DO INSTITUTIONAL CHANGES AFFECT BUSINESS CYCLES?

Do institutional changes affect business cycles?

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Introduction

The literature contains abundant evidence, supported by various methodologies, that economic activity shows some synchrony across the developed countries [see Del Negro and Otrok (2003), Giannone and Reichlin (2006) and Canova, Ciccarelli and Ortega (2007), among others]. There is also increasing evidence that the cyclical characteristics of real economic variables have been changing over time. Several factors lie behind these developments. Firstly, structural changes may have taken place that have altered shock transmission mechanisms, both within and across borders. For example, the Great Inflation of the 1970s and the greater subsequent macroeconomic stability in United States and in other developed countries are usually explained by changes in the priorities or preferences of the monetary authorities. Secondly, the shocks that affect economies have progressively changed, in terms both of their characteristics and their frequency. For instance, Helbing and Bayoumi (2003) find evidence that common shocks across countries have been more usual in recent years than previously.[2] Finally, a third cause that may alter the nature of cyclical fluctuations are institutional changes. Despite the major institutional transformations witnessed over recent decades, particularly in Europe, the literature on this area is very scant.

This article summarises a more extensive paper that researches the effects that institutional changes may have on business cycle dynamics. It uses in this connection the recent European experience and, specifically, it analyses the impact in Europe of three developments related to the Economic and Monetary Union (EMU): the entry into force of the Maastricht Treaty in 1993, the creation of the European Central Bank in 1998 and the launch of euro-denominated banknotes and coins in 2002. To have a broad time perspective, the period analysed runs from 1970 Q1 to 2007 Q3. As to geographical scope, the cycle of ten European countries is analysed, seven of them part of the euro area (Germany, France, Italy, Spain, Belgium, the Netherlands and Finland) and three outside it (the United Kingdom, Denmark and Sweden).

To this end, and drawing on the estimation of an empirical model, a study is made of the changes over time of indicators of the common European cycle and of the specific national cycles, and also of their characteristics in different sub-samples. Further, forecasting exercises are performed taking as a starting point the date of the entry into force of each of the institutional changes envisaged and, finally, the dynamics of the variables in response to shocks are assessed.

The empirical model

The estimated empirical model consists of a panel VAR, along the lines of that proposed in Canova and Ciccarelli (2004). This econometric framework is particularly suited to responding to the questions raised, since it can be applied to large-scale databases and it allows for the specification of different dynamics for each series, interdependencies among countries and variables, and changes over time in these interdependencies.

Essentially, the model expresses the quarter-on-quarter growth rate of the variable y of country i as a function of the past of that variable, of all the other variables of that country deemed

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1. This article is a summary of Banco de España Working Paper 0921, by Fabio Canova, Matteo Ciccarelli and Eva Ortega: *Do institutional changes affect business cycles? Evidence from Europe.* **2.** Other authors identify a reduction in their volatility, which they attribute to the decline in inflation volatility and the greater persistence of cycles in the United States [Canova and Gambetti (2009)] or to a greater correlation between the business cycles of different countries [Stock and Watson (2003)].

relevant and of the other countries (all represented by Yt–1), and also of the present and past of a limited set of exogenous variables (Wt)[3] and of an error term. The variables analysed for each of these countries are GDP, total employment, industrial production, private consumption and productive investment. For each of these an equation is estimated as follows:

$$y_{it} = D_{it}(L)\, Y_{t-1} + F_{it}(L)\, W_t + e_{it}$$

This model is useful for studying the effects of institutional changes on European business cycles for three main reasons. First, because the coefficients of each equation may vary over time, which allows the structural changes (linked to changes in the institutional framework) to be isolated and separated from the gradual transformations that may occur. Further, the fact that specific coefficients are estimated for each variable obviates the biases that might arise due to not considering sufficiently the possibility of such variables behaving heterogeneously. Finally, by allowing the dynamic interaction of each series with other variables and countries, the model envisages a great variety of possible interdependencies, which is optimal for capturing appropriately the effect of institutional changes that go beyond the national arena.

To resolve the problem of the wide range of parameters that must be estimated,[4] the technique described in Canova, Ciccarelli and Ortega (2007) was used. This technique decomposes the vector of coefficients into four mutually orthogonal components, which allows for isolation of: a) the cyclical movements common to all the variables and countries; b) those of a national nature; c) those specific to a single variable in the different countries; and d) those due to world variables, exogenous to Europe. In this way, the change in each variable in a specific country can be expressed as a sum of four indicators: that of the common European cycle, that of the national cycle, that specific to the variable considered and that determined by exogenous variables. The cycle indicators thus obtained are observable and follow a more subdued course than the source variables, so the medium-term movements associated with the business cycle can be better captured.[5]

Changes over time in the indicators of the common European cycle and the national cycles

The common European cycle, estimated with the above methodology for the aggregate of the ten European countries analysed, follows a similar pattern to that of euro area GDP (see Chart 1).[6] Chart 2 depicts the median of the estimated values for the national cycles of the main countries analysed. As can be seen, although they are heterogeneous in the time profile, the amplitude of the cycles and the duration of the fluctuations become similar over time.

These impressions are confirmed when various statistics summarising some of the cycle characteristics estimated for the sample period and for several sub-samples are calculated. In

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3. The exogenous variables considered are: non-energy commodities prices, oil prices, world trade and GDP, US interest rates and the New York Stock Exchange index. The details on the quarterly data used may be consulted in the paper by Canova, Ciccarelli and Ortega (2009) that acts as a basis for this article.   **4.** Taking a sole lag for each endogenous variable and for the exogenous ones, each of the 50 equations of the system (five variables per country, ten countries) has 56 coefficients in each of the 151 quarters of the sample period 1970 Q1-2007 Q3. That makes for a total of 50 x 56 x 151 coefficients that have to be estimated.   **5.** The estimation technique used is the Bayesian method, which requires the definition of a priori general distributions for the parameters, combining them with the sample likelihood function. For simplicity's sake, we assume that the time-variant parameters to be estimated follow a random walk. This model specification has been shown to be that offering the best estimation properties. Specifically, these are better than in a similar model which does not allow specific cycles for each country, for each variable or for the exogenous variables. It is also preferable to a model where, instead of a single common cycle, two differentiated common indicators are estimated, one for the euro area countries and the other for the United Kingdom, Denmark and Sweden.   **6.** Chart 1 shows the median of the values estimated and the limits of the 68% confidence interval. If the a posteriori distributions were normal, that interval would correspond to the mean plus/minus one standard deviation.
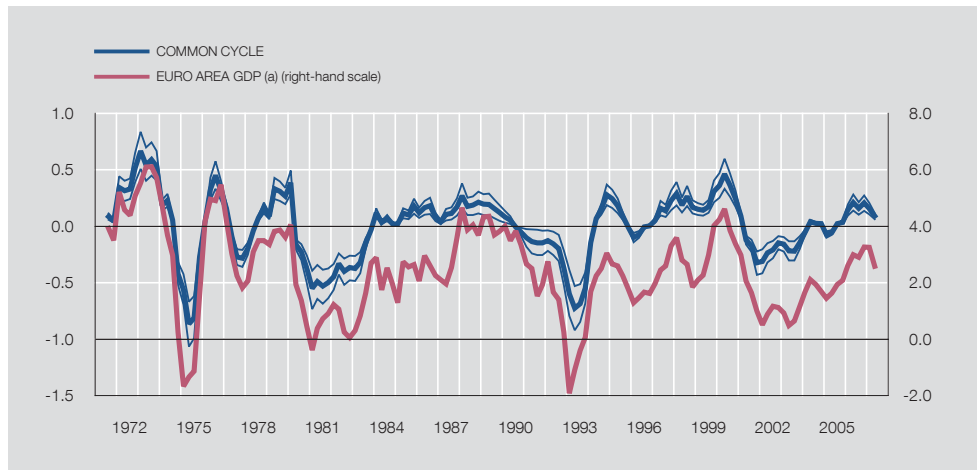
SOURCES: ECB and Banco de España.

a. Deviation of the annualised quarter-on-quarter growth rate from its average in the period from 1970 Q1 to 2007 Q3. This same transformation was also applied in the series used to estimate the common and national cycles.

particular, Table 1 offers information on volatility, persistence and degree of synchrony with the common cycle, respectively approximated using standard deviation, the autocorrelation coefficient and the correlation coefficient. As the first two columns of the table show, euro area GDP and the common cycle are highly correlated and have similar persistence. Note, however, that the area's GDP is more volatile than the common European cycle. It can also be shown that the correlation between the cycle estimated for each country and the common cycle increases over time in most cases. Further, the volatility of the various estimated indicators declines significantly in the mid-1990s and, more markedly, in the final years of the sample (with the exception of Germany). In some cases, this diminished volatility is accompanied by an increase in the persistence of fluctuations.

These changes in cyclical characteristics square reasonably well with the results in the literature. In accordance with Canova, Ciccarelli and Ortega (2007), the reinforcement of common aspects in the cyclical fluctuations in Europe should be chiefly attributed to the fact that there has been an intensification of overall oscillations across countries over time. On the other hand, it should not be interpreted that national cycles are disappearing or that they were less synchronised in past decades, with those of some countries lagging those of others (indeed, as Table 1 shows, the largest correlation between the indicators of national cycles and the indicator of the common European cycle is the coincident correlation in virtually all cases and sub-samples, but this correlation has been increasing throughout the period analysed).

Institutional changes and real fluctuations

As noted above, the estimated model can be used to assess the impact on European cycles of the institutional changes linked to the creation of the euro area. To do this, we compared the characteristics of the indicators of the common European cycle and of the specific national cycles in the defined sub-samples, taking as the cut-off point the entry into force of the three aforementioned institutional changes.[7] Subsequently, we conduct-

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7. 1993 Q4 is used as the cut-off for assessing the impact of the Maastricht Treaty, which, although signed on February 1992, did not come into effect until November 1993. The European Central Bank was created on 1 June 1998, so the cut-off is 1998 Q3. Lastly, the cut-off taken for the introduction of euro banknotes and coins is 2002 Q1, since they were introduced on 1 January of that year.

CHART 2
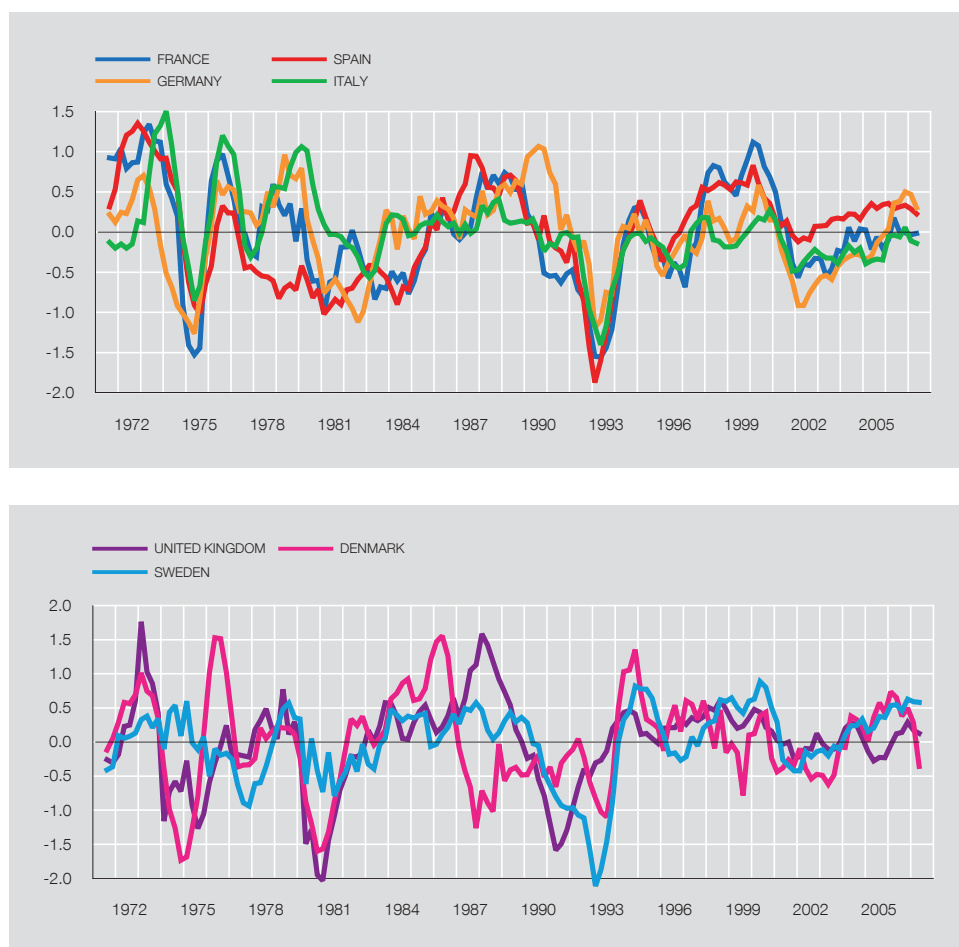
SOURCE: Banco de España.

ed exercises to check whether the institutional changes caused structural changes which invalidate the macroeconomic forecasts made with the information available up to the starting point of the changes or whether they altered the shock transmission mechanisms.

Table 1 shows that from 1993 the standard deviations decreased and the maximum correlations increased for the various European countries considered. However, an examination of the results for the period from 1985 Q3 to 2007 Q3 shows that the bulk of these changes had occurred previously, in the mid-1980s. Moreover, there does not seem to be evidence of changes in the properties of the cycle indicators in the post-Maastricht, post-ECB or post-euro changeover samples, or of changes in the dynamics of the national business cycles of the future euro area members and of the other countries. Although volatilities progressively decreased over the course of this period, the correlations with the common cycle scarcely changed or changed only moderately.

Another way of identifying the possible impact of institutional changes on cycles in Europe is to assess whether the behaviour of the variables studied for European countries was very different, in each of the stages analysed, from that which would have been predicted under the estimated model using only the information available at each point in time. The results of this exercise indicate that the five-year predictions under models estimated in this way largely contain the values subsequently observed in the three

TABLE 1

	COMMON CYCLE	EURO AREA GDP	DE	FR	IT	ES	UK	DK	SE
FULL SAMPLE: 1971 Q1 to 2007 Q3									
Volatility (a)	2.8	15.7	5.2	6.3	4.6	6.1	6.3	6.4	5.4
Autocorrelation (b)	0.89	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Correlation with common cycle (c)		0.90 (-1)	0.73 (0)	0.84 (0)	0.66 (1)	0.74 (0)	0.60 (0)	0.63 (-1)	0.64 (0)
1985 Q3 to 2007 Q3									
Volatility (a)	2.2	12.3	4.7	5.7	3.2	5.1	5.4	6.0	6.0
Autocorrelation (b)	0.91	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9
Correlation with common cycle (c)		0.86 (-1)	0.69 (0)	0.88 (0)	0.84 (0)	0.82 (-1)	0.59 (-2)	0.45 (-1)	0.86 (0)
Pre-Maastricht: 1971 Q1 to 1993 Q3									
Volatility (a)	3.2	18.2	5.8	6.9	5.3	7.1	7.8	7.7	5.6
Autocorrelation (b)	0.88	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Correlation with common cycle (c)		0.92 (-1)	0.73 (0)	0.84 (0)	0.70 (1)	0.74 (0)	0.60 (0)	0.61 (-1)	0.64 (0)
Post-Maastricht:1993 Q4 to 2007 Q3									
Volatility (a)	2.2	9.9	3.8	5.3	2.4	3.6	2.2	4.9	4.5
Autocorrelation (b)	0.89	0.9	0.9	0.9	0.8	0.9	0.8	0.7	0.9
Correlation with common cycle (c)		0.93 (-1)	0.86 (0)	0.85 (0)	0.86 (0)	0.80 (0)	0.68 (-1)	0.62 (-1)	0.89 (0)
Post-ECB creation: 1998 Q3 to 2007 Q3									
Volatility (a)	2.0	10.7	4.1	4.8	1.9	2.3	2.3	4.0	3.6
Autocorrelation (b)	0.91	0.9	0.9	0.9	0.8	0.9	0.8	0.7	0.9
Correlation with common cycle (c)		0.93 (-1)	0.91 (0)	0.86 (0)	0.85 (1)	0.90 (-1)	0.75 (0)	0.52 (0)	0.95 (0)
Post-euro changeover: 2002 Q1 to 2007 Q3									
Volatility (a)	1.7	8.6	4.3	2.1	1.4	1.5	1.8	4.3	3.3
Autocorrelation (b)	0.93	0.9	1.0	0.7	0.7	0.9	0.7	0.8	0.9
Correlation with common cycle (c)		0.96 (-1)	0.95 (1)	0.88 (0)	0.85 (0)	0.91 (-1)	0.58 (0)	0.87 (-1)	0.97 (0)

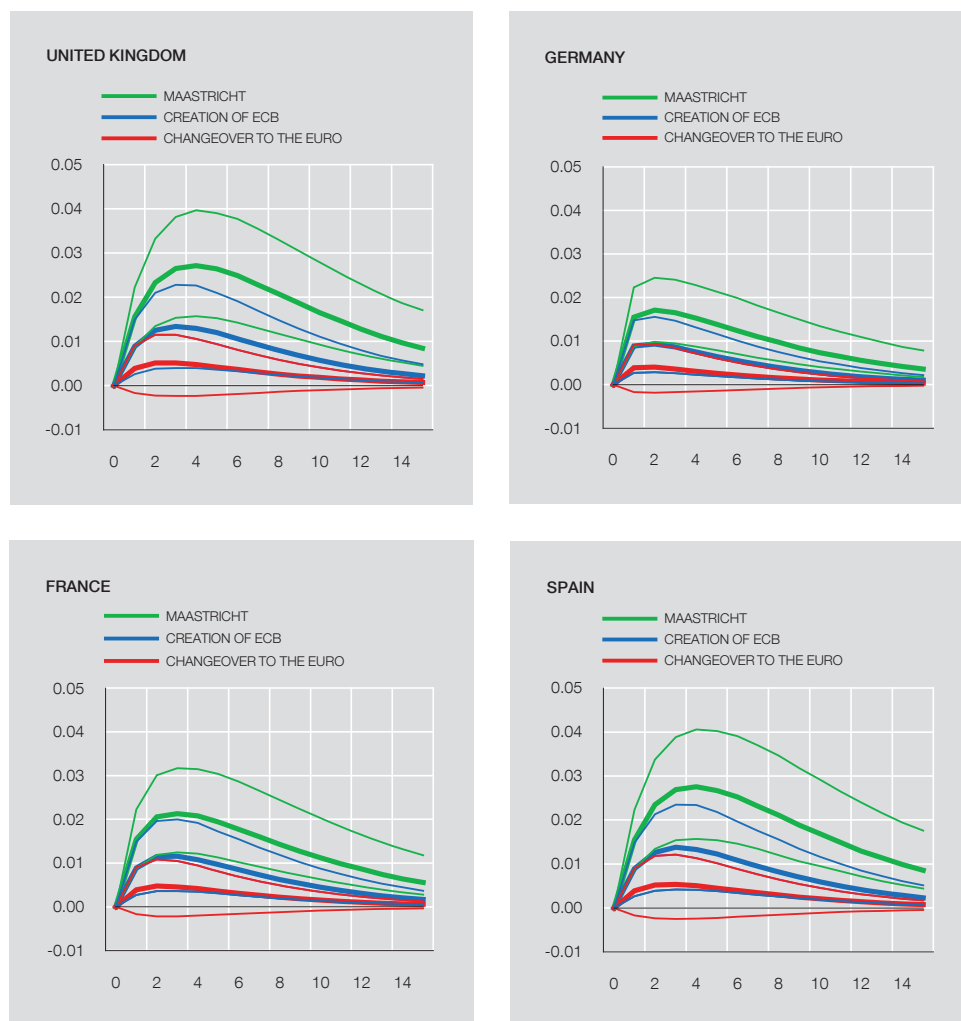SOURCE: Banco de España.

a. Measured as standard deviation.
b. Measured as first-order autoregressive coefficient.
c. Measured as the largest correlation with the common cycle; the lag is given in brackets [e.g. (-1) denotes a lead of one quarter relative to the common cycle].

cases, for most of the variables, countries and prediction horizons.[8] It should be noted that the capacity of the estimated model to predict the future behaviour of the non-euro area countries increases with time. This can be interpreted as meaning that developments in the euro area are becoming increasingly important when it comes to predicting the behaviour of the other European countries and that it is therefore most appropriate to use a model which includes interaction across countries, such as that employed here.

The above results seem to indicate that there have been no identifiable structural changes in the characteristics of cycles in Europe as a result of changes in institutional arrangements. It is, however, of interest to analyse to what extent there may have been changes in the transmission of some shocks. Chart 3 shows the effect of a rise in US interest rates[9] on the GDP of various countries, using the estimated model with information up to 1993 Q4, 1998 Q3 and 2002 Q1. The thick lines are the average responses and the thin lines are the 90% confidence intervals of the a posteriori distribution of these responses. To summarise the data, only some representative countries are shown.

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8. See Canova, Ciccarelli and Ortega (2009) for further details on these results.   **9.** The size of the interest rate increase is that equivalent to one standard deviation in this series for the whole of the period from 1970 Q1 to 2007 Q3.

CHART 3

UNITED KINGDOM
- MAASTRICHT
- CREATION OF ECB
- CHANGEOVER TO THE EURO

GERMANY
- MAASTRICHT
- CREATION OF ECB
- CHANGEOVER TO THE EURO

FRANCE
- MAASTRICHT
- CREATION OF ECB
- CHANGEOVER TO THE EURO

SPAIN
- MAASTRICHT
- CREATION OF ECB
- CHANGEOVER TO THE EURO

SOURCE: Banco de España.

The responses are qualitatively similar in the different stages considered and across the different countries. When interest rates rise in the United States, the dollar appreciates and the consequent greater price competitiveness in Europe stimulates a mild increase in the GDP growth rate for a few quarters. However, according to these estimates, the size of this response has been decreasing over time, with some convergence between countries being observed. The same occurs for other shocks, so it seems that the transmission of shocks has been becoming increasingly similar for the countries now forming the euro area and also, albeit with a somewhat greater lag, for the other European countries.

To conclude, the exercises conducted show that the characteristics of the common European cycle and the national cycles have been changing over time, and there is now less volatility and greater uniformity between national cycles and the European cycle. The evidence found is consistent with the argument that, since the mid-1980s, there has been a cyclical convergence in Europe, probably due to a greater synchrony of the shocks to European economies. This process of convergence began prior to the inception of the euro area, which seems reasonable, since numerous European countries shared a system of quasi-fixed exchange rates prior to 1999, and there was growing economic policy coordination in the convergence stage of the run-up to the euro area. Also, as would be expected, the institutional changes associated with the creation of the euro area have had a gradual effect on the fluctuations of real

variables, although it is not possible to identify a precise moment of structural change. Lastly, national idiosyncrasies are less important than some decades ago, although they continue to be present, and business cycles are more similar between countries than in the past.

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