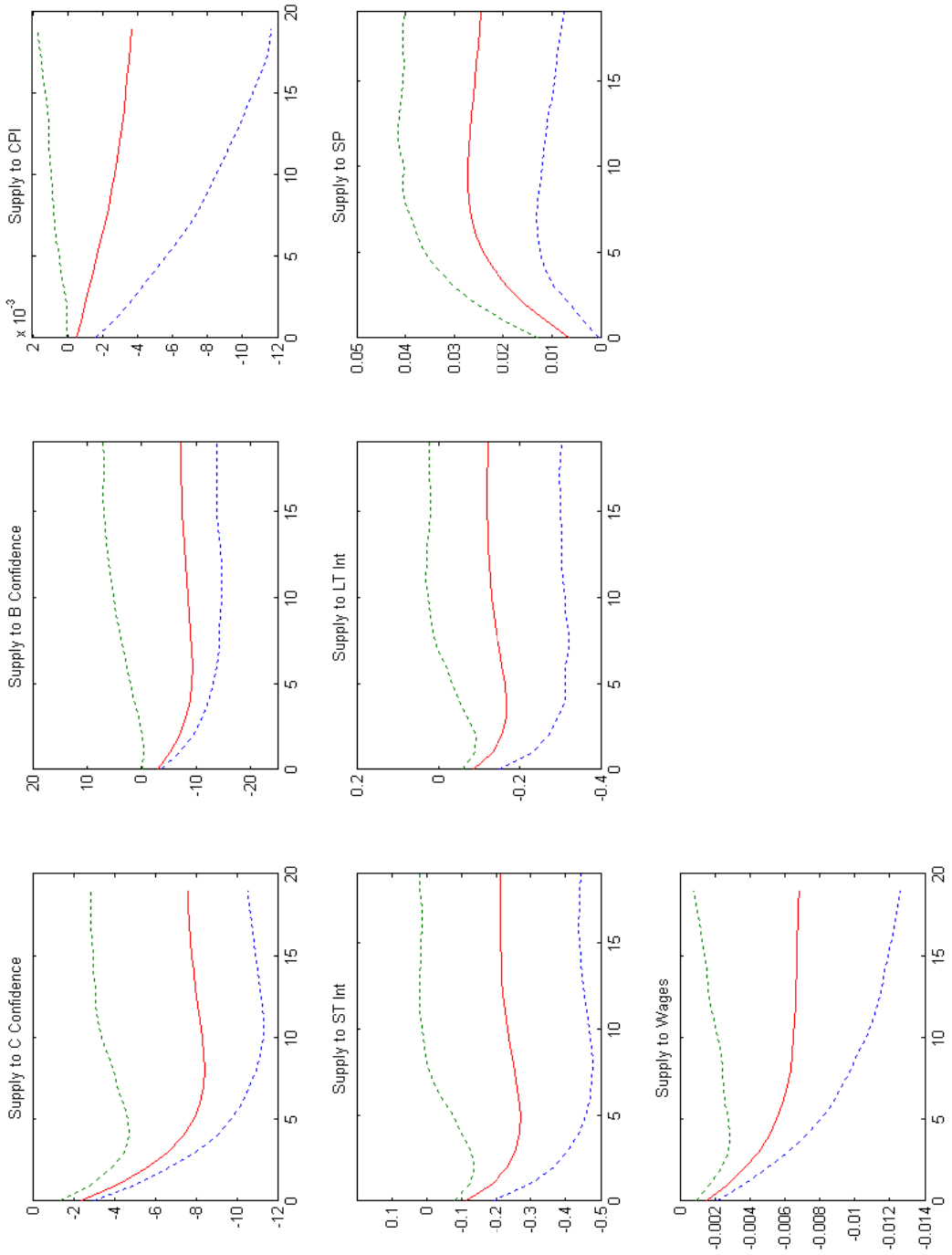


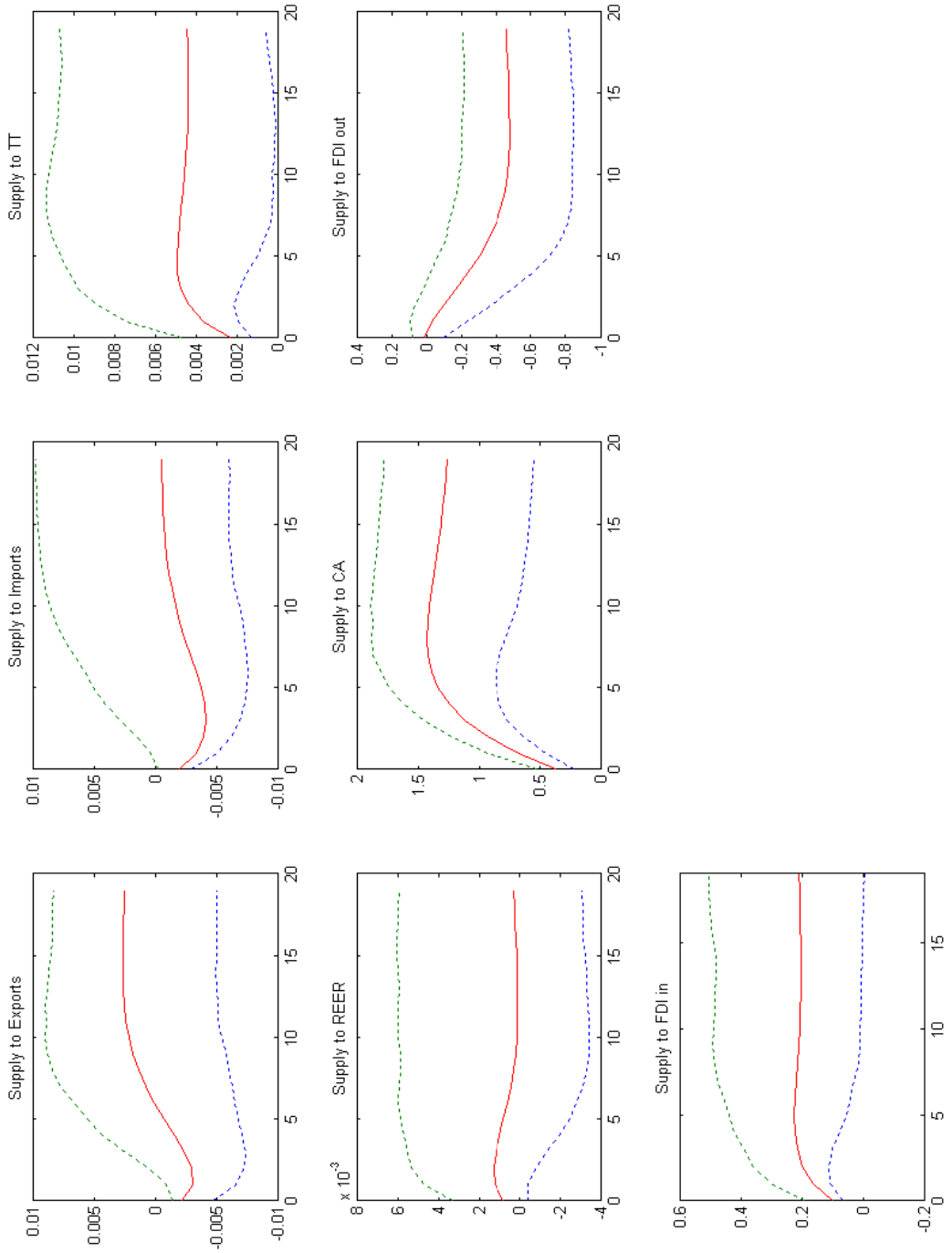

Demand to CPI
Demand to M1
Demand to B Confidence
Demand to LT Int
Demand to Wages
Demand to C Confidence
Demand to ST Int
Demand to SP


Demand to TT
x 10^-3
Demand to FDI out
Demand to Imports
Demand to CA
Demand to Exports
Demand to REER
Demand to FDI in

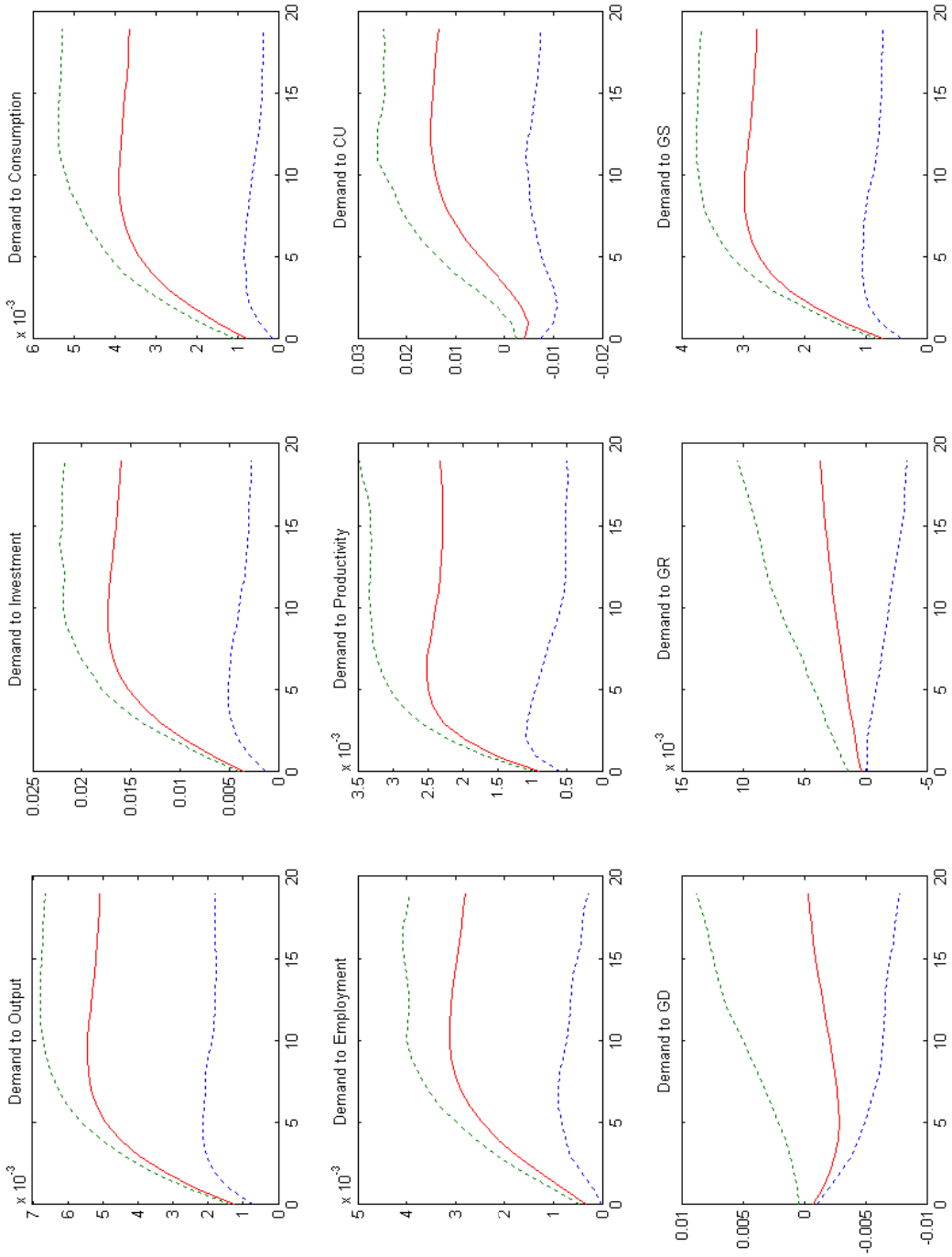
Supply Shock (France)

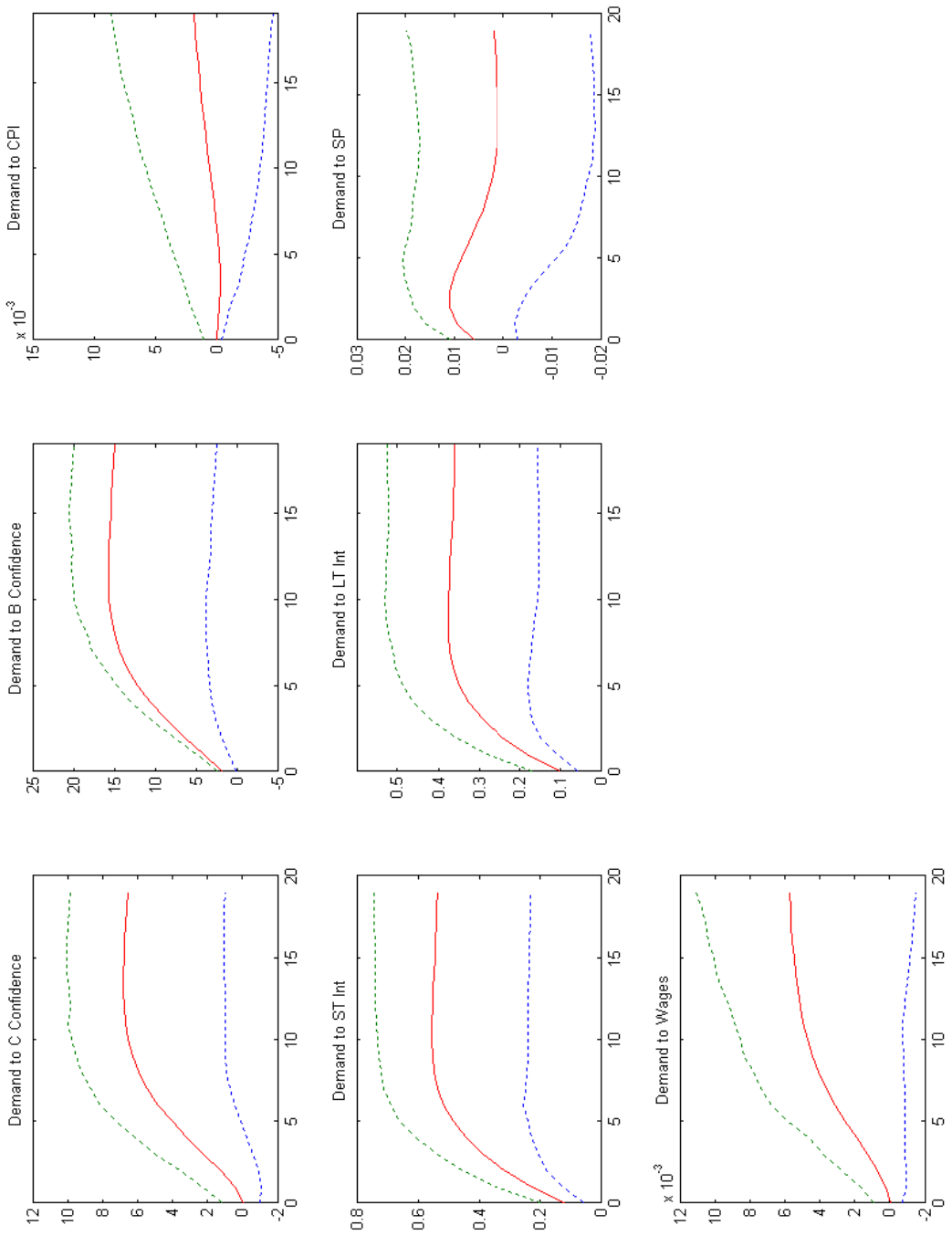


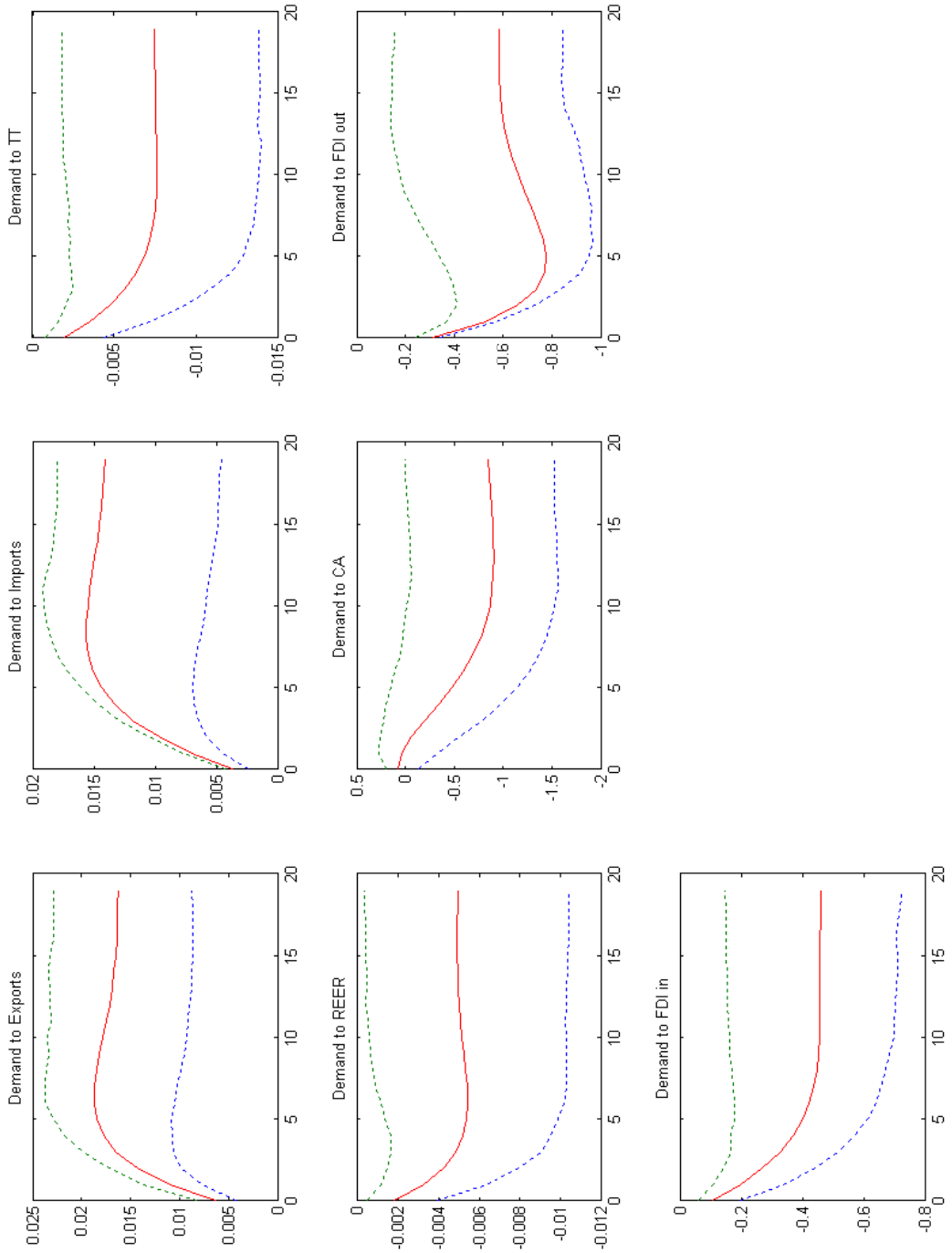

Supply to CPI
x 10^-3
Supply to SP
Supply to B Confidence
Supply to LT Int
Supply to C Confidence
Supply to ST Int
Supply to Wages


Supply to TT
Supply to FDI out
Supply to Imports
Supply to CA
Supply to Exports
Supply to REER
x 10^-3
Supply to FDI in

Demand Shock (France)



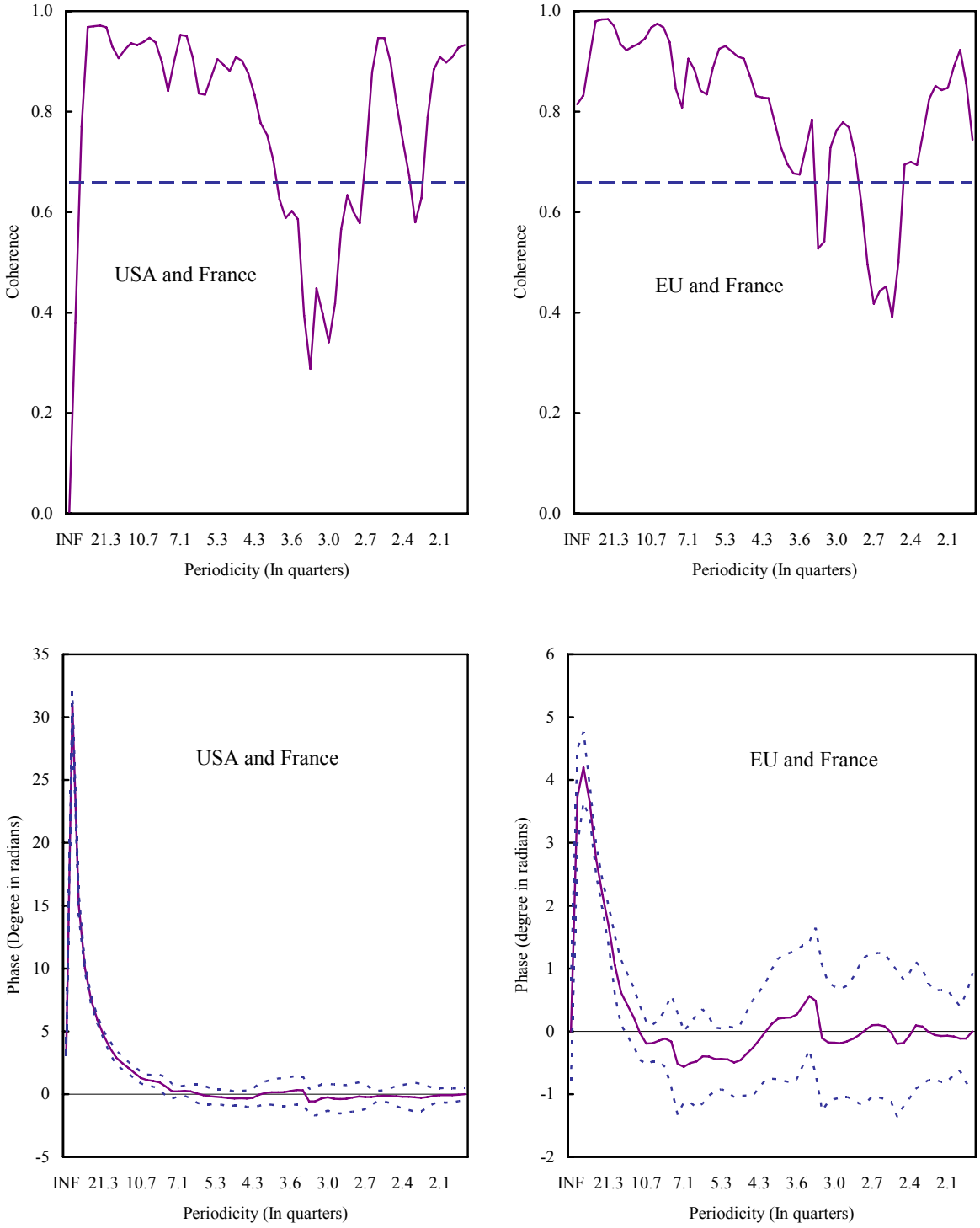

Demand to CPI
x 10^-3
Demand to SP
Demand to B Confidence
Demand to LT Int
Demand to C Confidence
Demand to ST Int
Demand to Wages
x 10^-3


Demand to TT
Demand to Imports
Demand to FDI out
Demand to Exports
Demand to CA
Demand to REER
Demand to FDI in

Acronyms

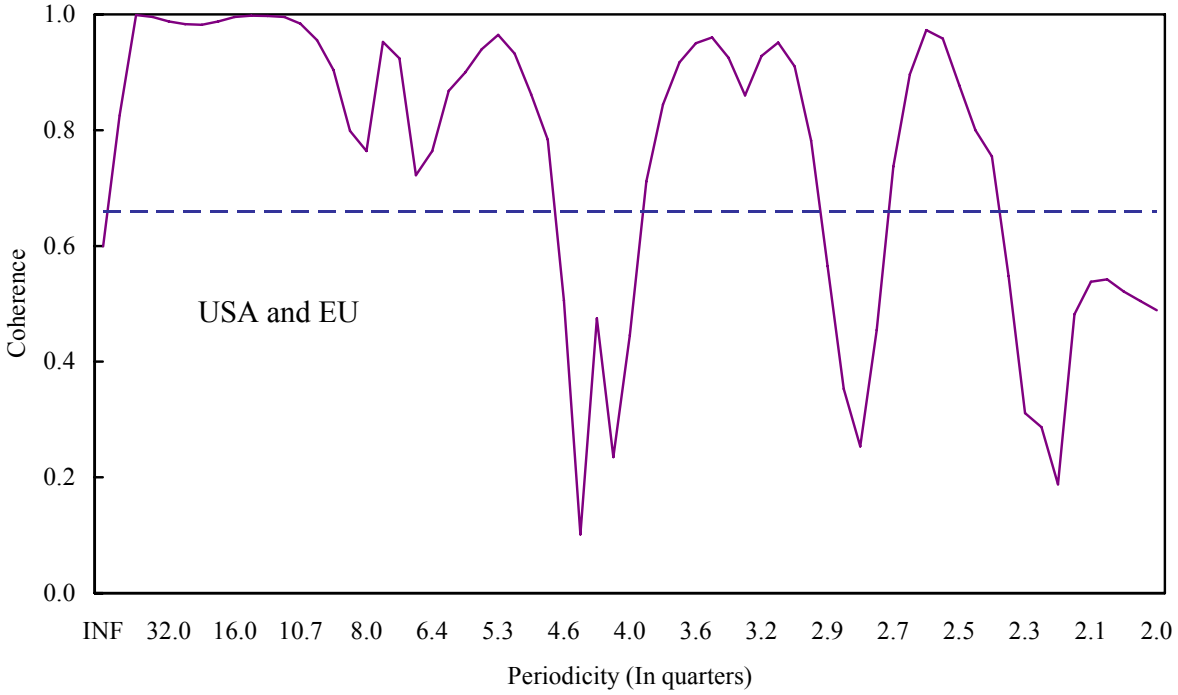
CU	Capacity utilization
GD	Government current disbursements
GR	Government current receipts
GS	Government net savings
C Confidence	Consumer confidence
B Confidence	Business confidence
CPI	Consumer price index
ST Int	Short-term interest rate
LT Int	Long-term interest rate on government bonds
SP	Share price index
TT	Terms of trade
REER	Real effective exchange rate
CA	Current account of the balance of payments
FDI	Foreign direct investment flows

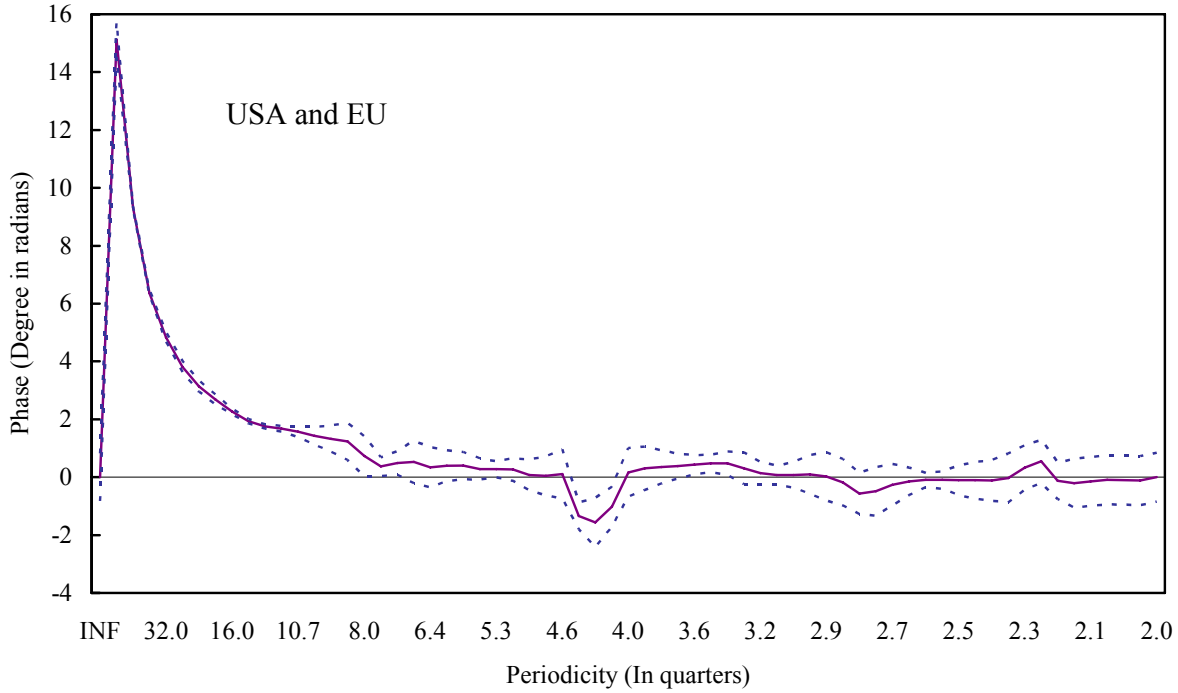
Figure 2. Common Components: Q2 1991 - Q4 2003
Shocks: USA GDP and EU (excluding France) GDP



Source: Staff estimates.

Figure 3. Common Components: Q2 1991 - Q4 2003
Shocks: USA GDP and EU (excluding France) GDP





Source: Staff estimates.

Table 1a. Forecast Error Variance of the Common Components of USA Variables Explained by the USA Supply Shock and the Demand Shock, 1980-2003 1/

	Variance Shares of the Common Components	Supply Shocks	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.54	0.87	0.30	0.92	0.11	0.05	0.67
Private investment	0.62	0.71	0.22	0.85	0.19	0.05	0.58
Personal consumption expenditure	0.32	0.87	0.40	0.93	0.04	0.02	0.33
Employment	0.60	0.75	0.11	0.82	0.21	0.12	0.83
Productivity	0.14	0.67	0.21	0.94	0.06	0.01	0.39
Capacity utilization	0.48	0.12	0.01	0.37	0.61	0.28	0.91
Government current disbursements	0.58	0.03	0.01	0.57	0.02	0.00	0.21
Government current receipts	0.25	0.34	0.00	0.37	0.39	0.15	0.77
Consumer confidence	0.66	0.11	0.01	0.32	0.50	0.32	0.91
Business confidence	0.74	0.74	0.15	0.86	0.24	0.09	0.79
Consumer prices	0.71	0.24	0.04	0.64	0.46	0.00	0.48
Short-term interest rates	0.36	0.15	0.01	0.48	0.83	0.22	0.90
Long-term interest rates	0.37	0.02	0.00	0.18	0.95	0.16	0.85
M1	0.44	0.19	0.02	0.38	0.60	0.11	0.81
Stock prices	0.09	0.56	0.04	0.75	0.02	0.00	0.25
Wages	0.32	0.31	0.00	0.28	0.42	0.27	0.88
Exports total	0.38	0.58	0.01	0.65	0.28	0.14	0.88
Imports total	0.45	0.71	0.22	0.85	0.24	0.06	0.66
Terms of trade	0.13	0.04	0.01	0.47	0.01	0.01	0.50
Real effective exchange	0.45	0.39	0.00	0.53	0.54	0.00	0.40
Current account balance	0.31	0.05	0.00	0.46	0.03	0.01	0.37
FDI out	0.03	0.04	0.01	0.56	0.26	0.02	0.57
FDI in	0.00	0.42	0.01	0.50	0.35	0.19	0.86

Table 1b. Forecast Error Variance of the Common Components of France Variables Explained by the USA Supply Shock and the Demand Shock, 1980-2003 1/

	Variance Shares of the Common Components	Supply Shock	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.43	0.23	0.01	0.30	0.34	0.22	0.85
Private investment	0.67	0.28	0.01	0.35	0.11	0.08	0.74
Personal consumption expenditure	0.20	0.40	0.00	0.36	0.02	0.04	0.66
Employment	0.65	0.06	0.01	0.51	0.20	0.05	0.66
Productivity	0.22	0.60	0.00	0.47	0.11	0.09	0.73
Capacity utilization	0.57	0.53	0.07	0.72	0.01	0.01	0.32
Government current disbursements	0.88	0.09	0.00	0.43	0.06	0.00	0.20
Government current receipts	0.73	0.00	0.00	0.46	0.10	0.00	0.29
Consumer confidence	0.47	0.51	0.12	0.89	0.24	0.01	0.61
Business confidence	0.73	0.02	0.01	0.56	0.16	0.06	0.68
Consumer prices	0.84	0.07	0.00	0.45	0.15	0.00	0.22
Short-term interest rates	0.20	0.12	0.02	0.54	0.76	0.21	0.88
Long-term interest rates	0.31	0.12	0.02	0.47	0.84	0.19	0.88
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.05	0.57	0.09	0.76	0.04	0.00	0.40
Wages	0.75	0.14	0.04	0.71	0.19	0.00	0.41
Exports total	0.42	0.03	0.01	0.19	0.89	0.48	0.95
Imports total	0.37	0.12	0.01	0.28	0.46	0.24	0.86
Terms of trade	0.42	0.29	0.02	0.60	0.69	0.03	0.66
Real effective exchange	0.18	0.13	0.00	0.33	0.72	0.01	0.69
Current account balance	0.03	0.64	0.27	0.86	0.26	0.01	0.53
FDI out	0.00	0.62	0.03	0.70	0.32	0.21	0.93
FDI in	0.01	0.15	0.01	0.51	0.75	0.08	0.75

1/ Forecast horizon is 20 quarters and refers to the levels of the series. Confidence intervals are constructed using bootstrapping methods.

Table 2. Forecast Error Variance of the Common Components of German Variables Explained by the USA Supply Shock and the Demand Shock, 1980-2003 1/

	Variance Shares of the Common Components	Supply Shocks	Confidence Intervals		Demand Shocks	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.78	0.003	0.001	0.321	0.066	0.001	0.478
Private investment	0.57	0.039	0.002	0.422	0.110	0.001	0.598
Personal consumption expenditure	0.78	0.024	0.002	0.341	0.007	0.004	0.273
Employment	0.87	0.131	0.003	0.444	0.043	0.004	0.302
Productivity	0.16	0.769	0.051	0.757	0.025	0.006	0.539
Capacity utilizsation	0.64	0.144	0.011	0.569	0.048	0.007	0.474
Government current disbursements	0.83	0.193	0.004	0.524	0.009	0.019	0.392
Government current receipts	0.76	0.082	0.003	0.371	0.030	0.005	0.283
Consumer confidence	0.52	0.130	0.005	0.486	0.012	0.007	0.536
Business confidence	0.62	0.057	0.005	0.440	0.146	0.035	0.636
Consumer prices	0.56	0.361	0.003	0.498	0.201	0.001	0.224
Short-term interest rates	0.43	0.158	0.027	0.592	0.601	0.165	0.836
Long-term interest rates	0.34	0.030	0.010	0.317	0.890	0.364	0.926
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.09	0.515	0.032	0.619	0.206	0.034	0.645
Wages	0.87	0.123	0.003	0.537	0.016	0.008	0.286
Exports total	0.34	0.164	0.007	0.221	0.487	0.283	0.910
Imports total	0.28	0.066	0.005	0.330	0.499	0.145	0.867
Terms of trade	0.57	0.287	0.009	0.561	0.670	0.019	0.663
Real effective exchange	0.31	0.342	0.006	0.569	0.613	0.008	0.585
Current account balance	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FDI out	0.01	0.594	0.099	0.815	0.256	0.005	0.388
FDI in	0.19	0.315	0.045	0.516	0.409	0.040	0.698

1/ Forecast horizon is 20 quarters and refers to the levels of the series. Confidence intervals are constructed using bootstrapping methods.

Table 3a. Forecast Error Variance of the Common Components of French Variables Explained by the USA Supply Shock and the Demand Shock, 1991-2003 1/

	Variance Shares of the Common Components	Supply Shocks	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.64	0.17	0.01	0.45	0.65	0.17	0.89
Private investment	0.72	0.36	0.01	0.46	0.37	0.15	0.88
Personal consumption expenditure	0.27	0.16	0.01	0.67	0.38	0.03	0.86
Employment	0.85	0.48	0.01	0.46	0.21	0.03	0.73
Productivity	0.42	0.05	0.00	0.47	0.68	0.05	0.82
Capacity Utilisation	0.73	0.38	0.01	0.75	0.07	0.02	0.47
Government current disbursements	0.63	0.53	0.01	0.68	0.20	0.06	0.88
Government current receipts	0.20	0.42	0.01	0.53	0.46	0.17	0.88
Consumer confidence	0.71	0.37	0.00	0.47	0.10	0.01	0.58
Business confidence	0.74	0.38	0.01	0.39	0.29	0.04	0.76
Consumer prices	0.32	0.35	0.00	0.62	0.07	0.01	0.65
Short-term interest rates	0.46	0.07	0.01	0.46	0.19	0.02	0.56
Long-term interest rates	0.75	0.03	0.00	0.47	0.22	0.02	0.74
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.22	0.58	0.01	0.59	0.17	0.01	0.56
Wages	0.63	0.20	0.01	0.53	0.32	0.02	0.71
Exports total	0.50	0.16	0.01	0.37	0.47	0.10	0.78
Imports total	0.50	0.37	0.01	0.46	0.50	0.28	0.90
Terms of trade	0.33	0.06	0.01	0.49	0.09	0.01	0.39
Real effective exchange	0.23	0.31	0.01	0.48	0.28	0.01	0.53
Current account balance	0.12	0.04	0.00	0.64	0.28	0.00	0.41
FDI out	0.01	0.09	0.01	0.74	0.75	0.08	0.91
FDI in	0.02	0.07	0.00	0.49	0.06	0.01	0.36

Table 3b. Forecast Error Variance of the Common Components of German Variables Explained by the USA Supply Shock and the Demand Shock, 1991-2003 1/

	Variance Shares of the Common Components	Supply Shocks	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.42	0.15	0.01	0.60	0.81	0.22	0.97
Private investment	0.37	0.16	0.01	0.56	0.81	0.22	0.93
Personal consumption expenditure	0.21	0.16	0.00	0.75	0.60	0.01	0.80
Employment	0.63	0.59	0.00	0.51	0.16	0.03	0.76
Productivity	0.42	0.12	0.01	0.61	0.80	0.05	0.83
Capacity utilization	0.80	0.30	0.00	0.42	0.11	0.01	0.69
Government current disbursements	0.61	0.52	0.00	0.58	0.00	0.00	0.47
Government current receipts	0.56	0.27	0.00	0.62	0.29	0.01	0.40
Consumer confidence	0.64	0.19	0.01	0.59	0.31	0.02	0.69
Business confidence	0.70	0.17	0.01	0.51	0.57	0.05	0.83
Consumer prices	0.57	0.37	0.00	0.57	0.01	0.01	0.62
Short-term interest rates	0.55	0.09	0.01	0.60	0.53	0.03	0.79
Long-term interest rates	0.37	0.02	0.00	0.47	0.21	0.01	0.74
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.30	0.56	0.01	0.59	0.25	0.01	0.67
Wages	0.63	0.29	0.01	0.82	0.33	0.00	0.57
Exports total	0.39	0.44	0.01	0.51	0.30	0.09	0.83
Imports total	0.39	0.45	0.01	0.54	0.46	0.22	0.91
Terms of trade	0.24	0.14	0.01	0.46	0.19	0.02	0.63
Real effective exchange	0.15	0.47	0.01	0.54	0.21	0.03	0.79
Current account balance	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FDI out	0.01	0.22	0.01	0.65	0.06	0.02	0.40
FDI in	0.23	0.31	0.01	0.41	0.24	0.02	0.63

1/ Forecast horizon is 20 quarters and refers to the levels of the series. Confidence intervals are constructed using bootstrapping methods.

Table 4a. Forecast Error Variance of the Common Components of French Variables Explained by the G7 Excluding France Supply Shock and the Demand Shock, 1991-2003 1/

	Variance Shares of the Common Components	Supply Shock	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.64	0.11	0.01	0.35	0.81	0.41	0.96
Private investment	0.72	0.33	0.01	0.52	0.43	0.17	0.90
Personal consumption expenditure	0.27	0.18	0.01	0.44	0.31	0.07	0.80
Employment	0.85	0.47	0.01	0.61	0.28	0.03	0.74
Productivity	0.42	0.15	0.01	0.41	0.79	0.16	0.91
Capacity utilization	0.73	0.32	0.03	0.73	0.09	0.01	0.37
Government current disbursements	0.63	0.59	0.01	0.79	0.16	0.03	0.77
Government current receipts	0.20	0.34	0.01	0.60	0.55	0.11	0.85
Consumer confidence	0.71	0.38	0.01	0.54	0.18	0.01	0.60
Business confidence	0.74	0.32	0.01	0.49	0.46	0.09	0.81
Consumer prices	0.32	0.52	0.00	0.71	0.00	0.00	0.39
Short-term interest rates	0.46	0.09	0.01	0.39	0.57	0.07	0.72
Long-term interest rates	0.75	0.09	0.00	0.39	0.58	0.19	0.89
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.22	0.58	0.01	0.70	0.15	0.00	0.34
Wages	0.63	0.16	0.02	0.41	0.52	0.07	0.79
Exports total	0.50	0.06	0.01	0.32	0.83	0.32	0.90
Imports total	0.50	0.27	0.01	0.55	0.69	0.35	0.95
Terms of trade	0.33	0.02	0.00	0.38	0.43	0.01	0.55
Real effective exchange	0.23	0.20	0.01	0.53	0.48	0.01	0.51
Current account balance	0.12	0.08	0.00	0.53	0.03	0.00	0.43
FDI out	0.01	0.07	0.01	0.57	0.56	0.09	0.83
FDI in	0.02	0.23	0.00	0.43	0.30	0.01	0.58

Table 4b. Forecast Error Variance of the Common Components of French Variables Explained by the Euro Area Excluding France Supply Shock and the Demand Shock, 1991-2003 1/

	Variance Shares of the Common Components	Supply Shock	Confidence Intervals		Demand Shock	Confidence Intervals	
			Lower Bound	Upper Bound		Lower Bound	Upper Bound
GDP	0.64	0.77	0.09	0.91	0.21	0.05	0.88
Private investment	0.72	0.80	0.12	0.92	0.04	0.02	0.74
Personal consumption expenditure	0.27	0.53	0.01	0.78	0.07	0.03	0.82
Employment	0.85	0.80	0.07	0.88	0.04	0.01	0.62
Productivity	0.42	0.20	0.00	0.48	0.65	0.12	0.91
Capacity utilization	0.73	0.26	0.05	0.50	0.15	0.01	0.52
Government current disbursements	0.63	0.67	0.15	0.93	0.10	0.01	0.52
Government current receipts	0.20	0.93	0.08	0.91	0.03	0.02	0.74
Consumer confidence	0.71	0.61	0.04	0.78	0.04	0.01	0.58
Business confidence	0.74	0.84	0.08	0.88	0.04	0.02	0.72
Consumer prices	0.32	0.30	0.01	0.75	0.19	0.00	0.39
Short-term interest rates	0.46	0.32	0.02	0.64	0.32	0.03	0.69
Long-term interest rates	0.75	0.17	0.01	0.72	0.34	0.01	0.65
M1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Stock prices	0.22	0.67	0.01	0.70	0.09	0.00	0.36
Wages	0.63	0.66	0.03	0.76	0.14	0.03	0.80
Exports total	0.50	0.66	0.05	0.77	0.19	0.04	0.77
Imports total	0.50	0.93	0.25	0.95	0.06	0.02	0.73
Terms of trade	0.33	0.24	0.01	0.56	0.14	0.01	0.45
Real effective exchange	0.23	0.74	0.01	0.71	0.03	0.01	0.56
Current account balance	0.12	0.11	0.01	0.59	0.00	0.00	0.36
FDI out	0.01	0.41	0.02	0.65	0.13	0.03	0.62
FDI in	0.02	0.03	0.01	0.42	0.38	0.01	0.59

1/ Forecast horizon is 20 quarters and refers to the levels of the series. Confidence intervals are constructed using bootstrapping methods.

APPENDIX I. Macroeconomic Series

Number	Country	Variable Name	Unit Root	Log	Treatment
1	France	Balance of income, value, balance of payments basis	1	nl	2
2	France	Current account, value	1	nl	2
3	France	Government consumption of fixed capital, value	1	l	3
4	France	Private final consumption expenditure, volume \ euros 1995	1	l	3
5	France	Dependent employment \ persons	1	l	3
6	France	Dependent employment of the business sector \ persons	1	l	3
7	France	Government employment \ persons	1	l	3
8	France	Self-employed \ persons	1	l	3
9	France	Total employment \ persons	1	l	3
10	France	Exchange rate, index of US$ per local currency \ index	1	l	3
11	France	Employment of the business sector \ persons	1	l	3
12	France	Real Effective exchange rate, 2000 = 100, ULC-based	1	l	3
13	France	Gross domestic product, volume, market prices \ euros 1995	1	l	3
14	France	Private nonresidential fixed capital formation, volume \ euros 1995	1	l	3
15	France	Fixed investment in nonresidential construction, volume	1	l	3
16	France	Government fixed capital formation, volume \ euros 1995	1	l	3
17	France	Private residential fixed capital formation, volume \ euros 1995	1	l	3
18	France	Fixed investment in machinery and equipment, volume \ euros	1	l	3
19	France	Industrial production \ index 1995	1	l	3
20	France	Private total fixed capital formation, volume \ euros 1995	1	l	3
21	France	Long-term interest rate on government bonds \ percent	1	nl	2
22	France	Gross total fixed capital formation, volume \ euros 1995	1	l	3
23	France	Labor force \ persons	1	l	3
24	France	Labor force participation rate	1	l	3
25	France	Imports of goods and services, volume, national accounts basis \ euros	1	l	3
26	France	Factor income paid abroad, volume, balance of payments basis \ local currency	1	l	3
27	France	Labor productivity of the total economy \ index 2000	1	l	3
28	France	Labor productivity of the business economy \ euros	1	l	3
29	France	Government saving (net), value \ euros	1	nl	2
30	France	Household saving ratio \ percent	1	nl	2
31	France	Current transfers received by households, value \ euros	1	l	3
32	France	Unit labor cost of the total economy \ index 2000	1	l	3
33	France	Unit labor cost of the manufacturing sector \ index 1995	1	l	3
34	France	Unemployment \ persons	1	l	3
35	France	Unemployment rate \ percent	1	nl	2
36	France	Wages, value \ euros	1	l	3
37	France	Wages of the government sector, value \ euros	1	l	3
38	France	Compensation rate of government employees \ euros	1	l	3
39	France	Wage rate of the manufacturing sector, hourly earnings \ index 1995	1	nl	2
40	France	Compensation rate of the business sector \ yearly salary in euro	1	l	3
41	France	Compensation of employees, value \ euros	1	l	3
42	France	Exports of goods and services, volume, national accounts basis \ euros 1995	1	l	3
43	France	Factor income from abroad, volume, balance of payments basis \ local currency	1	l	3
44	France	Property income received by households, value \ euros	1	l	3
45	France	Government current disbursements, value \ euros	1	l	3
46	France	Current disbursements of households, value \ euros	1	l	3
47	France	Government current receipts, value \ euros	1	l	3
48	France	Current receipts of households, value \ euros	1	l	3
49	France	Self-employment income received by households, value \ euros	1	l	3
50	France	Direct Investment abroad	1	nl	2
51	France	Dir. invest. in rep. econ., N.I.E.	1	nl	2
52	France	Portfolio investment liab., N.I.E.	1	nl	2
53	France	Exports prices	1	l	3
54	France	Imports prices	1	l	3
55	France	Terms of trade	1	l	3
56	France	CPI: 108 cities (index number, 2000=100, AQM, DEC, average)	1	l	3
57	France	France\interest rates\confidence and economic sentiment\share prices SBF 250 / stock	1	l	3
58	France	Treasury bills: 3 months (percent per annum, AQM, DEC, average)	1	nl	2
59	France	Cyclical indicators\surveys of manufacturing industry:\industrial confidence indicator	0	nl	0
60	France	\Cyclical indicators\consumer opinion on economic and financial	0	nl	0
61	France	Fixed investment in construction, volume	0	l	1
62	France	Increase in stocks, volume \ euros 1995	0	nl	0
63	France	Wage rate of the business sector \ euros per	0	l	1
64	France	Household disposable income, real \ euros	0	l	1
65	France	France\cyclical indicators\surveys of manufacturing industry:\current level of capacity	0	l	1
66	France	Portfolio investment assets	0	nl	0
67	France	Other investment assets	0	nl	0
68	France	Other investment liab., N.I.E.	0	nl	0
69	France	Financial account, N.I.E.	0	nl	0
70	Germany	Government consumption of fixed capital, value \ euros	1	l	3
71	Germany	Private final consumption expenditure, volume \ euros 1995	1	l	3
72	Germany	Dependent employment \ persons	1	l	3
73	Germany	Dependent employment of the business sector	1	l	3
74	Germany	Government employment \ persons	1	l	3
75	Germany	Self-employed \ persons	1	l	3
76	Germany	Total employment \ persons	1	l	3
77	Germany	Employment of the business sector	1	l	3
78	Germany	Exchange rate, index of US$ per local currency \ index	1	l	3
79	Germany	Real Effective exchange rate, 2000 = 100, ULC-based	1	l	3
80	Germany	Gross domestic product, volume, market prices \ euros 1995	1	l	3
81	Germany	Private nonresidential fixed capital formation, volume \ euros 1995	1	l	3

APPENDIX I. Macroeconomic Series (continued)

Number	Country	Variable Name	Unit Root	Log	Treatment
82	Germany	Fixed investment in nonresidential construction, volume	1	l	3
83	Germany	Fixed investment in construction, volume \ DM	1	l	3
84	Germany	Government fixed capital formation, volume \ euros 1995	1	l	3
85	Germany	Private residential fixed capital formation, volume \ euros 1995	1	l	3
86	Germany	Fixed investment in machinery and equipment, volume \ DM	1	l	3
87	Germany	Industrial production	1	l	3
88	Germany	Private total fixed capital formation, volume \ euros 1995	1	l	3
89	Germany	Long-term interest rate on government bonds \ percent	1	nl	2
90	Germany	Gross total fixed capital formation, volume \ euros 1995	1	l	3
91	Germany	Labor force	1	l	3
92	Germany	Imports of goods and services, volume, national accounts basis \ euros 1995	1	l	3
93	Germany	Labor productivity of the total economy \ index 2000	1	l	3
94	Germany	Labor productivity of the business economy	1	l	3
95	Germany	Government saving (net), value \ euros	1	nl	2
96	Germany	Current transfers received by households, value	1	l	3
97	Germany	Unit labor cost of the total economy	1	l	3
98	Germany	Unit labor cost of the manufacturing sector \ Local currency index	1	l	3
99	Germany	Unemployment \ euros	1	l	3
100	Germany	Unemployment rate \ percent	1	nl	2
101	Germany	Wages, value \ euros	1	l	3
102	Germany	Wage rate of the business sector	1	l	3
103	Germany	Compensation rate of government employees	1	l	3
104	Germany	Compensation rate of the business sector \ DM	1	l	3
105	Germany	Compensation of employees, value \ euros	1	l	3
106	Germany	Exports of goods and services, volume, national accounts basis \ euros 1995	1	l	3
107	Germany	Household disposable income, real \ euros	1	l	3
108	Germany	Government current disbursements, value \ euros	1	l	3
109	Germany	Current disbursements of households, value \ euros	1	l	3
110	Germany	Government current receipts, value \ euros	1	l	3
111	Germany	Current receipts of households, value \ euros	1	l	3
112	Germany	Direct Investment abroad	1	nl	2
113	Germany	Portfolio investment assets	1	nl	2
114	Germany	Portfolio investment liab., N.I.E.	1	nl	2
115	Germany	Exports prices	1	l	3
116	Germany	Imports prices	1	l	3
117	Germany	Terms of trade	1	l	3
118	Germany	Share prices (Index number, AQM, DEC, average)	1	l	3
119	Germany	Call money rate (percent per annum, AQM, DEC, average)	1	nl	2
120	Germany	Consumer Price Index (SA, 2000=100)	1	l	3
121	Germany	PPI: total manufacturing industries (SA, 2000=100)	1	l	3
122	Germany	Cyclical indicators\surveys of manufacturing industry:\industrial confidence indicator	0	nl	0
123	Germany	Cyclical indicators\consumer opinion on economic and financial	0	nl	0
124	Germany	Increase in stocks, volume \ euros 1995	0	nl	0
125	Germany	Household saving ratio \ percent	0	nl	0
126	Germany	The Federal Republic of Germany (prior to 1990Q4 West-Germany)\cyclical	0	l	1
127	Germany	Dir. Invest. in Rep. Econ., N.I.E.	0	nl	0
128	Germany	Other investment assets	0	nl	0
129	Germany	Other investment liab., N.I.E.	0	nl	0
130	Germany	Financial account, N.I.E.	0	nl	0
131	Italy	Balance of income, value, balance of payments basis	1	nl	2
132	Italy	Current account, value	1	nl	2
133	Italy	Government consumption of fixed capital, value \ euros	1	l	3
134	Italy	Private final consumption expenditure, volume \ euros 1995	1	l	3
135	Italy	Dependent employment \ persons	1	l	3
136	Italy	Self-employed \ persons	1	l	3
137	Italy	Total employment \ persons	1	l	3
138	Italy	Employment of the business sector \ persons	1	l	3
139	Italy	Exchange rate, index of US$ per local currency \ index	1	l	3
140	Italy	Private non-residential fixed capital formation, volume \ euros	1	l	3
141	Italy	Fixed investment in non-residential construction, volume \ euros	1	l	3
142	Italy	Fixed investment in construction, volume \ euros	1	l	3
143	Italy	Government fixed capital formation, volume \ euros	1	l	3
144	Italy	Private residential fixed capital formation, volume \ euros	1	l	3
145	Italy	Fixed investment in machinery and equipment, volume \ euros	1	l	3
146	Italy	Industrial production \ index 1995	1	l	3
147	Italy	Private total fixed capital formation, volume \ euros	1	l	3
148	Italy	Long-term interest rate on government bonds \ percent	1	nl	2
149	Italy	Gross total fixed capital formation, volume \ euros	1	l	3
150	Italy	Capital stock of the business sector, volume \ euros	1	l	3
151	Italy	Capital stock, housing, volume	1	l	3
152	Italy	Labor force \ persons	1	l	3
153	Italy	Labor force participation rate	1	nl	2
154	Italy	Imports of goods and services, volume, national accounts basis \ euros	1	l	3
155	Italy	Factor income paid abroad, volume, balance of payments basis \ local currency	1	l	3
156	Italy	Labor productivity of the total economy \ index 2000	1	l	3
157	Italy	Labor productivity of the business economy \ euros	1	l	3
158	Italy	Government saving (net), value \ euros	1	nl	2
159	Italy	Household saving, value \ euros	1	l	3
160	Italy	Household saving ratio \ percent	1	nl	2
161	Italy	Current transfers received by households, value \ euros	1	l	3
162	Italy	Unit labor cost of the total economy \ local currency	1	l	3

APPENDIX I. Macroeconomic Series (continued)

Number	Country	Variable Name	Unit Root	Log	Treatment
163	Italy	Unit labor cost of the manufacturing sector \ local currency index	1	l	3
164	Italy	Unemployment \ persons	1	l	3
165	Italy	Unemployment rate \ percent	1	nl	2
166	Italy	Wages, value \ euros	1	l	3
167	Italy	Wage rate of the business sector \ euros/person	1	l	3
168	Italy	Compensation rate of government employees \ euros/person	1	l	3
169	Italy	Wage rate of the manufacturing sector, hourly earnings \ index 1995	1	l	3
170	Italy	Compensation rate of the business sector \ yearly salary in euros per	1	l	3
171	Italy	Compensation of employees, value \ euros	1	l	3
172	Italy	Exports of goods and services, volume, national accounts basis \ euros	1	l	3
173	Italy	Factor income from abroad, volume, balance of payments basis \ local currency	1	l	3
174	Italy	Household disposable income, real \ euros	1	l	3
175	Italy	Property income received by households, value \ euros	1	l	3
176	Italy	Government current disbursements, value \ euros	1	l	3
177	Italy	Current disbursements of households, value \ euros	1	l	3
178	Italy	Government current receipts, value \ euros	1	l	3
179	Italy	Current receipts of households, value \ euros	1	l	3
180	Italy	Self-employment income received by households, value \ euros	1	l	3
181	Italy	Portfolio investment liab., N.I.E.	1	nl	2
182	Italy	Exports prices	1	l	3
183	Italy	Imports prices	1	l	3
184	Italy	Terms of trade	1	l	3
185	Italy	CPI: all Italy (index number, 2000=100, AQM, DEC, average)	1	l	3
186	Italy	Italy\interest rates\confidence and economic sentiment\share prices ISE MIB	1	l	3
187	Italy	Money market rate (percent per annum, AQM, DEC, average)	1	nl	2
188	Italy	Real Effective exchange rate, 2000 = 100, ULC-based	0	l	1
189	Italy	Gross domestic product, volume, market prices \ EUROS 1995	0	l	1
190	Italy	Increase in stocks, volume \ EUROS	0	nl	0
191	Italy	Italy\cyclical indicators\surveys of manufacturing industry:\current level of capacity	0	l	1
192	Italy	Direct investment abroad	0	nl	0
193	Italy	Dir. invest. in rep. econ., N.I.E.	0	nl	0
194	Italy	Portfolio investment assets	0	nl	0
195	Italy	Other investment assets	0	nl	0
196	Italy	Other investment liab., N.I.E.	0	nl	0
197	Italy	Financial account, N.I.E.	0	nl	0
198	Japan	Balance of income, value, balance of payments basis	1	nl	2
199	Japan	Current account, value	1	nl	2
200	Japan	Government consumption of fixed capital, value \ JPY	1	l	3
201	Japan	Private final consumption expenditure, volume \ JPY 2000	1	l	3
202	Japan	Dependent employment \ persons	1	l	3
203	Japan	Dependent employment of the business sector \ persons	1	l	3
204	Japan	Government employment \ persons	1	l	3
205	Japan	Self-employed \ persons	1	l	3
206	Japan	Total employment \ persons	1	l	3
207	Japan	Employment of the business sector \ persons	1	l	3
208	Japan	Exchange rate, index of US$ per local currency \ index	1	l	3
209	Japan	Real Effective exchange rate, 2000 = 100, ULC-based	1	l	3
210	Japan	Gross domestic product, volume, market prices \ JPY 2000	1	l	3
211	Japan	Private non-residential fixed capital formation, volume \ JPY 2000	1	l	3
212	Japan	Fixed investment of government enterprises, volume \ JPY 2000	1	l	3
213	Japan	Government fixed capital formation, volume \ JPY 2000	1	l	3
214	Japan	Private residential fixed capital formation, volume \ JPY 2000	1	l	3
215	Japan	Industrial production \ index 2000	1	l	3
216	Japan	Private total fixed capital formation, volume \ JPY 2000	1	l	3
217	Japan	Long-term interest rate on government bonds \ percent	1	nl	2
218	Japan	Gross total fixed capital formation, volume \ JPY 2000	1	l	3
219	Japan	Capital stock of the business sector, volume \ JPY 2000	1	l	3
220	Japan	Capital stock, housing, volume \ JPY 2000	1	l	3
221	Japan	Labor force \ persons	1	l	3
222	Japan	Labor force participation rate	1	nl	2
223	Japan	Imports of goods and services, volume, national accounts basis \ JPY 2000	1	l	3
224	Japan	Money supply, broad definition: M2 or M3 \ JPY	1	l	3
225	Japan	Factor income paid abroad, volume, balance of payments basis \ local currency	1	l	3
226	Japan	Labor productivity of the total economy \ index 2000	1	l	3
227	Japan	Labor productivity of the business economy	1	l	3
228	Japan	Government saving (net), value \ JPY	1	nl	2
229	Japan	Household saving, value \ JPY	1	l	3
230	Japan	Household saving ratio \ percent	1	nl	2
231	Japan	Unit labor cost of the total economy \ index 2000	1	l	3
232	Japan	Unit labor cost of the manufacturing sector \ index 2000	1	l	3
233	Japan	Unemployment \ persons	1	l	3
234	Japan	Unemployment rate \ percent	1	nl	2
235	Japan	Velocity of money	1	l	3
236	Japan	Wages, value \ JPY	1	l	3
237	Japan	Wage rate of the business sector \ index	1	l	3
238	Japan	Compensation rate of government employees	1	l	3
239	Japan	Wage rate of the manufacturing sector, hourly earnings \ index 2000	1	l	3
240	Japan	Compensation rate of the business sector \ yearly salary in yen per	1	l	3
241	Japan	Compensation of employees, value \ JPY	1	l	3
242	Japan	Exports of goods and services, volume, national accounts basis \ JPY 2000	1	l	3
243	Japan	Factor income from abroad, volume, balance of payments basis \ local currency	1	l	3

APPENDIX I. Macroeconomic Series (continued)

Number	Country	Variable Name	Unit Root	Log	Treatment
244	Japan	Household disposable income, real \ JPY	1	l	3
245	Japan	Property income received by households, value \ JPY	1	l	3
246	Japan	Government current disbursements, value \ JPY	1	l	3
247	Japan	Current disbursements of households, value \ JPY	1	l	3
248	Japan	Government current receipts, value \ JPY	1	l	3
249	Japan	Current receipts of households, value \ JPY	1	l	3
250	Japan	Self-employment income received by households, value \ JPY	1	l	3
251	Japan	Direct Investment abroad	1	nl	2
252	Japan	Portfolio investment assets	1	nl	2
253	Japan	Financial account, N.I.E.	1	nl	2
254	Japan	Exports prices	1	l	3
255	Japan	Imports prices	1	l	3
256	Japan	Terms of trade	1	l	3
257	Japan	Call monetary rate (percent per annum, AQM, DEC, average)	1	nl	2
258	Japan	Share prices (index number, AQM, DEC, average)	1	l	3
259	Japan	PPI / WPI (Index number, 2000=100, AQM, DEC, average)	1	l	3
260	Japan	CPI: all Japan-485 items (Index number, 2000=100, AQM, DEC, average)	1	l	3
261	Japan	Increase in stocks, volume \ JPY 2000	0	nl	0
262	Japan	Current transfers received by households, value \ JPY	0	l	1
263	Japan	Dir. invest. in rep. econ., N.I.E.	0	nl	0
264	Japan	Portfolio investment liab., N.I.E.	0	nl	0
265	Japan	Other investment liab., N.I.E.	0	nl	0
266	Spain	Balance of income, value, balance of payments basis	1	nl	2
267	Spain	Current account, value	1	nl	2
268	Spain	Government consumption of fixed capital, value \ euros	1	l	3
269	Spain	Unit capital-labor costs	1	l	3
270	Spain	Private final consumption expenditure, volume \ euros	1	l	3
271	Spain	Dependent employment \ persons	1	l	3
272	Spain	Dependent employment of the business sector \ persons	1	l	3
273	Spain	Government employment \ persons	1	l	3
274	Spain	Self-employed \ persons	1	l	3
275	Spain	Total employment \ persons	1	l	3
276	Spain	Employment of the business sector \ persons	1	l	3
277	Spain	Exchange rate, index of US$ per local currency \ index	1	l	3
278	Spain	Real Effective exchange rate, 2000 = 100, ULC-based	1	l	3
279	Spain	Gross domestic product, volume, market prices \ euros	1	l	3
280	Spain	Private non-residential fixed capital formation, volume \ euros	1	l	3
281	Spain	Fixed investment in non-residential construction, volume \ euros	1	l	3
282	Spain	Fixed investment in construction, volume	1	l	3
283	Spain	Government fixed capital formation, volume \ euros	1	l	3
284	Spain	Private residential fixed capital formation, volume \ euros	1	l	3
285	Spain	Fixed investment in machinery and equipment, volume \ euros	1	l	3
286	Spain	Industrial production \ index	1	l	3
287	Spain	Private total fixed capital formation, volume \ euros	1	l	3
288	Spain	Long-term interest rate on government bonds \ percent	1	nl	2
289	Spain	Gross total fixed capital formation, volume \ euros	1	l	3
290	Spain	Labor force \ persons	1	l	3
291	Spain	Imports of goods and services, volume, national accounts basis \ euros	1	l	3
292	Spain	Factor income paid abroad, volume, balance of payments basis \ local currency	1	l	3
293	Spain	Labor productivity of the total economy \ index	1	l	3
294	Spain	Labor productivity of the business economy \ euros	1	l	3
295	Spain	Government saving (net), value \ euros	1	nl	2
296	Spain	Household saving, value \ euros	1	l	3
297	Spain	Current transfers received by households, value \ euros	1	l	3
298	Spain	Unit labor cost of the total economy \ index	1	l	3
299	Spain	Unit labor cost of the manufacturing sector \ index	1	l	3
300	Spain	Unemployment \ persons	1	l	3
301	Spain	Unemployment rate \ percent	1	nl	2
302	Spain	Wages, value \ euros	1	l	3
303	Spain	Wage rate of the business sector \ euros/man/year	1	l	3
304	Spain	Compensation rate of government employees \ euros	1	l	3
305	Spain	Compensation rate of the business sector \ yearly salary in euros	1	l	3
306	Spain	Compensation of employees, value \ euros	1	l	3
307	Spain	Exports of goods and services, volume, national accounts basis \ euros	1	l	3
308	Spain	Factor income from abroad, volume, balance of payments basis \ local currency	1	l	3
309	Spain	Household disposable income, real \ euros	1	l	3
310	Spain	Property income received by households, value \ euros	1	l	3
311	Spain	Government current disbursements, value \ euros	1	l	3
312	Spain	Current disbursements of households, value \ euros	1	l	3
313	Spain	Government current receipts, value \ euros	1	l	3
314	Spain	Current receipts of households, value \ euros	1	l	3
315	Spain	Self-employment income received by households, value \ euros	1	l	3
316	Spain	Other investment liab., N.I.E.	1	nl	2
317	Spain	Exports Prices	1	l	3
318	Spain	Terms of Trade	1	l	3
319	Spain	Call money rate (percent per annum, AQM, DEC, average)	1	nl	2
320	Spain	Share prices (index number, AQM, DEC, average)	1	l	3
321	Spain	PPI / WPI (index number, 2000=100, AQM, DEC, average)	1	l	3
322	Spain	CPI: (no specifics avail.) (index number, 2000=100, AQM, DEC, average)	1	l	3
323	Spain	Increase in stocks, volume \ euros	0	nl	0
324	Spain	Household saving ratio \ ratio	0	nl	0

APPENDIX I. Macroeconomic Series (continued)

Number	Country	Variable Name	Unit Root	Log	Treatment
325	Spain	Direct investment abroad	0	nl	0
326	Spain	Dir. Invest. in rep. econ., N.I.E.	0	nl	0
327	Spain	Portfolio investment liab., N.I.E.	0	nl	0
328	Spain	Other investment assets	0	nl	0
329	Spain	Financial account, N.I.E.	0	nl	0
330	Spain	Imports Prices	0	l	1
331	United Kingdom	Balance of income, value, balance of payments basis	1	nl	2
332	United Kingdom	Current account, value	1	nl	2
333	United Kingdom	Government consumption of fixed capital, value \ GBP	1	l	3
334	United Kingdom	Unit capital-labor costs	1	l	3
335	United Kingdom	Private final consumption expenditure, volume \ 2001 GBP	1	l	3
336	United Kingdom	Dependent employment \ persons	1	l	3
337	United Kingdom	Dependent employment of the business sector \ persons	1	l	3
338	United Kingdom	Government employment \ persons	1	l	3
339	United Kingdom	Self-employed \ persons	1	l	3
340	United Kingdom	Total employment \ persons	1	l	3
341	United Kingdom	Employment of the business sector \ persons	1	l	3
342	United Kingdom	Exchange rate, index of US$ per local currency \ index	1	l	3
343	United Kingdom	Real Effective exchange rate, 2000 = 100, ULC-based	1	l	3
344	United Kingdom	Gross domestic product, volume, market prices \ 2001 GBP	1	l	3
345	United Kingdom	Private non-residential fixed capital formation, volume \ GBP	1	l	3
346	United Kingdom	Fixed investment in construction, volume \ GBP 2001	1	l	3
347	United Kingdom	Government fixed capital formation, volume \ GBP 00	1	l	3
348	United Kingdom	Private residential fixed capital formation, volume \ 2001 GBP	1	l	3
349	United Kingdom	Fixed investment in machinery and equipment, volume \ GBP 2001	1	l	3
350	United Kingdom	Private total fixed capital formation, volume \ GBP 00	1	l	3
351	United Kingdom	Long-term interest rate on government bonds \ percent	1	nl	2
352	United Kingdom	Increase in stocks, volume \ 2001 GBP	1	nl	2
353	United Kingdom	Gross total fixed capital formation, volume \ 2001 GBP	1	l	3
354	United Kingdom	Capital stock of the business sector, volume \ GBP 2001	1	l	3
355	United Kingdom	Labor force \ persons	1	l	3
356	United Kingdom	Labor force participation rate	1	nl	2
357	United Kingdom	Imports of goods and services, volume, national accounts basis \ GBP 2001	1	l	3
358	United Kingdom	Factor income paid abroad, volume, balance of payments basis \ GBP	1	l	3
359	United Kingdom	Labor productivity of the total economy \ index 2000	1	l	3
360	United Kingdom	Labor productivity of the business economy	1	l	3
361	United Kingdom	Household saving, value \ GBP	1	l	3
362	United Kingdom	Household saving ratio \ percent	1	nl	2
363	United Kingdom	Current transfers received by households, value \ GBP	1	l	3
364	United Kingdom	Unit labor cost of the total economy \ index 2000	1	l	3
365	United Kingdom	Unit labor cost of the manufacturing sector \ index 2001	1	l	3
366	United Kingdom	Unemployment \ persons	1	l	3
367	United Kingdom	Wages, value \ GBP	1	l	3
368	United Kingdom	Wage rate of the business sector \ GBP	1	l	3
369	United Kingdom	Compensation rate of government employees \ GBP	1	l	3
370	United Kingdom	Wage rate of the manufacturing sector, hourly earnings \ index 2001	1	l	3
371	United Kingdom	Compensation rate of the business sector \ yearly salary in GBP	1	l	3
372	United Kingdom	Compensation of employees, value \ GBP	1	l	3
373	United Kingdom	Exports of goods and services, volume, national accounts basis \ 2001 GBP	1	l	3
374	United Kingdom	Factor income from abroad, volume, balance of payments basis \ GBP	1	l	3
375	United Kingdom	Household disposable income, real \ GBP	1	l	3
376	United Kingdom	Property income received by households, value	1	l	3
377	United Kingdom	Government current disbursements, value \ GBP	1	l	3
378	United Kingdom	Current disbursements of households, value \ GBP	1	l	3
379	United Kingdom	Government current receipts, value \ GBP	1	l	3
380	United Kingdom	Current receipts of households, value \ GBP	1	l	3
381	United Kingdom	Self-employment income received by households, value \ GBP	1	l	3
382	United Kingdom	Exports prices	1	l	3
383	United Kingdom	Imports prices	1	l	3
384	United Kingdom	Terms of trade	1	l	3
385	United Kingdom	Overnight interbank min (percent per annum, AQM, DEC, average)	1	nl	2
386	United Kingdom	United Kingdom - PPI / WPI (index number, 2000=100, AQM, DEC, average)	1	l	3
387	United Kingdom	United Kingdom - CPI: all items (index number, 2000=100, AQM, DEC, average)	1	l	3
388	United Kingdom	FTSE 100	1	l	3
389	United Kingdom	Other investment assets	1	nl	2
390	United Kingdom	Other investment liab., N.I.E.	1	nl	2
391	United Kingdom	United Kingdom\cyclical indicators\surveys of manufacturing industry:\current level	1	l	3
392	United Kingdom	Cyclical indicators\surveys of manufacturing industry:\composite industrial	0	nl	0
393	United Kingdom	Cyclical indicators\consumer opinion on economic and financial	0	nl	0
394	United Kingdom	Government saving (net), value \ GBP	0	nl	0
395	United Kingdom	Unemployment rate \ percent	0	nl	0
396	United Kingdom	Direct investment abroad	0	nl	0
397	United Kingdom	Dir. invest. in Rep. Econ.., N.I.E.	0	nl	0
398	United Kingdom	Portfolio investment assets	0	nl	0
399	United Kingdom	Portfolio investment liab., N.I.E.	0	nl	0
400	United Kingdom	Financial account, N.I.E.	0	nl	0
401	United States	Balance of income, value, balance of payments basis \ U.S. dollar	1	nl	2
402	United States	Current account, value in US$ \ U.S. dollar	1	nl	2
403	United States	Government consumption of fixed capital, value \ U.S. dollar	1	l	3
404	United States	Private final consumption expenditure, volume \ U.S. dollar	1	l	3
405	United States	Employment, country specific, variable a \ U.S. dollar	1	l	3

APPENDIX I. Macroeconomic Series (concluded)

Number	Country	Variable Name	Unit Root	Log	Treatment
406	United States	Dependent employment \ U.S. dollar	1	1	3
407	United States	Dependent employment of the business sector \ U.S. dollar	1	1	3
408	United States	Government employment \ U.S. dollar	1	1	3
409	United States	Self-employed \ U.S. dollar	1	1	3
410	United States	Total employment \ U.S. dollar	1	1	3
411	United States	Employment of the business sector \ U.S. dollar	1	1	3
412	United States	Real Effective exchange rate, 2000 = 100, ULC-based	1	1	3
413	United States	Gross domestic product, volume, market prices \ U.S. dollar	1	1	3
414	United States	Private nonresidential fixed capital formation, volume \ U.S. dollar	1	1	3
415	United States	Government fixed capital formation, volume \ U.S. dollar	1	1	3
416	United States	Industrial production \ U.S. dollar	1	1	3
417	United States	Private total fixed capital formation, volume \ U.S. dollar	1	1	3
418	United States	Long-term interest rate on government bonds \ U.S. dollar	1	nl	2
419	United States	Long-term interest rate on corporate bonds \ U.S. dollar	1	nl	2
420	United States	Short-term interest rate \ U.S. dollar	1	nl	2
421	United States	Gross total fixed capital formation, volume \ U.S. dollar	1	1	3
422	United States	Capital stock of the business sector, volume \ U.S. dollar	1	1	3
423	United States	Capital stock, housing, volume \ U.S. dollar	1	1	3
424	United States	Labor force \ U.S. dollar	1	1	3
425	United States	Labor force participation rate \ U.S. dollar	1	nl	2
426	United States	Imports of goods and services, volume, national accounts basis \ U.S. dollar	1	1	3
427	United States	Money supply, narrow definition: base money, M1 or M2 \ U.S. dollar	1	1	3
428	United States	Money supply, broad definition: M2 or M3 \ U.S. dollar	1	1	3
429	United States	Factor income paid abroad, volume, balance of payments basis \ U.S. dollar	1	1	3
430	United States	Labor productivity of the total economy \ U.S. dollar	1	1	3
431	United States	Labor productivity of the business economy \ U.S. dollar	1	1	3
432	United States	Household saving ratio \ U.S. dollar	1	nl	2
433	United States	Current transfers received by households, value \ U.S. dollar	1	1	3
434	United States	Unit labor cost of the total economy \ U.S. dollar	1	1	3
435	United States	Unit labor costs in the business sector \ U.S. dollar	1	1	3
436	United States	Unit labor cost of the manufacturing sector \ U.S. dollar	1	1	3
437	United States	Velocity of money \ U.S. dollar	1	1	3
438	United States	Wages, value \ U.S. dollar	1	1	3
439	United States	Wages of the government sector, value \ U.S. dollar	1	1	3
440	United States	Wage rate of the business sector \ U.S. dollar	1	1	3
441	United States	Compensation rate of government employees \ U.S. dollar	1	1	3
442	United States	Wage rate of the manufacturing sector, hourly earnings \ U.S. dollar	1	1	3
443	United States	Compensation rate of the business sector \ U.S. dollar	1	1	3
444	United States	Compensation of employees, value \ U.S. dollar	1	1	3
445	United States	Exports of goods and services, volume, national accounts basis \ U.S. dollar	1	1	3
446	United States	Factor income from abroad, volume, balance of payments basis \ U.S. dollar	1	1	3
447	United States	Household disposable income, real \ U.S. dollar	1	1	3
448	United States	Property income received by households, value \ U.S. dollar	1	1	3
449	United States	Government current disbursements, value \ U.S. dollar	1	1	3
450	United States	Current disbursements of households, value \ U.S. dollar	1	1	3
451	United States	Government current receipts, value \ U.S. dollar	1	1	3
452	United States	Current receipts of households, value \ U.S. dollar	1	1	3
453	United States	Self-employment income received by households, value \ U.S. dollar	1	1	3
454	United States	Direct investment abroad	1	nl	2
455	United States	Dir. invest. in rep. econ., N.I.E.	1	nl	2
456	United States	Portfolio investment assets	1	nl	2
457	United States	Portfolio investment liab., N.I.E.	1	nl	2
458	United States	Financial account, N.I.E.	1	nl	2
459	United States	Exports prices	1	1	3
460	United States	Imports prices	1	1	3
461	United States	Terms of trade	1	1	3
462	United States	PPI / WPI (index number, 2000=100, AQM, DEC, average)	1	1	3
463	United States	CPI all items city average (index number, 2000=100, AQM, DEC, average)	1	1	3
464	United States	Share prices: industrial (index number, AQM, DEC, average)	1	1	3
465	United States	Cyclical indicators\business climate: consumers confidence\1985 = 100 SA	0	nl	0
466	United States	USA PMI business confidence	0	nl	0
467	United States	Fixed investment in nonresidential construction, volume \ U.S. dollar	0	1	1
468	United States	Private residential fixed capital formation, volume \ U.S. dollar	0	1	1
469	United States	Fixed investment in machinery and equipment, volume \ U.S. dollar	0	1	1
470	United States	Increase in stocks, volume \ U.S. dollar	0	nl	0
471	United States	Government saving(net), value \ U.S. dollar	0	nl	0
472	United States	Household saving, value \ U.S. dollar	0	1	1
473	United States	Unemployment \ U.S. dollar	0	1	1
474	United States	Unemployment rate \ U.S. dollar	0	nl	0
475	United States	Production/rate of capacity utilisat	0	nl	0
476	United States	Other investment assets	0	nl	0
477	United States	Other investment liab., N.I.E.	0	nl	0
478	World	Commodity Food and Beverage Price Index, 1995 = 100, includes Food and	1	1	3
479	World	Crude Oil (petroleum), simple average of three spot prices; Dated Brent, West Texas	1	1	3
480	World	Commodity Metals Price Index, 1995 = 100, includes Copper, Aluminum, Iron Ore,	1	1	3
481	World	Commodity Nonfuel Price Index, 1995 = 100, includes Food and Beverages and	1	1	3
482	World	Commodity Industrial Inputs Price Index, 1995 = 100, includes Agricultural Raw	0	1	1
483	G7 excl. France	Gross domestic product, volume, index number	1	1	3
484	G7 excl. France	Consumer Price Index (SA, 2000=100), index number	1	1	3
485	Euro area excl. France	Gross domestic product, volume, euro	1	1	3
486	Euro area excl. France	Gross domestic product deflator, index number	1	1	3

Nota bene: Integrated of order 0 = 0, 1 = 1, 2 = 2; not integrated of order 1 or 2 = NS; natural log variables = 1; no transformation = nl.
0: no transformation; 1: logarithm; 2: first difference; 3: first difference of logarithm.

References

Altig, D., L.J. Christiano, M. Eichenbaum, and J. Linde, 2002, "Technology Shocks and Aggregate Fluctuations," manuscript.

Anderton, R., F. di Mauro, and F. Moneta, 2004, "Understanding the Impact of the External Dimension of the Euro Area: Trade, Capital Flows and Other International Macroeconomic Linkages," *ECB*, ECB Occasional Paper 12.

Bai, J., and S. Ng, 2002, "Determining the Number of Factors in Approximate Factor Models," *Econometrica*, 70(1), pp. 191–221.

Canova, F., and G. de Nicoló, 2003, "On the Sources of Business Cycles in the G-7," *Journal of International Economics,* 46, pp. 133–66.

Chamberlain, G., 1983, "Funds, Factors, and Diversification in Arbitrage Pricing Models," *Econometrica* 51, pp. 1281–304.

Chamberlain, G., and M. Rothschild, 1983, "Arbitrage, Factor Structure and Mean-Variance Analysis in Large Markets," *Econometrica* 51, pp. 1305–24.

Eickmeier, S., "Business Cycle Transmission from the U.S. to Germany—A Structural Factor Approach," *European Economic Review*, forthcoming.

Eickmeier, S., and J. Breitung, 2006, "How Synchronized are Central East European Economies with the Euro Area? Evidence from a Structural Factor Model," *Journal of Comparative Economics*, 34(3), pp. 538–563.

Eickmeier, S., 2006, "Comovements and Heterogeneity in the Euro Area Analyzed in a Non-stationary Dynamic Factor Model", *Bundesbank*, Discussion Paper, Series 1, 31/2006.

Elliott, G., T.J. Rothenberg, and J. Stock, 1996, "Efficient Tests for an Autoregressive Unit Root," *Econometrica* 64, pp. 813–36.

Fernández-Villaverde, J., J. Rubio-Ramírez, T. J. Sargent, and M.W. Watson, 2005, "A, B, C's (and D)'s for Understanding VARs," NBER Technical Working Papers No. 0308.

Forni, M., M. Hallin, F. Lippi, and L. Reichlin, 2000, "The Generalized Dynamic Factor Model: Identification and Estimation," *The Review of Economics and Statistics* 82(4), pp. 540–54.

Forni, M., D. Giannone, M. Lippi, and L. Reichlin, 2005, "Opening the Black Box: Structural Factor Models with Large Cross-Sections," manuscript.

Geweke, J., 1977, "The Dynamic Factor Analysis of Economic Time Series," in *Latent Variables in Socio-Economic Models;* edited by D.J. Aigner and A.S. Golberger (Amsterdam: North-Holland), p. 19.

Giannone, D., L. Reichlin, and L. Sala, 2002, "Tracking Greenspan: Systematic and Unsystematic Monetary Policy Revised," CEPR Working Paper 3550.

Hansen, L.P. and T.J. Sargent, 1991, "Two Problems in interpreting Vector Autoregressions," in L.P. Hansen and T.J. Sargent, eds., *Rational Expectations Econometrics*, Boulder: Westview, pp. 77–119.

Kabundi, A., 2004, "Estimation of Economic Growth Using Business Survey Data," *International Monetary Fund*, WP/04/69.

Kapetanios, G. and M. Marcellino, 2006, "A Parametric Estimation Method for Dynamic Factor Models of Large Dimensions", *CEPR* Discussion Paper No. 5620, April.

King, R.G., C.I. Plosser, J.H. Stock and M.W. Watson, 1991, "Stochastic Trends and Economic Fluctuations," *American Economic Review*, 83, pp. 819–40.

Kose, M.A., and K. Yi, 2001, "International Trade and Business Cycles: Is Vertical Integration the Missing Link?" *American Economic Association Papers and Proceedings*, 91(2), pp. 371–5.

Kose, M.A., E.S. Prasad, and M.E. Terrones, 2003, "How Does Globalization Affect the Synchronization of Business Cycles?" *American Economic Association Papers and Proceedings*, 93(2), pp. 57–62.

Kose, M.A., C. Otrok, and C.H. Whiteman, 2003, "International Business Cycles: World, Region, and Country-Specific Factors," *American Economic Review*, 93(4), pp. 1216–39.

Kwiatowski, D., P.C.B. Phillips, P. Schmidt, and Y. Shin, 1992, "Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root?" *Journal of Econometrics*, 54, pp.159–78.

Imbs, J., 2004, "Trade, Finance, Specialization and Synchronization," *Review of Economics and Statistics*, 86(3), pp. 723–34.

IMF, 2001, "World Economic Outlook," *International Monetary Fund*, October, pp. 65–79.

IMF, 2004, "GEM: A New International Macroeconomic Model," International Monetary Fund.

Lumsdaine, R.L. and E.S. Prasad, 2003, "Identifying the Common Component in International Economic Fluctuations: A New Approach," *The Economic Journal*, 113(484), pp. 101–27.

Montfort, A., J.P. Rennee, R. Rüffer, and G. Vitale, 2004, "Is Economic Activity in the G7 Synchronized? Common Shocks Versus Spillover Effects," *Journal of International Economics*, 40, pp. 85–104.

Nadal De Simone, F., 2003, "Common and Idiosyncratic Components in Real Output: Further International Evidence," International Monetary Fund WP/02/229.

Nadal De Simone, F., 2005, "Recent French Inflation Behavior: Is It any Different from the Euro Area's?" International Monetary Fund, IMF Country Report 05/397.

Nadal De Simone, F., 2007, "Asymmetry in Business Fluctuations: International Evidence on Friedman's Plucking Model," J*ournal of International Money and Finance*, 26(1), pp. 64-85.

Peersman, G., 2003, "What Caused the Early Millennium Slowdown? Evidence Based on Vector Autoregressions," *Journal of Applied Econometrics*, 20, pp. 185–207.

Sargent, T.J., and C.A. Sims, 1977, "Business Cycle Modeling without Pretending to have too Much a Priori Economic Theory," in *New Methods in Business Research,* edited by C.A. Sims (Minneapolis: Federal Reserve Bank of Minneapolis).

Sims, C. A., 1992, "Interpreting the Macroeconomic Time Series Facts. The Effects of Monetary Policy", *European Economic Review*, 36, pp. 975-1011.

Sims, C.A. and T. Zha, 1999, "Error Bands for Impulse Responses," *Econometrica* 67(5), pp. 1113–55.

Stock, J.H., and M.H. Watson, 1998, "Diffusion Indexes," NBER Working Paper 6702.

Stock, J.H., and M.H. Watson, 2002, "Macroeconomic Forecasting Using Diffusion Indexes," *Journal of Business & Economic Statistics*, 20(2), pp. 147–162.

Uhlig, H., 2003, "What Moves Real GNP?" manuscript.