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THE CHARACTERISTICS OF BUSINESS CYCLES IN SELECTED EUROPEAN EMERGING MARKET ECONOMIES

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Abstract

This paper analyses the business cycles of selected European emerging market economies (EME) in terms of their statistical properties and degree of synchronization with the euro area, and discusses the associated policy implications. The evidence suggests that in these economies cyclical fluctuations are wider and more frequent than in the euro area, that there is moderate consumption smoothing, and that technological shocks and labour hoarding are driving labour-market dynamics. The macroeconomic policy stance is not significantly countercyclical. Furthermore, the degree of synchronization of domestic business cycles with the business cycle of the euro area is weak in all the EME except Hungary and Poland.

I. Introduction

This paper seeks to examine the business cycles of a number of European emerging market economies (EME) according to two dimensions. The first dimension concerns the structure of business cycles in terms of persistence, volatility and cross-correlations of cyclical fluctuations of output and other main macroeconomic variables. Thus it compares the statistical properties of cyclical fluctuations in the EME to those of a benchmark economy: the euro area, as well as some large individual countries of western Europe. The second dimension is the correlation of business cycles between the EME and the euro area.

This type of analysis is important for various reasons. First of all, understanding cyclical fluctuations is crucial to macroeconomic policy-making. Large cyclical swings might call for stabilization over and above what is achieved by automatic stabilizers, especially in emerging and developing market economies, where domestic financial markets are relatively less developed and a larger segment of the population is at risk of poverty. In this respect, the analysis of business cycles is not only important for monetary and fiscal policy-making, but also for the design of social welfare systems and labour-market policies. Furthermore, the costs and benefits of deep regional economic integration, as currently pursued by the core group of EME investigated in this study, will depend to a large extent on the similarities of their business cycles to the business cycles of the western members of the European Union (EU). An assessment of similarities and dissimilarities then requires an analysis of cross-correlations of cyclical fluctuations of macroeconomic variables in a country as well as the correlations of cycles across countries.

While the literature on business cycle analysis is vast, until recently relatively little empirical evidence was available on the EME. The short period of time since the end of the communist era limited the application of the statistical tool generally used in the literature on business cycles. Moreover, the immediate aftermath of the collapse of communism was marked by transformational recessions, signifying sharp output losses due to changes in the economic system. Thus, including these early years in the sample would have created problems in interpretation of the results. At the same time, however, excluding transformational recessions would imply a further reduction in the

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available string of data. Nevertheless, in the past few years a number of studies have tried to characterize cyclical fluctuations in emerging market economies.[1]

The main innovations of this paper relative to the earlier body of research are summarized as follows. First, most of the existing papers consider only one of the two dimensions of business cycle characteristics. They look at persistence, volatility and cross-correlations of variables within a country without studying the cross-country correlations or vice-versa. This paper combines the two aspects, hence allowing for a more complete comparison between the EME cycles and those of the euro area. Second, because of the peculiarities of the EME economic conditions, it is important to have a benchmark to compare and assess the statistical properties of their business cycles. Other countries at the same stage of economic development would certainly provide a possible benchmark. However, because most of the emerging market economies are undergoing a process of regional integration, it was considered more appropriate to choose the euro area aggregate as the primary benchmark. Identifying the characteristics of the business cycle of the euro area aggregate is in itself an innovative element of this paper. Indeed, most business cycle analyses in western Europe have focused on individual countries rather than on the aggregate. However, to reinforce the findings, the largest EU members are also considered individually as alternative benchmarks. Third, the paper seeks to deal with the problem of transformational recessions by applying a simple statistical criterion. The approach generally taken in the literature is either to disregard the existence of transformational recessions and treat them as any other observation in the sample,[2] or to cut the first few years off the sample. The first approach renders the interpretation of results rather problematic, since transformational recessions are clearly outliers and their inclusion in a statistical analysis tends to bias estimates. The second approach is probably more appropriate, but requires the identification of a cut-off point; for this, most studies have made an arbitrary choice, omitting the years until 1993 or 1994.

Usually, with this approach, the same cut-off point is applied to all the emerging market economies. In this paper, instead, the cut-off varies by country through the application of a criterion based on the relative size of the cyclical swings. While the adoption of this criterion is admittedly simplistic, it points to a possible direction in the statistical treatment of transformational recessions for the purpose of business cycle analysis. Finally, with respect to the choice of countries, the paper looks at the four central European countries (the Czech Republic, Hungary, Poland and Slovakia) plus the candidate accession countries (Bulgaria, Croatia and Romania) and Russia. This last addition represents a departure from several other contributions in the field, and is motivated by the fact that Russia is a pivotal player in the region, even though at this stage there are no prospects of its acceding to the EU. However, since business cycle analysis in Russia is difficult because of the limited availability and reliability of data, results for this country ought to be treated with extreme caution.

The main findings of the paper can be summarized in the form of a number of stylized facts. Business cycles in the EME are more volatile and frequent than in the euro area. Private consumption is procyclical and quite volatile, but this volatility relative to the volatility of GDP is no higher than in the euro area. Investment is also strongly procyclical. Net exports are countercyclical and are positively correlated with the output cycles in the euro area. Government consumption is acyclical on average (though procyclical in several countries), and more sharply erratic than in the euro area. Employment is mildly procyclical in the central European economies and acyclical in the others, while labour productivity is procyclical in most of the EME. Taken together, the cyclical pattern of employment and labour productivity seems to suggest that labour-market dynamics are driven by technological shocks, but in the central European economies labour hoarding is also an important factor. This interpretation is supported to some extent by the finding that prices and inflation are not procyclical (with the notable

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[1] See for instance, P. Benczur and A. Ratfai, *Economic Fluctuations in Central and Eastern Europe. The Facts*, Centre for Economic Policy Research (CEPR) Discussion Paper, No. 4846 (London), January 2005; Z. Darvas and G. Szapary, *Business Cycle Synchronization in the Enlarged EU*, Centre for Economic Policy Research (CEPR) Discussion Paper, No. 5179 (London), August 2005; J. Fidrmuc and I. Korhonen, "A meta-analysis of business cycle correlations between the euro area, CEECs and SEECs. What do we know?", National Bank of Austria, *Focus on European Economic Integration*, 2/04 (Vienna), 2004, pp. 76-94, and references therein.

[2] M. Frenkel, C. Nickel and G. Schmidt, *Some Shocking Aspects of EMU Enlargement*, Deutsche Bank, Research Note 99-4 (Frankfurt am Main), 1999.

exception of Poland). The correlation of business fluctuations of the EME with the euro area is generally low, suggesting a considerable degree of asynchronization. However, Poland and Hungary stand out as two countries with a positive and statistically significant correlation of their business cycles with that of the euro area aggregate.

The rest of the study is organized as follows: section II describes the empirical methodology used; section III presents the results for the benchmark; section IV discusses the results for the EME, based on common, stylized facts; finally, section V summarizes the results and the policy implications, and provides some directions for future research. The appendices provide details of the data set and of country-specific results that are not reported in section IV.

II. Methodology and variables for the analysis of cyclical fluctuations

The study of business cycles first requires a decomposition of time-series into a trend and a cyclical component. This section reviews the methodology applied, and introduces the macroeconomic variables and summary statistics used to describe the statistical properties of cyclical fluctuations.

A. Trend-cycle decomposition

Consider a general multiplicative model expressing the generic macroeconomic variable Y in terms of a trend component T, a cyclical component C, a seasonal component S and an error term ε:

$$Y_t = T_t C_t S_t \varepsilon_t \quad (1)$$

where t denotes time. This paper makes use of quarterly, seasonally adjusted data.[3] Moreover, following the standard approach in the literature, the stochastic term ε is considered small enough to be included in the cyclical component. Thus, after taking logs, the reference model is reduced to:

$$y_t = \tau_t + c_t \quad (2)$$

The aim of business cycle analysis is to study the behaviour of the cyclical component c. Therefore, given the time-series y, the methodological issue is how to separate the two components, trend and cycle. The traditional approach[4] characterizes macroeconomic time-series as stationary stochastic processes about a deterministic function (i.e. polynomial, exponential or logarithmic) of time. In its simplest form this implies:

$$y_t = \alpha + \beta t + c_t \quad (3)$$

where the stationary component can be represented by an ARMA process. This representation has some evident drawbacks. If the trend is a deterministic function of time, then the evolution of the time-series in the long-term is equally deterministic, with the unlikely implication that forecast margins of error are constant as the time-horizon stretches. Furthermore, in the setting of equation (3), any non-transitory movement is identified as a growth component, without any possible link to cyclical dynamics. Finally, if the trend component were stochastic, then a specification based on a deterministic trend would lead to largely incorrect inferences.

Following the analysis of Nelson and King[5] and Nelson and Plosser,[6] the more recent empirical literature has moved towards a representation of macroeconomic time-series as integrated stochastic

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[3] The original data set contains non-seasonally adjusted data for all countries and all variables. Seasonal adjustment is undertaken using the United States Census Bureau's X12 seasonal adjustment program. (Quantitative Micro Software (QMS), *EViews 5 User's Guide* Irvine, CA, 2004). Application of this procedure leads to a rejection of the null hypothesis that the series contains a seasonal component for all variables in all countries.

[4] W. Fellner, *Trends and Cycles in Economic Activity: An Introduction to Problems of Economic Growth* (New York, Holt, 1956).

[5] C. Nelson and H. King, "Spurious periodicity in inappropriately detrended time series", *Econometrica*, Vol. 49, 1981, pp. 741-751.

[6] C. Nelson and C. Plosser, "Trends and random walks in macroeconomic time series: some evidence and implication", *Journal of Monetary Economics*, Vol. 10, 1982, pp. 139-162.

processes. Under the hypothesis that the series is in fact integrated to the order of 1, the following representation for decomposition of the trend-cycle can be proposed:[7]

$$y_t = \tau_t + c_t \tag{4a}$$

$$Var(\Delta\tau_t) > 0 \quad \text{and} \quad Var(c_t) > 0 \tag{4b}$$

$$\tau_t \sim I(1) \quad \text{and} \quad c_t \sim I(0) \tag{4c}$$

The representation summarized by the three equations (4a), (4b) and (4c) has a straightforward interpretation as a problem of signal extraction; given the original observations on the series *y*, the problem is to estimate the parameters of the two unobservable stochastic processes τ and *c*. Several solutions to this signal extraction problem have been advanced in the literature.

Beveridge and Nelson[8] propose a decomposition where the trend component is a random walk, the first differences of which are perfectly correlated with the cyclical component. In this way, the problem of identification of two stochastic components of different nature is circumvented: only one component is identified and the other is determined residually. On the one hand, this approach does not require imposing a priori restrictions on the structure of the two stochastic components. On the other hand, it does not allow tracing back the movements in the original series to either one or the other component. Harvey[9] and Watson[10] employ an unobservable components structural model. Here, the trend component is a random walk, the first differences of which are orthogonal to the cyclical component at any lag. The estimation of the parameters of the two stochastic components can then be done within the framework of a space-state model, with the likelihood function maximized through a Kalman filter procedure.

Hodrick and Prescott[11] suggest identifying the cyclical component of the series as deviations from a trend obtained from a Whittaker-Henderson filter applied to the original series. With this procedure, which commonly goes under the name of the Hodrick-Prescott (HP) filter, the trend is represented by the sequence τ_t, which solves the following minimization problem:

$$\min_{[\tau_t]_{t=1}^{T}} \sum_{t=1}^{T} (y_t - \tau_t)^2 \tag{5}$$

$$\text{s.t.} \quad \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \leq \mu \tag{6}$$

In other words, the HP filter computes the series τ of *y* by minimizing the variance of *y* around τ, subject to a penalty that constrains the second difference of τ. The smaller the parameter μ, the smoother the series τ will be.

The HP filter has become rather popular in the literature, even though it is subject to some criticism. First of all, it is argued that the choice of the smoothness parameter is arbitrary. Furthermore, it has been shown that the HP filter tends to suppress high- and low-frequency cycles and

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[7] D. Quah, "The relative importance of permanent and transitory components: identification and some theoretical bounds", *Econometrica*, Vol. 60, 1992, pp. 107-118.

[8] S. Beveridge and C. Nelson, "A new approach to decomposition of economic time series into permanent and transitory components with particular attention to measurement of business", *Journal of Monetary Economics*, Vol. 7, 1981, pp. 151-174.

[9] A. Harvey, "Trends and cycles in macroeconomic time series", *Journal of Business and Economic Statistics*, Vol. 3, 1985, pp. 216-227.

[10] M. Watson, "Univariate detrending methods with stochastic trends", *Journal of Monetary Economics*, Vol. 18, 1986, pp. 49-75.

[11] R. Hodrick and E. Prescott, "Post-war US business cycles: an empirical investigation", *Journal of Money, Credit and Banking*, Vol. 29, No. 1, 1997, pp. 1-16.

amplifies business cycle frequencies.[12] Finally, the filter is unstable at the end and the beginning of the sample, and its treatment of structural breaks might be unsatisfactory, as these are smoothed out in previous and subsequent periods. Some of the weaknesses of the HP filter[13] can be addressed through the use of an alternative filtering procedure proposed by Baxter and King,[14] known in short as the BP filter. This is a linear filter that takes weighted moving averages of the data where cycles occurring within a band, presented by a specified lower and upper bound, are passed through and the remaining cycles are filtered out. Hence, the cyclical component is filtered on the basis of a specified range for its duration.

Most of the analysis of business cycles in the EME makes use of the HP filter, possibly because the BP filter involves a loss of observation at the two ends of the sample and therefore its application is more problematic when the data set has a relatively short time-series dimension. To make results as comparable as possible to the rest of the literature, this paper uses the HP filter. However, the BP filter was also applied to check the sensitivity of the results to the detrending methodology, and they turned out to be qualitatively similar.[15]

B. Macroeconomic variables for the analysis of business cycles

Measuring business cycles requires choosing a reference indicator; that is, the macroeconomic variable that is the most representative of aggregate economic activity. Real aggregate GDP appears to be the obvious candidate. It certainly provides the most comprehensive coverage of all sectors of the economy, and is generally consistent with both the theoretical formalization of business cycles and the practical aspect of economic policy-making. However, GDP statistics are sometimes published with relatively long time lags. Moreover, because different components of aggregate demand demonstrate different cyclical behaviour, concerns arise as to whether GDP is an effective representation of economic cycles. For these reasons, industrial production has sometimes been used as an alternative reference indicator. Some studies have also made use of a composite reference indicator, obtained by aggregating different variables. In this paper, *real aggregate GDP* is used as the key reference, while some summary statistics for *industrial production* are also presented. In fact, the correlation between GDP and industrial production turns out to be sufficiently high as to ensure that the qualitative nature of the results obtained with GDP as the reference would not change if industrial production were used in its place. The idea of combining these two variables, and possibly some others, to construct a composite reference indicator is rejected, as it would add an additional degree of discretion in the choice of the aggregation method.

The choice of the other macroeconomic variables has been determined by both theoretical and practical considerations. On the theoretical side, those variables need to be considered that provide a synthetic, quantitative representation of the link between shocks (real or nominal) and the economy. A generic list would therefore include the components of aggregate demand, labour-market and productivity indicators, prices, wages, exchange rates and interest rates (or related monetary policy measures), as well as fiscal policy measures (possibly in addition to government consumption, which already figures as a component of aggregate demand). On the practical side, especially when studying emerging market economies, the choice is constrained by the limited availability and reliability of data. Taking this constraint into account, and broadly in line with the rest of the literature, this papers looks at the following variables. Aggregate demand variables are *private consumption*, *investment*, *government consumption*, *imports* and *exports* (and the difference between exports and imports, namely *net exports*). Labour-market dynamics are captured by *employment* and *labour productivity*.

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[12] T. Cogley, and J. Nasson, "Effects of the Hodrik-Prescott filter on trend and difference stationary time-series: implications for business cycle research", *Journal of Economic Dynamics and Control*, Vol. 19, 1995, pp. 253-278.

[13] Albeit not all of them, and, in particular, not the problem of instability at the beginning and end of the sample.

[14] M. Baxter and R. King, "Measuring business cycles: approximate band-pass filters for economic time series", *Review of Economics and Statistics*, Vol. 81, 1999, pp. 575-593.

[15] The full set of results based on the application of the BP filter is available from the author upon request.

With respect to prices and monetary variables, the analysis includes both the level and the growth rate of the *consumer price index* and the *real interest rate* (defined as the nominal, short-term interest rate net of inflation). Few of the EME had any reliable data on wages. Similarly, data on inventories and stocks were of dubious quality (though some statistics for a variable representing stocks are available from the author upon request), while data on other fiscal variables were scarce. Some results are, nevertheless, reported for central governments' *fiscal balance*. However, care should be taken in interpreting the summary statistics and the cross-correlations for this variable, because in this context it represents the non-stationary component of a deficit and is therefore different from the cyclically adjusted balance. Further details on sources and definitions of variables are given in appendix 1.

C. Statistics for the analysis of business cycles

The decomposition methodology described in section A above is applied to the variables listed in section B. The detrended series thus obtained are then used for the characterization of business cycles along two dimensions.

The first dimension concerns the statistical properties of cyclical fluctuations in the temporal domain. In line with the literature,[16] two summary statistics are used for this purpose: the *standard deviation*, which is an indicator of the volatility of cyclical fluctuations, and hence of the magnitude of business cycles, and the *auto-correlation coefficient*, which measures the persistence of cyclical fluctuations. This coefficient is computed as:

$$\rho_k = \frac{\sum_{t=k+1}^{T}(c_t - \bar{c})(c_{t-k} - \bar{c})}{\sum_{t=1}^{T}(c_t - \bar{c})^2} \qquad (7)$$

where k is a given time lag and $\bar{c}$ is the average of c. Only values of ρ_1 are reported in this paper. In general, an auto-correlation coefficient closer to 1 indicates more persistent, and therefore less frequent, fluctuations.

The analysis in the temporal domain is completed by the computation of pair-wise correlations between the cyclical components of the reference indicator (GDP) and those of the other macroeconomic variables. Pair-wise correlation coefficients measure the extent to which macroeconomic variables co-move in line with the reference indicator, and can therefore be used to characterize a variable as being either procyclical (if the correlation is positive) or countercyclical (if the correlation is negative). Where the correlation coefficient is not statistically different from zero, the variable is classified as acyclical. To allow for non-contemporaneous co-movements, pair-wise correlations are computed up to eight lags/leads, even though for reasons of space the tables report correlation coefficients only up to four lags/leads.

The second dimension of analysis concerns the international correlation of business cycles. A formal assessment of the synchronization of cycles with the euro area is undertaken here by computing the coefficient of correlation between the cyclical component of GDP in each EME and that in the euro area (and some of its largest members). Significantly positive coefficients indicate that business cycles are, to some extent, synchronized. To allow for non-contemporaneous synchronization, correlation coefficients are computed at different time lags.

There exist alternative methods to gauge the degree of synchronization of business cycles in a regional cluster. Fidrmuc and Korhonen[17] provide an excellent survey of methodologies and results. The choice made in this paper has a twofold motivation. First, the cross-country correlation of cyclical components is a natural extension of the business cycle analysis in the temporal domain and hence

[16] L. Stanca and M. Gallegati, *Le Fluttuazioni Economiche in Italia, 1861-1995* (Torino, Giappichelli, 1998) provide a comprehensive overview of methods of analysis of business cycle empirical regularities in the temporal domain.

[17] J. Fidrmuc and I. Korhonen, op. cit.

nicely completes the study. The application of alternative methods, in addition to the analysis in the temporal domain, might have made the paper excessively cumbersome. Second, some of the additional methodologies surveyed by Fidrmuc and Korhonen[18] entail data requirements that only a very small number of the EME would be able to provide. Therefore, the decision made in this paper to look at the cross-correlations of detrended variables appears to be a good compromise between statistical rigour and data availability.

D. Sample period and transformational recessions

Ideally, the sample period for the analysis would cover the first quarter of 1990 to the fourth quarter of 2004. However, while the ending of the sample period does not constitute a problem, the beginning does. For many EME, information was not available prior to 1990, and sometimes much later.[19] But more importantly, practically all the countries experienced transformational recessions at the beginning of the transition. These took the form of sharp falls in output due to changes in the economic system and might therefore heavily distort the interpretation of the results. The most obvious way to deal with transformational recessions is to exclude them by cutting out a certain number of observations at the beginning of the sample period. However, the problem is how to identify the cut-off point. Most studies have chosen to arbitrarily drop all observations prior to a certain date (i.e. 1993). This paper tries to improve on this approach, or at least to point to a direction of possible improvement; rather than setting a common cut-off point for all countries, a simple statistical criterion is applied on a country-by-country basis.

The criterion is based on the identification of relative extremes (maximums and minimums) in the detrended series. A relative extreme is identified as the quarter corresponding to an inversion in the sign of the first difference (quarter-on-quarter) of the detrended series, as long as the new sign also persists in the two subsequent quarters. This generates a sequence of relative extremes: p_1, p_2….p_N. Two statistics can then be defined:

$$m = \frac{\sum_{n=2}^{N} |p_n - p_{n-1}|}{N-1} \tag{8}$$

$$l = \sqrt{\frac{\sum_{j=1}^{J} (d_j - \bar{d})^2}{J-1}} \tag{9}$$

where $d_j = |p_n - p_{n-1}|$, $j = 1, 2….J$, $J = N - 1$ and $\bar{d}$ is the average taken over all ds. These two statistics are used to compute threshold values $\delta = m \pm fl$, where f is a positive integer. We then denote q as the quarter corresponding to the generic relative extreme $p_{n,}$ and let $d_{j,q}$ be the d_j that has p_n as its most recent quarter.[20] The difference, $d_{j,q^*,}$ is then identified, and hence the corresponding quarter q^*, that satisfies the two conditions: (i) $d_{j,q^*} > \delta$ and (ii) $d_{j+1,q^*} < \delta$. The criterion of the paper is to drop from the sample all observations prior to quarter q^*. If more than one d_{j,q^*} exists, so that there is more than one q^*, then the cut-off point is the most recent of the q^*.

In other words, the criterion excludes periods characterized by deviations of GDP from trend that are very large relative to the average deviation. Intuitively, transformational recessions are outliers that occur at the beginning of the sample period. The criterion tries to identify these outliers on the basis of their size relative to the average and the standard deviation of all cyclical deviations observed in the country.

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[18] Ibid.

[19] In fact, some of the countries that are investigated here did not even exist in their current form in 1990.

[20] Each d is the absolute difference between two relative extremes, and each of those extremes is associated with a quarter: p_n is associated with quarter q and p_{n-1} is associated with some earlier quarter s. Then $d_{j,q} = |p_n - p_{n-1}|$.

Of course, this approach has its own drawbacks. Transformational recessions must be treated as outliers because of their different nature, and not just because of their size. But the criterion is merely quantitative, in the sense that any excessively large recession is identified as an outlier. There is therefore no guarantee that only all transformational recessions will be excluded. In most countries, transformational recessions occur at the beginning of the sample and are effectively represented by a drop (or a sequence of drops) that is systematically and significantly larger than any subsequent cyclical fluctuations. In this case, the criterion works rather well. But in a few countries (Bulgaria and Romania, for instance), the initial large recession due to transformation is followed by a period of relatively less pronounced fluctuations, and then by other very deep downturns. These downturns occur much later in the sample period (i.e. second half of the 1990s), and it is questionable whether they can be regarded as transformational recessions. But the application of the criterion in those cases would still identify them as outliers, causing all corresponding observations to be omitted from the analysis. More generally, the criterion builds on an arbitrary choice of the parameter *f*. A very low value of *f* increases the likelihood that downturns other than transformational recessions will be treated as outliers, thus artificially lowering the volatility of the business cycle. Conversely, too high a value for *f* increases the likelihood that some transformational recessions will not be excluded. In practice, for a rather large range of *f* values cut-off points in most countries do not change. The two exceptions are Bulgaria and Romania; that is, the two countries where downturns almost as deep as the initial transformational recessions occurred towards the middle and end of the sample. In their case, however, the decision was made to retain these observations. That is, the criterion was applied to identify the outliers only in the first half of the 1990s, when transformational recessions were most likely to have occurred, and not in the second half of that decade, when large recessions were probably the result of shocks other than the transformation of the economic system.

In the end, the beginning of the sample period for each country was set as follows: Bulgaria Q1/2005, Croatia Q1/1994, the Czech Republic Q1/1992, Hungary Q1/1993, Poland Q4/1991, Romania Q1/1995, Russia Q1/1995 and Slovakia Q1/1994. The minimum number of observations was therefore 40. Ideally, it would have been preferable to have more observations, but this is a common problem in the study of the EME.[21]

III. The business cycle in the euro area aggregate (and selected west European countries) as a benchmark

The summary statistics describing the statistical properties of business cycles in the euro area aggregate are reported in table 1. For each detrended macroeconomic variable, the standard deviation, auto-correlation and cross-correlation with output are reported. In comparing standard deviations within a country, all variables are considered log-transformed with the following exceptions: industrial production and consumer prices are index numbers, fiscal balance and net exports are ratios to GDP, productivity is the output-to-employment ratio, inflation is an annualized rate of growth, and real interest rate is not logged. The sample period is Q1/1990 to Q4/2004. Summary statistics for individual countries in the euro area and the United Kingdom are commented upon in the rest of this section.[22]

The statistics in table 1 point to characteristics of the business cycle in the euro area that are broadly in line with the stylized facts relating to business cycles of industrialized economies reported in the literature.[23] Starting with GDP, the high auto-correlation coefficient indicates that fluctuations

[21] Results obtained from a sample period that does not exclude transformational recessions are available from the author upon request. In general, the sign and, to some extent, the strength of correlations between macroeconomic variables and the reference indicator are identical to those obtained from the sample that excludes transformational recessions. The statistical properties of business cycles are, however, qualitatively different in the sense that volatility is systematically much higher in the sample that includes transformational recessions.

[22] The full set of results is available from the author upon request.

[23] Seminal contributions in this field include D. Backus and P. Kehoe, "International evidence on the historical properties of business cycles", *American Economic Review*, Vol. 82, 1992, pp. 864-888; F. Kydland and E. Prescott, "Business cycles:

TABLE 1

Summary statistics of business cycle fluctuations in the euro area

	Summary statistics		Correlations with the cyclical component of GDP								
			Lags					Leads			
	Standard deviation	Auto-correlation	-4	-3	-2	-1	0	1	2	3	4
GDP	0.008	0.852	..	..	..	..	1	..	..	..	..
Industrial production	1.578	0.875	-0.142	0.171	0.469	0.727	0.871	0.825	0.665	0.436	0.201
Private consumption	0.007	0.755	0.309	0.460	0.526	0.608	0.619	0.496	0.397	0.300	0.199
Investment	0.021	0.874	0.107	0.386	0.616	0.799	0.892	0.805	0.663	0.480	0.276
Government consumption	0.006	0.706	0.460	0.415	0.263	0.076	-0.033	-0.227	-0.371	-0.481	-0.590
Fiscal balance	0.581	0.897	-0.211	-0.023	0.188	0.372	0.501	0.610	0.644	0.598	0.497
Net exports	0.004	0.712	-0.013	-0.200	-0.286	-0.293	-0.243	-0.208	-0.233	-0.266	-0.278
Imports	0.027	0.873	-0.054	0.270	0.563	0.793	0.889	0.815	0.661	0.447	0.242
Exports	0.024	0.839	-0.091	0.154	0.433	0.692	0.835	0.789	0.619	0.373	0.149
Employment	0.006	0.892	0.369	0.566	0.733	0.824	0.840	0.693	0.508	0.333	0.154
Productivity	0.004	0.703	-0.364	-0.144	0.064	0.342	0.587	0.535	0.400	0.202	-0.044
CPI	0.371	0.831	0.092	-0.012	-0.062	-0.140	-0.279	-0.392	-0.536	-0.660	-0.695
Inflation	0.329	0.589	0.347	0.345	0.425	0.474	0.376	0.300	0.172	-0.042	-0.199
Real interest rate	0.637	0.686	0.529	0.581	0.532	0.324	0.077	-0.140	-0.317	-0.416	-0.387

Source: Author's own estimates.

Note: Summary statistics and cross-correlations of Hodrick-Prescott detrended series for the euro area aggregate over the period Q1/1990-Q4/2004. For each macroeconomic variable, lags/leads are computed as the correlation between that variable at time *t* and GDP at *–n* (*+n*) periods before/after. That is, the variable follows/anticipates GDP. A zero lag or lead denotes the contemporaneous correlation.

are rather persistent, and hence infrequent. The standard deviation is somewhat smaller than what is usually reported for the United States. This suggests that GDP cycles in the euro area aggregate are less volatile than in the United States.[24] Industrial production is heavily correlated with output and only slightly more persistent, with some evidence of a leading effect, but this seems to be limited to a time span of only few quarters. The properties of output and industrial production cycles in the largest economies of the euro area (France, Germany and Italy) are similar to those of the euro area aggregate. The main difference is that GDP cycles in individual countries tend to be more volatile than in the euro area aggregate. Outside the euro area, the United Kingdom displays rather large output volatility (the standard deviation of detrended GDP in that country being some 20 per cent higher than in the euro area aggregate).

Turning to the components of aggregate demand, private consumption and investment are strongly procyclical, as is to be expected, given that they account for a large share of GDP. Private consumption is slightly less volatile than GDP, suggesting only moderate consumption smoothing.[25] Investment, on the other hand, is highly volatile and persistent. Government consumption does not appear to be systematically countercyclical. The negative correlation with a lead might indeed be a consequence of a lagged procyclical response. This would also be consistent with the zero contemporaneous correlation.[26] The evidence thus suggests that the role of fiscal policy as a

real facts and a monetary myth", *Federal Reserve Bank of Minneapolis Quarterly Review*, Spring 1990, pp. 3-18 B. Chadha and E. Prasad, "Are prices countercyclical? Evidence from the G-7", *Journal of Monetary Economics*, Vol. 34, No. 2, 1994, pp. 239-257; and R. Fiorito and T. Kollintzas, "Stylized facts of business cycles in the G7 from a real business cycle perspective", *European Economic Review*, Vol. 38, No. 2, pp. 235-269. A. Agresti and B. Mojon, *Some Stylized Facts on the Euro area Business Cycle*, European Central Bank Working Paper, No. 95 (Frankfurt am Main), December 2001, have studied the business cycle in the euro area aggregate and have shown that its characteristics are largely independent of the specific method of data aggregation.

[24] To some extent, lower volatility in the euro area aggregate might be the consequence of an imperfect synchronization of business cycles among its members. If the business cycles of individual countries in the region are not perfectly correlated, then aggregation will inevitably result in smoother cyclical fluctuations.

[25] In the literature, the ratio of standard deviation of consumption to standard deviation of real GDP is generally reported to fall somewhere between 0.8 and 0.85. The estimates of this paper imply a ratio of 0.87.

[26] Government consumption is, however, countercyclical in some euro area members, such as France.

stabilization tool is left almost exclusively to the non-discretionary component of spending (i.e. the automatic stabilizers). Indeed, it has been noted recently[27] that the countercyclicality of fiscal policies in the euro area, operating mainly through automatic stabilizers, has been undermined by procyclical discretionary fiscal measures. Finally, net exports are only mildly countercyclical and lag behind output fluctuations. In fact, both imports and exports are procyclical, but imports slightly more so than exports.

Employment and labour productivity are both strongly procyclical in the euro area aggregate. Employment fluctuations tend to lag behind output fluctuations and display relatively low volatility. These patterns seems to suggest that firms hoard labour and hence smooth the adjustment of their labour force stock over the output cycle.[28] Prices are anti-cyclical while inflation is procyclical and lags behind the output cycle. This pattern has been detected in a number of other studies,[29] and can be rationalized in a model where prices are sticky in response to shocks. Finally, the real interest rate is acyclical in the euro area aggregate. Combined with the previous finding on government consumption, this result seems to suggest that macroeconomic policy in the euro area aggregate has not been very countercyclical.[30] However, it must be acknowledged that in some countries (notably France and Germany), the real interest rate is more strongly procyclical, reflecting the procyclicality of nominal interest rates and the substantial acyclicality of inflation (which in other countries, such as Italy, is procyclical).

The analysis of the benchmark is concluded with a look at the correlations of output fluctuations across countries. Between the euro area aggregate and any of the large continental economies the cross-correlation coefficient is high and close to 1; specifically, it is 0.8 for Italy and 0.9 for France and Germany. The cycles of the euro area aggregate and the large economies are thus highly synchronized. The United Kingdom, on the other hand, appears to have a significantly more independent cycle. The correlation with the euro area aggregate is only 0.05, and the highest correlation with the large continental economies is only 0.3 (e.g. with Italy).

IV. The business cycles of the European emerging market economies

This section reports some basic, stylized facts concerning the statistical properties of business cycles in the European EME. Of course, even in a small and rather homogeneous sample, there are differences across countries. Additional country-specific details are reported in the appendix 2. The section also presents evidence concerning the international dimension of business cycle analysis, namely the degree of synchronization of fluctuations between the EME and the benchmark.

A. Statistical properties of cyclical fluctuations in the European emerging market economies: the stylized facts

The basic features of cyclical fluctuations in the European EME are summarized in tables 2 and 3. For each country, table 2 reports the standard deviation and auto-correlation of GDP fluctuations, and the contemporaneous correlation between the fluctuations of macroeconomic variables and the fluctuations of output.[31] For each of those items, the table also reports the unweighted sample average and the average for the group of four central European countries (the Czech Republic, Hungary, Poland and Slovakia).

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[27] IMF, *World Economic Outlook 2004* (Washington, D.C.).

[28] The United Kingdom, on the other hand, combines procyclical fluctuations of employment with countercyclical fluctuations of productivity. This rather unique pattern implies that employment overresponds to output cycles, and consequently points to a substantial rejection of the *labour hoarding* hypothesis. Labour-market dynamics is therefore mostly driven by exogenous technological shocks.

[29] See, for instance, B. Chadha and E. Prasad, op. cit. and A. Agresti and B. Mojon, op. cit.

[30] P. Aghion and P. Howitt, "Appropriate growth policy: a unifying framework", 2005 Joseph Schumpeter Lecture at the Annual Congress of the European Economic Association (Amsterdam), 24-27 August 2005, reach the same conclusion, and argue that the lack of countercyclicality of macroeconomic policies is one of the major reasons why growth performance in the euro area has fallen so short of that in the United States over the past few years.

[31] As was done for the euro area, lagged and leading correlations are computed in addition to contemporaneous correlation. Lags and leads are not reported in the table because of space constraints. However, where relevant, they are commented upon in the text.

TABLE 2

Output fluctuations and correlations with other variables in the European EME

	GDP		*Contemporaneous correlations with GDP*												
	Standard deviation	*Auto-correlation*	*Industrial production*	*Private consumption*	*Investment*	*Government consumption*	*Fiscal balance*	*Net exports*	*Exports*	*Imports*	*Employment*	*Labour productivity*	*CPI*	*Inflation*	*Real interest rate*
Bulgaria	0.139	0.270	0.29	0.76	0.72	0.58	-0.28	-0.47	0.06	0.36	-0.04	0.75	-0.29	-0.29	0.26
Croatia	0.049	0.819	0.74	0.89	0.72	0.27	0.31	-0.62	0.18	0.55	0.00	0.46	0.04	-0.23	0.25
Czech Republic	0.027	0.777	0.19	0.67	0.79	-0.23	0.03	-0.31	0.18	0.29	0.35	0.82	-0.43	0.16	0.00
Hungary	0.040	0.801	0.70	0.48	0.21	0.21	0.18	-0.41	0.28	0.68	0.55	0.50	0.00	-0.32	0.06
Poland	0.023	0.757	0.85	0.50	0.81	0.35	0.26	-0.45	0.61	0.76	0.51	0.36	0.39	0.41	0.00
Romania	0.037	0.878	0.78	0.85	0.78	0.52	-0.39	0.73	0.07	-0.18	-0.20	0.71	-0.33	-0.39	0.33
Russian Federation	0.030	0.694	0.87	0.04	0.58	0.45	0.06	-0.29	0.11	0.29	0.21	0.80	0.31	0.07	-0.23
Slovakia	0.012	0.653	0.52	0.30	0.48	0.27	0.29	-0.29	-0.06	0.31	0.23	0.36	-0.41	-0.39	0.57
Turkey	0.168	0.905	0.90	0.94	0.86	0.26	0.17	-0.74	0.48	0.89	0.20	0.90	-0.25	-0.40	-0.49
Average for central European countries	0.025	0.747	0.56	0.49	0.57	0.15	0.19	-0.37	0.25	0.51	0.41	0.51	-0.11	-0.03	0.16
Average for all the EME	0.045	0.706	0.62	0.56	0.64	0.30	0.06	-0.26	0.18	0.38	0.20	0.59	-0.09	-0.12	0.16
France	0.008	0.850	0.81	0.77	0.92	-0.47	0.49	-0.15	0.81	0.86	0.75	0.68	-0.42	0.15	0.33
Germany	0.008	0.694	0.66	0.60	0.75	0.04	0.27	0.05	0.75	0.72	0.72	0.53	-0.23	0.17	0.37
Italy	0.008	0.750	0.82	0.58	0.78	-0.17	0.23	-0.27	0.44	0.53	0.30	0.60	0.14	0.45	0.07
United Kingdom	0.009	0.845	0.77	0.39	0.31	0.13	0.71	0.36	0.53	0.23	0.64	-0.33	-0.48	0.43	0.17
Euro area	0.008	0.852	0.87	0.62	0.89	-0.03	0.50	-0.24	0.84	0.89	0.84	0.59	-0.28	0.38	0.08

Source: Author's own estimates.

Note: Summary statistics and cross-correlations of HP detrended series for European emerging market economies, the euro area aggregate and selected members of the EU. The sample period is Q1/1990-Q4/2004. See text for details concerning the beginning of the sample in the EME.

TABLE 3

Summary statistics of cyclical fluctuations of selected macroeconomic variables in the European EME

	Private consumption		*Investment*		*Government consumption*		*Net exports*		*Employment*		*Labour productivity*		*CPI*		*Inflation*		*Real interest rate*	
	Standard deviation	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*	*Standard deviation*	*Auto-correlation*
Bulgaria	0.057	0.385	0.171	0.321	0.123	0.502	0.037	0.396	0.077	0.728	0.115	0.351	0.020	0.820	339.277	0.739	325.457	0.718
Croatia	0.026	0.733	0.046	0.768	0.021	0.728	0.024	0.312	0.031	0.642	0.036	0.618	4.597	0.168	242.627	0.637	258.557	0.517
Czech Republic	0.020	0.607	0.043	0.804	0.023	0.460	0.013	0.427	0.008	0.694	0.014	0.788	1.215	0.800	4.834	0.530	4.523	0.301
Hungary	0.019	0.747	0.039	0.533	0.035	0.561	0.024	0.622	0.010	0.807	0.009	0.509	1.313	0.804	2.930	0.826	2.152	0.715
Poland	0.012	0.708	0.053	0.871	0.009	0.494	0.020	0.834	0.015	0.675	0.013	0.497	1.483	0.883	3.054	0.608	5.485	0.104
Romania	0.032	0.899	0.046	0.903	0.058	0.828	0.010	0.828	0.031	0.632	0.041	0.732	4.577	0.886	47.768	0.829	42.026	0.812
Russian Federation	0.038	0.550	0.094	0.412	0.013	0.604	0.031	0.716	0.008	0.539	0.026	0.745	26.625	0.867	90.382	0.801	94.310	0.816
Slovakia	0.023	0.550	0.097	0.776	0.056	0.406	0.045	0.557	0.021	0.633	0.021	0.684	1.735	0.819	3.338	0.717	4.817	0.714
Turkey	0.042	0.730	0.122	0.787	0.040	0.383	0.035	0.664	0.015	0.309	0.043	0.670	12179	0.877	12.028	0.653	33.295	0.186
Average for central European countries	0.019	0.653	0.058	0.746	0.031	0.480	0.026	0.610	0.013	0.702	0.014	0.620	1.436	0.827	3.539	0.670	4.244	0.459
Average for all the EME	0.028	0.647	0.074	0.674	0.042	0.573	0.026	0.587	0.025	0.669	0.035	0.616	5.195	0.756	91.776	0.711	92.166	0.587
France	0.007	0.699	0.026	0.916	0.009	0.859	0.004	0.563	0.006	0.892	0.006	0.657	0.381	0.767	0.364	0.609	1.098	0.721
Germany	0.008	0.474	0.028	0.628	0.011	0.558	0.007	0.577	0.006	0.894	0.006	0.524	0.522	0.825	0.676	0.592	0.610	0.533
Italy	0.012	0.871	0.029	0.804	0.008	0.829	0.020	0.192	0.009	0.625	0.009	0.757	0.572	0.914	0.618	0.853	1.131	0.719
United Kingdom	0.006	0.594	0.023	0.777	0.008	0.493	0.005	0.641	0.015	0.643	0.012	0.632	0.268	0.634	0.764	0.756	0.595	0.676
Euro area	0.007	0.755	0.021	0.874	0.006	0.706	0.004	0.712	0.006	0.892	0.004	0.703	0.371	0.831	0.329	0.589	0.637	0.686

Source: Author's own estimates.

Note: Summary statistics and cross-correlations of HP detrended series for the European emerging market economies, the euro area aggregate and selected members of the EU. The sample period is Q1/1990-Q4/2004. See text for details concerning the beginning of the sample in the European emerging market economies.

Data for the euro area aggregate and for individual large European economies are also presented at the bottom of the table to facilitate comparison against the benchmark. Table 3 reports the standard deviation and auto-correlation coefficient of the cyclical component of selected macroeconomic variables for each country. Again, those for the euro area aggregate and individual western European economies are reported at the bottom of the table as memorandum items.

Stylized fact 1: Cyclical output fluctuations in the European EME are more volatile and frequent than in the euro area. The standard deviation of detrended GDP series is systematically larger in the European EME than in the euro area. On the other hand, the auto-correlation coefficient is on average smaller, although in Romania, and possibly Croatia, it is of a magnitude comparable to that of the euro area. Within the group of EME, GDP fluctuations in the central European EME bear the closest resemblance to the benchmark, particularly in terms of persistence. There appears to be no systematic association between volatility and persistence of the cycle, in the sense that some of the economies with larger volatility also display rather persistent fluctuations. As with the euro area, the correlation of GDP and industrial production is high, with the exception of Bulgaria and the Czech Republic. Moreover, industrial production has a mild leading effect.

Stylized fact 2: Private consumption and investment are procyclical and more volatile, in absolute terms, than in the euro area. However, their volatility relative to the volatility of GDP is, on average, not higher than in the euro area. Private consumption in the EME is procyclical. Russia is a notable exception, displaying an acyclical pattern that certainly deserves further investigation in future research. Consumption fluctuations in the EME are more volatile and less persistent than in the euro area. However, when expressed as a ratio to GDP volatility, the volatility of consumption in the EME is not systematically higher than in the euro area. The central European EME, in particular, display relatively low volatility. This supports the view that the development of domestic financial markets and the process of international financial integration are opening up greater consumption smoothing opportunities for households in those countries.

Investment is procyclical, even though the correlation with output is less strong than in the euro area. In Hungary the correlation is not even statistically different from zero. As was observed for private consumption, investment fluctuations in the EME are more volatile and less persistent than in the euro area aggregate. However, relative to GDP volatility, investment volatility is not as high as in the euro area aggregate. In some of the countries where it is lower (i.e. the Czech Republic, Poland and Romania), the persistence of investment is not much smaller than in the euro area aggregate.

Stylized fact 3: Government consumption is more erratic in the European EME than in the euro area. Government consumption is acyclical on average, but procyclical in several countries (Bulgaria, Poland, Romania and Russia). Volatility is greater than in the euro area, both in absolute and relative (to GDP) terms. This high volatility is associated with low persistence, pointing to an erratic pattern of fluctuations in government consumption in the EME. This could have potentially negative dynamic implications as it might increase economic uncertainty and hence reduce domestic and foreign investment. Furthermore, the procyclicality or acyclicality of government consumption is likely to undermine the overall countercyclicality of a government's fiscal policy stance. The negative welfare implications can then be quite strong, especially in terms of the risk-insurance role that government consumption is likely to play in the EME.[32] The acyclicality of the detrended component of the fiscal balance supports the view that fiscal policy is seldom countercyclical, in line with the experience of several other emerging market economies.[33]

Stylized fact 4: *In the EME, exports appear to respond more to the euro area business cycle than to the domestic business cycle.* Exports in the European EME are acyclical. However, their correlation with the business cycle (i.e. output and consumption fluctuations) of the euro area is

[32] See, for instance, D. Rodrik, "Why do more open economies have bigger governments?", *Journal of Political Economy*, Vol. 106, 1998, p. 5.

[33] See, for instance, G. Kopits (ed.), *Rules-Based Fiscal Policy in Emerging Markets* (Washington, D.C., Palgrave-McMillan and International Monetary Fund, 2004).

positive and statistically significant, especially for the central European EME. Imports, on the other hand, are strongly procyclical, while net exports are countercyclical, with the only evident exception of Romania. The strong link between the EME' exports and the euro area's business cycle suggests that trade can indeed be an important channel of synchronization of business cycles. An expansion in the euro area could foster demand for exports from the EME. This, in turn, would increase net exports, aggregate demand and, ultimately, output in the EME.

Stylized fact 5:Employment is procyclical in the central European economies and ayclical in the other emerging market economies. Labour productivity is strongly procyclical. There appear to be some important differences in the cyclical behaviour of employment between the central European EME and the others. In the central European countries, employment is procyclical, possibly with the exception of Slovakia (where the correlation coefficient is bordering on significance at low confidence values). Furthermore, employment fluctuations appear to lag behind those of output, and are in general smoother (i.e. less volatile). In the other EME, employment is substantially acyclical, with less marked lagged and smoothing effects. Labour productivity, on the other hand, is strongly procyclical in all of the countries, though the strength of the correlation varies a great deal across countries. An interpretation for those patterns is that labour-market dynamics are driven by procyclical technological shocks, with some form of labour hoarding taking place in the central European economies. Procyclical productivity can be rationalized by models with procyclical technological shocks[34] and those with labour hoarding.[35] (i.e. Burnside et al., 1993). Procyclical technological shocks generate a substantially acyclical pattern of employment, while labour hoarding would imply procyclical, but lagged and smooth, employment fluctuations. Therefore technological shocks are likely to drive labour-market cyclical dynamics in the EME, but labour hoarding seems to be an important part of the story in the central European EME.

Stylized fact 6: Several EME are characterized by very high volatility of prices, inflation and real interest rates. Discerning a cyclical pattern for prices and inflation is difficult, but it seems that they are not procyclical. Real interest rate movements, on the other hand, tend to be acyclical. Consumer prices and inflation fluctuations exhibit a rather mixed pattern. In Bulgaria, the Czech Republic, Romania and Slovakia, the consumer price index is countercyclical. In Croatia, Hungary and, possibly, Russia (where the correlation is close to statistical significance), prices are instead acyclical. Only in Poland is there a clear procyclical pattern. Similarly, most EME display either countercyclical (Hungary, Romania and Slovakia) or acyclical (Bulgaria, Croatia, the Czech Republic and Russia) inflation. Again, Poland is the only economy where inflation fluctuations are unambiguously procyclical.

Most emerging market economies have suffered from either very high inflation or hyperinflation in the aftermath of price liberalization. This makes the volatilities of the consumer price index and the inflation rate very high, on average, especially outside the group of the central European EME. Extreme volatility might then explain the difficulties in discerning a common cyclical pattern. It is worth stressing that the absence of a clearly procyclical behaviour of prices and inflation (with the exception of Poland) is consistent with the interpretation of business cycle models based on technological shocks.

To some extent, the difficulties in discerning a pattern for inflation and prices translate into similar ambiguities with regard to the pattern of real interest rates. The broad evidence is that movements in the real interest rate are acyclical, with the exception of Slovakia where they tend to be procyclical. This is in line with that observed for the euro area aggregate, and might be interpreted as an indication that monetary policy stance of the EME is generally neutral over the business cycle.

B. International correlation of business cycles

Table 4 reports the cross-correlations of output fluctuations between the European EME and the euro area aggregate up to four lags/leads. The cross-correlations for individual countries are not displayed in the table, but they are commented on below.

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[34] F. Kydland and E. Prescott, "Time to build and aggregate fluctuations", *Econometrica*, Vol. 50, 1982, pp. 1345-1370.

[35] C. Burnside, M: Eichenbaum and S. Rebelo, "Labour hoarding and the business cycle", *Journal of Political Economy*, Vol. 101, 1993, pp. 245-273.

TABLE 4

Correlations of output fluctuations of the European EME with euro area aggregate

	Correlations with the cyclical component of GDP of euro area aggregate								
	Lags					*Leads*			
	-4	*-3*	*-2*	*-1*	*0*	*1*	*2*	*3*	*4*
Bulgaria	-0.24	-0.14	0.05	0.17	0.30	0.32	0.28	0.28	0.23
Croatia	-0.48	-0.50	-0.45	-0.37	-0.27	-0.30	-0.34	-0.30	-0.24
Czech Republic	-0.23	-0.13	0.00	0.10	0.15	0.18	0.16	0.13	0.06
Hungary	0.24	0.36	0.47	0.51	0.44	0.33	0.18	0.05	-0.05
Poland	0.26	0.36	0.46	0.47	0.42	0.24	0.03	-0.16	-0.30
Romania	-0.44	-0.41	-0.34	-0.28	-0.22	-0.14	-0.07	0.02	0.06
Russian Federation	-0.20	-0.11	-0.04	0.04	0.10	0.21	0.24	0.20	0.22
Slovakia	-0.27	-0.35	-0.35	-0.37	-0.33	-0.36	-0.39	-0.40	-0.34

Source: Author's own estimates.

Note: For each country, lags/leads are computed as the correlation between the cyclical component of GDP in that country at time *t* and the cyclical component of GDP in the euro area aggregate at *-n* (*+n*) periods before/after. A lag/lead indicates the contemporaneous correlation coefficient.

Stylized fact 7: With the exception of Hungary and Poland, the output cycles in the EME are substantially asynchronized with the output cycles in the euro area aggregate. For the central European EME, the correlation is generally positive, with the exception of Slovakia. However, the correlation coefficient is statistically different from zero only for Hungary and Poland. Furthermore, there is evidence that output cycles in these countries lag behind those of the euro area by a period of a few quarters. Of the other emerging market economies in the sample, Bulgaria and Russia display positive correlations, while Croatia and Romania show negative correlations. However, possibly with the exception of Bulgaria (whose estimated correlation coefficient is just at the threshold of statistical significance), none of others' are statistically different from zero.

The pattern of synchronization between the EME and Germany (or France or Italy) is not very different from that observed for the euro area aggregate. This is hardly surprising, given the strong positive correlation between the cycles of the euro area aggregate and those of these individual countries. Hungary and Poland are the only two EME that have cyclical fluctuations significantly correlated with those of Germany. Correlations with the cycles of the United Kingdom are also largely insignificant in statistical terms for all the EME except Hungary.

V. Policy issues and conclusions

The analysis in this paper suggests that in the European emerging market economies, business cycles are in general frequent and characterized by large fluctuations of output and other macroeconomic variables. As is well known, cyclical volatility of output and consumption has strong dynamic as well as welfare implications.[36] An important policy issue thus concerns the stabilization of cycles. However, the process of monetary unification entails a loss of independence of monetary policy. This has important implications, since the EME are set to progressively adopt the monetary policy stance of the European Central Bank (ECB), which, according to evidence, is mildly countercyclical. Furthermore, the business cycles of the EME appear to be only weakly correlated with those of the euro area (possibly with the exception of Hungary and Poland). Taken together, these two facts imply that the EME, at least those that are rapidly progressing towards integration into the

[36] G. Ramey and V. Ramey, "Cross-country evidence on the link between volatility and growth", *American Economic Review*, Vol. 85, 1995, pp. 1138-1151, first documented the negative empirical relationship between output volatility and growth. This negative relationship has been subsequently confirmed by a number of studies (see M. Kose, E. Prasad and M. Terrones, *How Do Trade and Financial Integration Affect the Relationship Between Growth and Volatility?*, IMF Working Paper 05/19 (Washington, D.C), January 2005). The World Bank, *World Development Report 2000*, (Washington, D.C.) provides evidence that poverty levels sharply rise in deep recessions, and hardly ever return to pre-recession levels once output recovers. G. Perry, "Can fiscal rules help reduce macroeconomic volatility?", in G. Kopits (ed.), *Rules-based Fiscal Policy in Emerging Markets* (Washington, D.C., Palgrave-McMillan and International Monetary Fund, 2004) presents additional evidence of the negative effects of cyclical output volatility on growth and poverty.

European Monetary Union (EMU), will have to rely mainly, if not exclusively, on fiscal policy for domestic stabilization purposes. However, the fiscal policy stance of these countries does not appear to be strongly countercyclical. On the contrary, as with several other emerging market economies, the European EME often display a procyclical (or acyclical) pattern of government consumption, which in turn undermines the effectiveness of automatic stabilizers to drive an overall countercyclical fiscal policy stance. In this context, it is recommended that the EME strengthen the countercyclicality of their discretionary fiscal policies and allow automatic stabilizers to work freely. Complementary policies should aim at further developing domestic financial systems in order to facilitate consumption smoothing of households of all income levels. More proactive labour-market policies would also prevent the hysteresis of unemployment, thus tempering the dynamic negative effects of deep recessions.

In the context of the process of monetary integration, another important finding of this paper concerns the responsiveness of exports to the business cycle of the euro area. Trade links can therefore be an important factor driving business cycle synchronization. The conclusion is in line with the idea that optimal currency areas might be endogenous or self-validating.[37] Yet the fact remains that, at present, the degree of business cycle synchronization with the euro area is weak for several of the countries that aim to join the EMU. This increases the importance of allowing a flexible adjustment of prices and wages and greater labour mobility across sectors and regions/countries to absorb asymmetric shocks.

To conclude, there are several areas for future research. The most obvious one is the extension of the analysis to cover more countries and variables as new data become available. Refinements in the treatment of transformational recessions would also be useful. The issue of consumption smoothing deserves more analysis, both theoretical and empirical, in order to understand how the greater risk-sharing opportunities brought about by globalization could help households reduce their vulnerability to output and income fluctuations.

[37] J. Frankel and A. Rose, "The endogeneity of the optimum currency area criteria", *Economic Journal*, Vol. 108, 1998, pp. 1009-1025 and G. Corsetti and P. Pesenti, *Self-Validating Optimum Currency Areas*, National Bureau of Economic Research (NBER), Working Paper No. 8783 (Cambridge, MA), February 2002.

Appendix 1: Definitions of variables and data sources

The data used for the business cycle analysis are quarterly time-series covering the first quarter of 1990 to the fourth quarter of 2004. For some European emerging market economies, the first available observation is later than the first quarter of 1990, and a number of initial observations are omitted from the sample as they relate to transformational recessions. The statistical criterion for cut-off in the sample is to eliminate those swings in detrended GDP series that occurred in the early 1990s and that clearly stand out as outliers relative to all subsequent swings (as described in the main text).

The variables used in the analysis are: aggregate GDP, private consumption, government consumption, fixed investment, imports and exports of goods and services, net exports (defined as imports minus exports), employment (total number of employed workers), labour productivity (defined as the ratio of aggregate GDP to employment), consumer price index, inflation (quarter-on-quarter growth rate of the consumer price index), fiscal balance (total revenues minus total expenditures of the central government), and real short-term interest rates. Aggregate GDP and the components of aggregate demand are all in constant prices, and net exports and fiscal balance are expressed as a ratio to real GDP. Aggregate GDP, components of aggregate demand (excluding net exports) and employment are log-transformed.

The business cycle analysis has to be performed on seasonally adjusted data. However, since the original data sources for the European EME often provide data that has not been seasonally adjusted, seasonal adjustment has been undertaken using the X12A.EXE seasonal adjustment program available from the United States Census Bureau. This appears to be a rather standard approach in the literature. Moreover, to check the reliability of the seasonal adjustment, the same procedure has been applied to non-seasonally adjusted series for the western European countries. The resulting seasonally adjusted series have been compared with those originally available from the data sources. Qualitative differences (i.e. the location of cyclical turning points) are minimal, thus suggesting that the Census X12A.EXE program performs well.

The data sources for the European emerging market economies are as follows. For national accounts data: *International Financial Statistics* of the International Monetary Fund (IMF), Eurostat New Chronos, national statistical offices, national central banks, UNECE Statistical Database and Oxford Economic Forecasting Database. For employment data: UNECE Statistical Database and the IMF's *International Financial Statistics.* For prices, inflation and interest rate data: UNECE Statistical Database, the IMF's *International Financial Statistics*, national statistical offices and national central banks. For fiscal balance: Eurostat New Chronos, Oxford Economic Forecasting Database, national statistical offices and national central banks. The data for western European countries are from Eurostat New Chronos, OECD *Main Economic Indicators*, UNECE Statistical Database, the IMF's *International Financial Statistics*, and the ECB *Monthly Statistical Bulletin* (for the euro area aggregate).

Appendix 2: Some further country details

Differences in underlying economic structures and policy choices result in cross-country differences in the structure and characteristics of business cycle fluctuations. It is therefore important to explain those country-specific features that diverge from the general stylized facts described in section 5.

In *Bulgaria*, the fluctuations of output tend to be much wider and more frequent than in the rest of the European EME. Most of the other macroeconomic variables also exhibit above-average volatility and frequency, thus often Bulgaria features as an outlier. With respect to the co-movement of macroeconomic variables with GDP, Bulgaria stands out for having rather strongly procyclical government consumption, coupled with a close to significant negative correlation of the cyclical fiscal balance with output. This might suggest that fiscal policy is not being used countercyclically to any significant extent. At the same time, Bulgaria is one of only two European emerging market economies where consumption fluctuations are significantly smoother than output fluctuations. Most of the correlations for the other variables are in line with the stylized facts.

In *Croatia*, cyclical GDP tends to be more volatile than in the central European economies, but certainly less volatile than in the other European EME. Similarly, persistence is lower than in the central European economies, but in line with that of the other European EME. The main difference relative to the stylized facts concerns the high persistence of government consumption (even higher than in the euro area); this suggests that fiscal expenditure is less erratic than in most of the other European EME.

In the *Czech Republic*, output cycles are highly persistent, but generally more volatile than in the other central European economies. In general, the statistical properties of the business cycle are in line with the stylized facts. A distinctive feature of the Czech Republic is the very high degree of procyclicality of productivity, coupled with procyclical employment. This makes the cyclical labour-market dynamics in the Czech Republic quite similar to those of the euro area.

In *Hungary*, fluctuations in output have the lowest volatility among the central European economies, while persistence is very close to that observed in some individual large economies in the euro area. An important aspect of the Hungarian business cycle that contrasts with most of the other European EME is its significant and positive correlation with the euro area aggregate (and Germany). Another striking difference from the stylized facts is that investment in Hungary is acyclical.

In *Poland*, fluctuations in cyclical output are relatively narrow and persistent by the standards of the European EME, and they positively and significantly correlate with the GDP cycle in the euro area aggregate. An important departure from the stylized facts concerns the behaviour of prices and inflation, which are characterized by procyclical fluctuations. This observation suggests that the interpretation of cyclical fluctuations based on technological (or other permanent supply-side) shocks might not be fully applicable to Poland. In fact, the procyclical fluctuations of prices and inflation are more consistent with demand-side shocks (i.e. shocks to components of the aggregate demand). These shocks then result in procyclical employment fluctuations, which are, nevertheless, smoother than output fluctuations to the extent that firms hoard labour. A combination of demand-side shocks and labour hoarding might therefore be a more likely interpretation of cyclical fluctuations in Poland. Another interesting distinctive feature of the Polish cycle is the procyclicality of government consumption, which in the other central European countries is acyclical.

In *Romania*, output fluctuations are fairly volatile, but characterized by very high persistence (actually, the highest persistence in the sample). Both consumption and investment are also more persistent than the sample average. There are a few features of the Romanian business cycle that do not conform to the stylized facts. One is that imports and exports are acyclical and net exports are procyclical. Another is the countercyclical behaviour of the fiscal balance, which is, however, consistent with the observed strongly procyclical and persistent fluctuations of government consumption. Together, these two findings might be taken as evidence that the cyclical component of the budget accommodates, rather than stabilizes, the cycle.

In *Russia*, cyclical output is more volatile than in all the other European EME except Bulgaria. More generally, for most of the other macroeconomic variables, cyclical fluctuations exhibit standard deviations above the sample average. The 1997-1998 crisis contributed significantly to this high volatility. Probably the most relevant departure from the stylized facts concerns private consumption, which in Russia seems to be acyclical. It is difficult to believe that acyclicality is the result of some extreme form of consumption smoothing, particularly given the fact that consumption is as volatile as GDP. Further analysis of this result and its implications for economic policy would certainly be an interesting area for future research.

In *Slovakia*, GDP fluctuations display low volatility (lowest in the sample after Hungary), but also low persistence (lowest in the sample after Bulgaria). This is indicative of narrow, but rather frequent, business cycles. Slovakia is the only country among the European EME where the cyclical fluctuations of the real interest rate are procyclical, reflecting – at least to some extent – the countercyclical behaviour of inflation and prices. A procyclical real interest rate might be indicative of a stabilizing role for monetary policy.