Benczúr, Péter; Rátfai, Attila

**Working Paper**

# Economic fluctuations in Central and Eastern Europe - the facts

MNB Working Papers, No. 2005/2

**Provided in Cooperation with:**
Magyar Nemzeti Bank, The Central Bank of Hungary, Budapest

*Suggested Citation:* Benczúr, Péter; Rátfai, Attila (2005) : Economic fluctuations in Central and Eastern Europe - the facts, MNB Working Papers, No. 2005/2, ISBN 9639383619, Magyar Nemzeti Bank, Budapest

This Version is available at:
https://hdl.handle.net/10419/83576

MAGYAR NEMZETI BANK

# MNB WORKING PAPERS

2005/2

PÉTER BENCZÚR–ATTILA RÁTFAI

## Economic Fluctuations in Central and Eastern Europe – the Facts

# Economic Fluctuations in Central and Eastern Europe – the Facts*

## February, 2005

* We thank Cosmin Ilut, Roman Horvath, Reimo Juks, Sorina Vaju and Robertas Zubrickas for excellent research assistance. Gert Peersman, Paul Wachtel, seminar participants at CEU, GDN Meeting in Prague, EABCN Workshop in Vienna, LAMES in Santiago and EEA in Madrid added helpful comments. The data used in this study is available at http://www.personal.ceu.hu/departs/personal/Attila_Ratfai/data/benczur-ratfai_webpage.htm. We thank CEU and GDN for financial support. The views expressed herein are ours and have not been endorsed by GDN or MNB.

Péter Benczúr: Senior Economist, Economics Department, Magyar Nemzeti Bank

E-mail: benczurp@mnb.hu

Attila Rátfai: Assistant Professor, Department of Economics, Central European University

E-mail: ratfaia@ceu.hu



Magyar Nemzeti Bank

H-1850 Budapest Szabadság tér 8-9.

http://www.mnb.hu

ISSN 1419 5178 (print)

ISSN 1585 5600 (online)

ISBN 9 639 383 61 9

# Contents

# Abstract

We carry out a detailed analysis of quarterly frequency dynamics in macroeconomic aggregates in twelve countries of Central and Eastern Europe. The facts we document include the variability and persistence in and the co-movement among output, and other major real and nominal variables. We find that consumption is highly volatile and government spending is procyclical. Gross fixed capital formation is highly volatile. Net exports are countercyclical. Imports are procyclical, much more than exports. Exports are most procyclical and persistent in open countries. Labor market variables are all highly volatile. Employment is lagging, and often procyclical. Real wages are dominantly procyclical. Productivity is dominantly procyclical and coincidental. Private credit is procyclical and dominantly lagging the cycle. The CPI is countercyclical, and is weakly leading or coincidental. The cyclicality of inflation is unclear, but its relative volatility is low. Net capital flows are mostly leading and procyclical and exhibit low persistence. Nominal interest rates are in general smooth and persistent. The nominal exchange rate is more persistent than the real one.

Overall, we find that fluctuations in CEE countries are larger than in industrial countries, and are of similar size than in other emerging economies. This is particularly true about private consumption. The co-movement of variables, however, shows a large degree of similarity. A notable exception is government spending: unlike in industrial economies, it is rather procyclical in transition economies. The findings also indicate that Croatia and the accession group show broadly similar cyclical behavior to industrial countries. The most frequent country outliers are Bulgaria, Romania and Russia, especially in labor market, price and exchange rate variables. Excluding these countries from the sample makes many of the observed patterns in cyclical dynamics quite homogenous.

**Key words:** Business Cycle Facts, Central and Eastern Europe
**JEL Classification:** E32

# 1. Introduction

The pure notion of the business cycle is a novelty for many observers, policymakers and citizens in the post-socialist countries of Central and Eastern Europe. Though economic fluctuations have been severely mixed with the transition bust and boom, it seems evident by now that these economies are also subject to ups and downs, regardless of the initial transition shock and the following catch-up process.

The current project is part of a large branch of international macroeconomics, aimed at documenting within-country empirical regularities about macroeconomic fluctuations. Our main goal is to report on business cycle facts in twelve Central and Eastern European (CEE) countries over the decade long period of economic transition, arguably the largest possible and meaningful panel of such observations, in terms of time frame and country coverage. While our exploration of facts is not driven by any particular model economy, the evidence we compile is meant to inform and serve as factual bases in modeling international business cycles. Our findings can also provide valuable tools in the design of stabilization and adjustment policies. Documenting the relative cyclical movements of major macro variables can help policymakers identify the most important targets, instruments and mechanisms of cyclical policies in these countries. Indeed, in a monetary union, such as the one CEE countries are set to join to in the coming years, since monetary policy is common, regional differences in cycles are fundamentally determined by local policies. Depending on similarities and differences relative to developed economies, our results can thus allow one to better judge how much of common "smoothing" policies should be adopted, and how much "regional flavor" is needed.

In this spirit, we seek to answer the following specific questions. Is there a common pattern in CEE business cycle fluctuations? Are the findings robust to alternative filtering procedures? Can we identify certain country characteristics, such as exchange rate regime, government size, openness in goods and financial markets that are associated with these differences? Are there important similarities and differences in the behavior of macroeconomic aggregates vis-à-vis developed countries, or other emerging market regions? In the process of joining the European institutions such as the EU and the EMU, can policy-makers treat CEE countries as a relatively homogeneous group? Or rather economic fluctuations in these economies fundamentally differ from each other, so they need to be considered on an individual basis? Can analysts and policymakers treat certain variables as systematically leading or lagging the business cycle?

To address this set of issues, we conduct a detailed unconditional analysis of quarterly frequency dynamics in major macroeconomic aggregates in individual CEE countries. Despite their similarity in geographical position and economic structure, these economies are a priori characterized by a significant amount of variation in the strength of trading ties to EU, policy arrangements, and country size. By examining macroeconomic data in a large group of countries with similar, still somewhat diverse history, we are seeking to establish stylized facts that highlight regularities that are more general than pure country-specific effects, and point to more general insights potentially useful for macroeconomic theory. We also shed some light on whether basic business cycle regularities in CEE

countries are systematically different from those in the G7 group or other European and developing countries.[1]

As standard in modern business cycle analysis since the seminal work of Lucas (1977), we focus on deviation, as opposed to level or difference cycles. Correspondingly, we define the business cycle component of macroeconomic variables as deviation from trend. Consequently, to obtain the cyclical component, the raw data is de-trended.[2] As no de-trending procedure is free of criticism, we employ three alternative procedures popular in the literature, such as Hodrick-Prescott (H-P) filtering, log first differencing, and fitting a quadratic time polynomial in obtaining the trend component of macroeconomic variables. While our empirical approach places no constraint on the joint determination of the variables of interest, the transformation of data, the selection of statistics and the interpretation of results are all guided by economic theory. The most important themes we address are the variability and persistence in and the co-movement among output and other fundamental real and nominal variables. More specifically, we first document the absolute and relative volatility of the variables involved. We also examine if de-trended macroeconomic aggregates move the same direction as (procyclical), the opposite direction as (countercyclical) or are unrelated to (acyclical) de-trended output; and describe phase shifts in the variables, i.e. if they lead or lag the cycle, or synchronous (coincidental) with it. Finally, we characterize the degree of persistence in the series by reporting on their first-order autoregressive coefficient.

Implementing this idea requires one to overcome a major hurdle, assembling a data set of quarterly frequency macroeconomic variables in transition economies. Dictated mainly by the availability of the relevant data, the countries we examine are Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia and Slovenia.[3] The sample period spans over a period of about a decade, starting in 1993:1 or one or two years later, and ending in 2003:4, resulting in an average time frame of about a decade. The variables we study include measures of output (real GDP and industrial production), the price level (and inflation), components of aggregate demand (private consumption, investment, government consumption, exports, imports), wages, employment, productivity, credit and monetary aggregates, prices, capital flows, interest rates and exchange rates.

The rest of this paper is organized as follows. Following a brief discussion of the related literature in Section 2, Section 3 reports on the data set in detail. Section 4 discusses the findings, while Section 5 concludes.

[1] In a companion paper, Benczúr and Rátfai (2004), we give a detailed survey of the international evidence on quarterly frequency fluctuations.

[2] Instead of removing the trend component and then examining variances, covariances, leads and lags, an alternative approach to follow is the turning point methodology of Harding and Pagan (2002). The idea is to define turning point events and relate them to actual changes in the series of interest, as opposed to the study of the evolution of trend-deviations. Exploring the data in CEE economies using this approach is the subject of ongoing research.

[3] Due to for the paucity of appropriate data, several countries in the broadly defined CEE region are excluded from the current study. Countries left out include Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, FYR Macedonia, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Serbia and Montenegro, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

# 2. Background

It is only a short while ago, since efforts to systematically document stylized facts of quarterly frequency aggregate fluctuations has started to appear. The classic study examining the cyclical properties of a number of H-P filtered macroeconomic time series in the US is Kydland and Prescott (1990). Their major findings, many of them having proved to be robust to alternative sampling periods and cyclical filters provided the empirical impetus for much of early Real Business Cycle (RBC) research. Among many other observations, Kydland and Prescott find that aggregate variables are in general highly persistent, output is more volatile than consumption, but less volatile than investment. Most variables appear to be procyclical including money, employment, investment, consumption, imports, exports and productivity. Important acyclical variables are the price level, net exports and the real wage. Countercyclical variables are few; they primarily include government consumption and the capital stock.

In the international context, Fiorito and Kollintzas (1994) are one of the pioneers in documenting quarterly frequency facts in countries other than the United States. Using the H-P filter, they isolate the cyclical components of quarterly frequency observations of major macroeconomic variables over the period of 1960 to 1989 in the G7 countries, Canada, Germany, France, Italy, Japan, the UK and the US.[4] Conforming to most of the findings in Kydland and Prescott (1990), they show that consumption is procyclical and tends to fluctuate less than output; investment is procyclical, fluctuating more than output, net exports are countercyclical, prices are countercyclical, and government consumption and money have no unambiguous pattern. In related work, employing a number of alternative de-trending procedures including the H-P filter, first-differencing and fitting a quadratic time-trend polynomial, Christodoulakis et al (1993) study business cycle fluctuations in twelve EC countries. Robustly to the specifics of de-trending, they again find that output, consumption, investments, prices and net exports behave fairly similarly across countries, while monetary aggregates, government spending and terms of trade evolve with no clear pattern.

Artis and Zhang (1997) investigate the degree of business cycle conformity in countries comprising of the ERM in 1993, and some other OECD countries such as Japan, Canada, the UK, Sweden, Finland and Norway. The reference countries are the US and Germany. Using monthly data for the period of 1961:1 to 1993:12, their main focus is on documenting the contemporaneous, and lead and lag cross-correlations in a single macroeconomic variable, de-trended industrial production. Robustly to de-trending by different filters, Artis and Zhang find that before the formation of the ERM, business cycles in their sample are typically linked to the US cycle. After the ERM came into existence in April 1979, fluctuations in industrial production in ERM countries began to move together with the corresponding cycle in Germany, the same shift not having occurred in Canada or in the other non-ERM countries.[5]

---

[4] An important predecessor to Fiorito and Kollintzas (1994) is Danthine and Donaldson (1993). Ahmed et al (1993), Backus and Kehoe (1992), Basu and Taylor (1999) and Bergman et al (1998) focus on long-span samples of annual frequency aggregate data in a few industrial countries.

[5] Artis and Zhang (1999) follow up on their previous work by extending the sample period to 1995:10 and increasing the number of countries studied. In addition to confirming most prior findings, they also document that the degree of business cycle synchronization and exchange rate variability are negatively correlated across countries. Agresti and Mojon (2001) also study regularities in Euro-area business cycles.

While the vast majority of related research focuses on developed economies, there is also a growing literature analyzing developing countries, though often carrying out analyses in a narrow way. These papers are either limited to pairwise correlations among a small group of countries, such as Alper (2003), Mendoza (1995), Kouparitsas (1997), and Kose and Reizman (1998); or a single country, such as Bjornland (2000), Burgoeing and Soto (2000), Kydland and Zaragaza (1997), and Rodriguez-Mata (1997). Alper (2003) for instance examines the quarterly frequency cyclical properties of the Mexican and Turkish economy over the period of 1987 to 2000. Among other things, he finds that the volatility of output is significantly higher in both countries than in the United States, and that consumption expenditures are even more volatile than output. Government consumption is procyclical but is not leading the cycle. Employment and productivity are procyclical. The comovement between real activity and different measures of the money supplies show no clear-cut pattern. The price level and inflation are countercyclical. Gross capital inflows are procyclical and lead the cycle.[6]

Agénor et al (2000) is a large step in unifying the two branches of the literature. Using quarterly data over the period of 1978:1 through 1995:4, they document a wide set of findings of cyclical variability and covariance for 12 developing countries: Chile, Colombia, India, the Republic of Korea, Malaysia, Mexico, Morocco, Nigeria, the Philippines, Tunisia, Turkey and Uruguay. The variables analyzed include industrial output, the price level and inflation, nominal and real wages, monetary aggregates and their velocity, domestic private sector credit, fiscal variables such as gross and net government expenditures and revenues, nominal and real exchange rates, and the trade balance. For robustness, in obtaining the cyclical component of time series, after removing cyclical variation, they de-trend all variables by two alternative filters, the Hodrick-Prescott and the Baxter-King band-pass ones. Agénor et al find that cyclical output, as proxied by industrial production is persistent, and much more volatile in developing countries than in industrial ones. Government expenditures are countercyclical. There is no clear pattern in the cyclical behavior of nominal wages and prices, nominal and real exchange rates, but real wages are strongly procyclical. The correlation between monetary aggregates and output is in general positive, but not very strongly so. The velocity of broad money tends to be strongly countercyclical. The contemporaneous correlation between output and the terms of trade is positive.

Overall, while direct evidence on business cycle frequency economic fluctuations is becoming available from an increasing number of countries and time periods, no study to our knowledge has aimed at systematically documenting business cycle facts in a major segment of emerging markets, transition economies.[7] In the current project, we seek to pursue this task.

[6] Chadha and Prasad (1994) find that inflation is procyclical in G-7 economies, though the price level is countercyclical.

[7] Darvas and Szapáry (2004) look at the synchronization between various measures of output of new member states and the EU.

# 3. Data

We use a relatively comprehensive sample of quarterly frequency macroeconomic data in CEE economies. The variables we study are real GDP, industrial production, private consumption, gross fixed investment, government consumption, exports, imports, net exports, employment, productivity, real wages, private sector credit, M1, M2, CPI, inflation, net capital flows, nominal interest rate, nominal effective exchange rate and real effective exchange rate.[8] These variables include most of the standard choices in the related literature. Private sector credit, inflation and measures of the exchange rate are added to ensure meaningful comparisons with the developing country data analyzed in Agénor et al (2000).[9]

ur sample ideally consists of 44 quarterly observations from 1993:01 to 2003:04. Excluding pre-1993 data from the sample is explained by a number of considerations. First, some of the transition countries simply did not exist before 1993, or simply did not systematically collect quarterly frequency aggregate data. Second, major data revisions taking place in the early 1990s render the quality of these early data highly questionable. Third, as documented in Artis et al (2004), the big transition shock showing up as a structural break in output just before 1993 would make the interpretation of the cycle as deviation from a smooth trend difficult. Finally, in countries like Hungary or Poland, many relevant variables are available at the quarterly frequency even before 1990. At the same time, in these same countries GDP and its components were not collected until 1995. To ensure comparability in time periods, underlying shocks and data quality, we thus use only post-1993 data. While all variables are available in just about every country over the whole period of time, as shown in Table A1, some of the countries have an imperfect record. In Hungary, Lithuania, Poland and Russia reliable figures for GDP and its components are available only from 1995:1 onwards, in Bulgaria, Croatia, the Czech Republic and Romania from 1994:1 onwards. As GDP components data in Slovenia are available only from 1997 onwards, they are omitted. Data on net capital flows with a sufficiently long coverage is not available in Poland. Total employment in Latvia and industrial employment is missing in the Czech Republic and Lithuania, making the corresponding productivity variables also unavailable.

The primary data sources are the International Financial Statistics of the IMF, local central banks, statistical offices and research institutes, the Emerging Market Database, the ILO database and the WIIW monthly database. As multiple sources often allow for extensive and careful cross-checking, we believe that the quality of the sample is not only as good as one can possibly to hope for in this context, it is also comparable to similar ones used for the purposes of empirical analyses in other countries.

Prior to the empirical analysis, the raw data are transformed. First, all variables are de-seasonalized using the X11 procedure, with multiplicative adjustment (the only exception being inflation and the interest rate, where the adjustment is additive). The main reason for selecting the X11 procedure is com-

[8] The Appendix contains further details including the definition, construction and source of all the variables.

[9] Fiorito and Kollintzas (1994) also analyze the properties of real interest rates, defined as the difference between nominal rates and realized future inflation. Such a procedure of calculating the real interest rate would be problematic in our sample, due to high and volatile inflation rates. Other potentially relevant variables like hours worked, terms of trade, FDI, or more detailed productivity figures tend to be unavailable at the quarterly frequency.

patibility with the rest of the literature. For the same reason, we use the adjusted series even if seasonality is rejected — in such cases, the adjusted series remain almost identical to the original anyway. For ratios, and other generated variables, we use the seasonally adjusted series; i.e. the ratios are not adjusted further.

Next, the cyclical component in the seasonally adjusted data is extracted. As argued by Canova (1998), and confirmed in Agénor et al (2000), cyclical patterns might depend on the particular de-trending procedure adopted. Some of the macro variables have a trend even in developed economies but such a behavior is much more prevalent in emerging ones. In order to arrive at a robust measure of cyclical variation, we employ several approaches to de-trending, and report the main statistics for all of them. Our choices are the H-P filter with parameter 1600 (the standard choice for quarterly data), log first differences (potentially problematic with trending variables, but the results typically turn out to be similar with this choice as well), and fitting a quadratic time polynomial. These choices coincide with the ones used in Christodoulakis et al (1993) and Fiorito and Kollintzas (1994).[10]

In almost all cases, filtering is applied to the natural logarithm of the variables. One set of exceptions is inflation and the nominal interest rate, which are already in log-difference form, so these series are directly filtered. Other exceptions are net exports and net capital flows, which can take on both negative and positive values. Similarly to Kydland and Zarazaga (1997) and Agénor et al (2000), we thus employ the ratio of net exports and net capital flows to output in percentage terms.[11] We thus scale net exports by nominal GDP measured in local currency, and net capital flows by nominal GDP measured in US dollars. In all other cases, taking logs and then de-trending takes care of country-specific scaling. Finally, productivity is calculated both at economy-wide and industry levels. Total productivity is defined as the ratio of GDP to total employment, while industrial productivity as the ratio of industrial output to industrial employment.

[10] Agénor et al (2000) use the band-pass filter of Baxter and King in detrending. We refrain from using these filters, as our near-forty quarterly observations may constitute too short of a period to safely adopt this approach.

[12] Kaminsky et al (2004) argue that the correlation between the levels of these variables, not normalized by output provides a superior measure of the cyclical stance. Using the cyclical component of the net export and capital flow data however makes the interpretation of the relevant volatility figures questionable; the scale is invariant within a country, but not across countries.

# 4. Results

Before looking at the variances and covariances in more detail, it is useful to have a bird-eye view of the output data to see if they show any cyclical pattern of the classical type. As randomly selected examples, Figures 1 to 3 show the evolution of GDP and industrial output in Estonia, Poland and Slovenia. Despite the relatively short sample period, the graphs confirm that GDP, and especially industrial output indeed follow a strong upward trend with notable ups and downs. One can clearly see an initial transition bust, followed by a robust expansion, in some instances broken by the apparent effect of the Russian crisis. In some quarters, growth has picked up, with an unclear cyclical behavior through the global slowdown recession starting around 2000. Overall, this is the standard picture one could expect, showing some visible though not absolutely clear cyclical pattern.

It is instructive to look at summary statistics of output fluctuations in CEE countries and compare them to ones documented in other regions. Table I reports measures of volatility and persistence in H-P-filtered output. Overall, output is somewhat more volatile in transition countries than in developed economies, and is about as volatile as in other developing ones. Some of this phenomenon might be related to differences in sample size; most other results in the literature are obtained from 15-30 years of quarterly data, where the trend component can be extracted more precisely, and the endpoints are less influential. Average GDP volatility in transition countries is a bit lower than in the small number of developing countries there exist data for, and slightly higher than in the EU countries.[12] Hungary and Slovenia appear to be clear outliers, Slovakia and Poland and following them with their relatively low GDP volatility statistics.

The persistence in H-P filtered output is similar across all countries in the table; the first two autocorrelations are typically significant, and the third one is marginally significant. Persistence is particularly high in G7 economies as compared to any other group of countries. The degree of persistence in general appears to be related to country size with the clear exceptions of the Czech Republic in the transition group and Belgium in the EU one. Persistence is particularly low only in Spain and Slovenia.[13] All in all, one of the major conclusions here is that the dynamic properties of output fluctuations in transition economy are not drastically different from the similar fluctuations in other developing countries, but are somewhat more pronounced than in more developed ones.

A number of related studies report facts of economic fluctuations by proxying output with industrial production. In contrast, we use real GDP as a measure of output. In order to provide a basis of comparison for our findings to the rest of the literature, we first examine the properties of industrial production data. Table II displays the degree of volatility, cyclicality and persistence in industrial production in CEE countries.[14] The data indicate that industrial production is highly volatile, about as volatile as in other developing countries. Relative volatility is reasonably stable across countries, indicating a certain

[12] The relatively high GDP volatility in non-G7 members of the EU might be partly due to data construction. In particular, the GDP volatility figures reported by Christodoulakis et al (1993) are constructed from annual frequency GDP figures by matching seasonal patterns in quarterly GDP to that of Industrial Production.

[13] Low cyclical persistence in Slovenia and Spain might be attributed to the statistical properties of the H-P filter (cf. Marcet and Ravn (2004)).

[14] We have all subsequent results with industrial production as a measure of output, as opposed to GDP computed. These are available upon request.

degree of uniformity in industrial sectors. Industrial output is also strongly procyclical and synchronous.[15] Major outlier in cyclicality is the Czech Republic with the lowest contemporaneous correlation coefficients of 0.21. Regarding the degree of persistence, Lithuania stands out by having an autoregressive coefficient of 0.27. While the H-P filtered series are in general highly persistent, first differenced industrial production data are not; indeed, they tend to be close to a white noise process.

Tables III through XXII summarize the results for three major groups of variables, fixed price output components (consumption, investment, government consumption, net exports, imports, exports), variables related to the labor market (employment, real wages, productivity), and monetary and nominal variables (private sector credit, M1, M2, CPI level, CPI inflation, net capital flows, nominal interest rate, nominal and real effective exchange rates). For all variables, the following statistics are reported: absolute volatility (standard deviation), volatility relative to output, contemporaneous correlation with output, measures of the phase shift (correlations between the variable itself, and lagged and leaded output) and persistence (first-order autocorrelation coefficient). While we always obtain result using all three alternative filtering procedures (H-P, time polynomial and first difference), the first three statistics are reported for all the three alternative de-trending procedures, the latter ones only for the H-P filter. As most of our results are robust to filtering techniques, especially the H-P and the time polynomial filter tend to produce virtually identical outcomes, the interpretation of findings is always based only on one of the filters, the H-P one.

## 4.1 GDP components

*Consumption.* The absolute and relative volatility of consumption is higher in all transition countries where the data available than in the US. Some of the countries have even higher consumption volatility than other developing countries such as Argentina, Mexico and Turkey. The comparison is also striking with the EU and the G7 country group. For instance, the UK has the largest relative volatility of 1.15 in G7, a figure being on the same order of magnitude as the smallest relative volatilities in the CEE sample with 0.97 in Lithuania, 1.04 in Poland and 1.06 in Russia. One may conclude that excessively high volatility contradicts the theoretical prior of consumption smoothing. Explanations of this puzzle can potentially be manifold. One of them is the dominance of durable consumption, a particularly important and volatile component of private consumption in transition economies, characterized by rapid income growth and changing consumer behavior (see Backus, Kehoe and Kydland [1995]). A complementary argument is the presence of liquidity constraint in economies with highly imperfect financial systems. It might also be the case that consumers have particularly strong precautionary motive to save, resulting in excess sensitivity in consumption responses to income. Finally, high volatility in consumption can stem from the dominance of permanent shocks to trend growth, a particularly pervasive feature of many developing economies (see Aguiar and Gopinath [2004]).

With the exceptions of Latvia being countercyclical and Lithuania acyclical, private consumption is highly procyclical. The contemporaneous correlation between consumption and GDP is always positive,

[15] The 95% significance level benchmark in the correlation coefficients we use is $2/\sqrt{T}$.

typically significantly so. The magnitude of the coefficients appears to be similar to ones found in industrial countries. There are many significantly positive, synchronous phase shift coefficients, though the pattern is not unequivocal, similarly to EU countries. Moreover, whether output is proxied by real GDP or industrial output does not seem to alter the cyclical properties of consumption. The persistence in consumption is non-negligible, though lower than in the US. The two notable outliers are again Latvia and Lithuania, with virtually no persistence in consumption.

*Investment.* Investment is strongly procyclical and is often coincidental. Latvia is an exception again. It is also the most volatile component of aggregate spending in all countries in the sample. Though we measure investment as gross fixed capital formation, thereby excluding its most volatile component inventories, the volatility of investment in CEE countries is very high in international comparison, especially relative to industrial countries, both in relative and absolute terms. Nonetheless, excessive volatilities might stem from data issues, like measurement problems (classification of certain items); or the privatization of a large portion of previously government owned physical assets. Investment tends to be persistent, with the exceptions of Hungary, Latvia and Romania. Indeed, Latvia and Romania happen to be countries with particularly low persistence and low correlation in investment.

Government consumption. Governments play a large and central role in all transition economies, and their prudence is one of the key criteria of EU and EMU accession. For this reason, budget items are often moved across years or budget categories, creating extra artificial volatility of spending, transforming its dynamics in an uncertain way. Given this caveat, government consumption appears to be more volatile than in industrial countries, and about as volatile than in developing countries. In addition, government spending tends to be more volatile than private consumption, and less volatile than investment in the sample. If anything, government consumption tends to be procyclical, though often just weakly so.[16] Croatia and Latvia are countercyclical, Estonia and Hungary acyclical. The persistence in government consumption is in general low.

*Net exports.* With the exception of Romania with an acyclical trade balance, all signs of the cyclicality statistics are negative, though only marginally so, in line with the experience in developing and G7 economies. Russia, major exporter of raw materials shows a number of sizeable and positive lead coefficients. Relative volatilities are dramatically higher than the corresponding statistic in the US, the latter being 0.45 (see Kydland and Prescott [1990]). While net exports tend to be the least volatile component of GDP, less volatile than private consumption in most countries, Hungary, Poland, Russia and Slovakia still exhibit lower consumption than net export volatility. Hungary, Russia and Slovakia also happen to be countries with a high degree of persistence in net exports.

*Imports.* The volatility of imports relative to GDP tends to be larger than the one for industrial countries. In our sample, imports in Poland and Slovakia are the most volatile ones in relative terms. In absolute terms, Croatia, Lithuania and Russia show particularly strong volatilities, while the Czech Republic and Slovenia particularly low absolute volatilities. Large relative volatilities might of course be related to heavy re-exporting activities in these countries. Just like in G7 countries, imports are always strongly procyclical and close to being coincidental in all countries.

[16] See Kaminsky et al (2004). In examining fiscal policy in four CEE countries, Coricelli and Ercolani (2002) also find a procyclical fiscal stance.

*Exports.* Again, relative export volatilities in CEE countries exceed those in industrial countries. Exports are least volatile in Russia, both in absolute and relative terms. Exports are much less procyclical than imports; indeed, they are often acyclical. Exports are especially procyclical and persistent in countries with the most open goods and capital markets, such as the Baltic countries and Hungary, but is also procyclical in major commodity exporter countries, such as Romania and Russia. None of the observed phase shift patterns are inconsistent with G7 results. For example, the US has a strong negative leading correlation, Canada has a medium-high positive lead, and Italy has a medium-high negative lagged correlation.

## 4.2 Labor market

*Employment.* We present evidence of both total and industrial employment. In general, employment in CEE countries tends to be more variable than in industrial ones, both in absolute and relative terms. Bulgaria shows a particularly high degree of absolute volatility. Cyclical patterns in employment are very similar to G7 results; with the exception of Estonia (only industrial employment) and Croatia, employment is highly procyclical. Similarly to G7 economies documented by Fiorito and Kollintzas (1994), phase shifts, especially in total employment are typically lagging the cycle in CEE countries. In this sense, phase shift patterns in employment point to theories of the business cycle embracing labor hoarding considerations. Cyclical employment is also quite persistent.

*Real wages.* The relative volatility of real wages is again significantly higher here than in G7 economies, particularly so in Hungary and Russia. Apart from potential measurement issues, high volatility might be attributed to the interaction of cyclical fluctuations and the trend real convergence process in these countries. Economic theory suggests that procyclical wages are consistent with technological shocks, while preference or government expenditure shocks can lead to countercyclical wages. In contrast to the evidence in industrial countries, significant positive correlation coefficients here dominate negative and zero ones, though the phase shifts show no unequivocal pattern. Cross-country differences in this respect may thus indicate the relative importance of these shocks. Real wages tend to be persistent, with the exception of Estonia.

*Productivity.* We study both total and industrial productivity. The former variable is defined as the ratio of GDP to total employment, the latter one as the ratio of industrial output to industrial employment. Absolute and relative volatilities in cyclical productivity are in general fairly high in many countries, well exceeding similar statistics in developed economies. The absolute volatility of total productivity appears to be low in the Czech Republic, Hungary, Poland, Slovakia and Slovenia. At the same time, industrial productivity is exceptionally volatile in Bulgaria, Estonia and Romania. Productivity is strongly procyclical, typically coincidental. Exceptions include acyclical total productivity in Slovakia, and countercyclical industrial productivity in Bulgaria and Slovakia.[17] The data also indicate persistence in cyclical productivity dynamics.

[17] The contemporaneous correlation coefficient in Bulgaria is significantly positive.

## 4.3 Monetary and financial variables

*Private sector credit.* Unlike Agénor et al (2000), we find some pronounced pattern in these countries. The relative volatilities in many countries appear to be fairly high, especially in Bulgaria and Latvia, though there is no international comparison available in this respect. Absolute volatility in Bulgaria is truly astronomic, potentially explained by the hyperinflation experience in 1997. Private sector credit is procyclical with the exceptions of Russia being countercyclical and the Czech Republic and Slovenia acyclical, and is uniformly highly persistent. As pointed out by Agénor et al, a strong positive sign could have important consequences for the cost of restrictive monetary policy if credit leads the cycle. In the current sample however private credit is dominantly lagging the cycle, or concurrent with it. In Bulgaria, Latvia, Lithuania and Russia, large negative lead correlation coefficients are followed by positive lag ones, potentially explained by crisis episodes in these countries.

*Money.* Relative volatilities in M1 in our sample are similar to, or larger than the ones in the US or G7 economies. Absolute volatility is again particularly high in Bulgaria, and to a lesser extent in Croatia, the Czech Republic, Russia and Slovakia. Given the high or moderate inflation history in most CEE countries, large volatility should come as no surprise. M1 is least volatile in countries having a certain degree of flexibility in their exchange rate regimes, Hungary, Poland, Romania and Slovenia. M1 is in general highly persistent, procyclical, and rather leading or coincidental. Though in many countries one can observe large cyclical coefficients of both signs at various leads and lags. Slovenia shows a somewhat strange pattern with correlations being insignificant at all leads and lags. Bulgaria is a clear exception in terms of cyclicality with no sizeable positive correlation between M1 and output. Kydland and Zarazaga (1997) also find M1 to be countercyclical using their "new version" of GDP estimates in Argentina, a country also plagued by a history of particularly deep financial crises. Money moving the opposite direction to output is however unprecedented in other countries.

Apart from Hungary and Slovakia, absolute volatilities in M2 are large, larger than for the G7 group, but never as high as in Argentina. M2 is highly volatile in Bulgaria, Croatia, Latvia and Russia. Overall, M2 behaves similarly to M1; it tends to be procyclical or acyclical, like in the G7 group. Romania is an exception with countercyclical M2 and procyclical M1.

*CPI.* Since a large and changing fraction of prices is in the regulated category in CEE economies, one would not expect a very clear cyclical pattern of the CPI. Surprisingly, most of the countries still exhibit countercyclical, and weakly leading or coincidental behavior of the price level. This behavior is similar to that of the G7, and it is usually interpreted as supporting the RBC approach with a shifting aggregate supply and a stable aggregate demand. Prices are weakly leading or coincidental, and procyclical only in Russia and acyclical in Lithuania and Poland. With Croatia and the Czech Republic as exceptions, the CPI in the current sample exhibits a much larger absolute volatility than in industrial countries. Reflecting the large nominal shock associated with the hyperinflation period in 1997 and the crises in 1998, prices are particularly volatile in Bulgaria, and Russia, respectively. Presumably associated with the high trend inflation and the inflation surge in 1997, Romania also exhibits highly volatile prices. The Baltic countries appear to constitute another group with moderately high absolute volatility figures. The CPI is in general highly persistent in most countries. Croatia has the least persistent and least volatile CPI.

*Inflation.* Chadha and Prasad (1994) argue that it is the behavior of inflation and output that reflects the relative importance of demand- versus supply-driven versus supply-driven disturbances. Though the relevant negative correlation coefficients outnumber the positive ones, the small size of the largest coefficients and the highly mixed pattern in leads and lags make inflation in CEE economies show no unambiguous cyclical properties. Inflation is not particularly volatile in most countries, the exceptions being Bulgaria, Romania and Russia again. These countries also stand out by having inflation series that are not only persistent but also highly negatively correlated with GDP.[18] It is also notable that inflation is procyclical in countries with relatively more flexible exchange regimes, such as Hungary, Poland and Slovenia. With the exception of Russia, there is little persistence in inflation.

*Net capital flow.* While no direct international comparison is available in this regard, net capital flows are most volatile in Hungary and Slovakia in the CEE group. Although no particularly strong cyclical pattern appear to exist, net capital flows tend to be leading the cycle and procyclical. Capital flows are countercyclical in Bulgaria and Russia. Consistently with the dynamics of the crisis in 1998, in Russia sizeable positive coincident and lagged coefficients also appear. With the exception of Russia, capital flows are not persistent.

*Nominal interest rate.* Interest rates, as proxied by the lending rate are extremely variable in Bulgaria, Russia, and somewhat in Romania. In other countries they exhibit very small volatilities. Though the figures are not always significant, nominal interest rates tend to show positive lagging, and negative leading correlation coefficients. They are persistent, with the exceptions of Croatia and Slovenia.

*Nominal effective exchange rates.* Exchange rate data in Bulgaria and Russia show exceptionally high absolute and relative volatilities. Volatilities are also high in Estonia, Latvia, Lithuania and Romania. These observations are partly explained simply by the few large discrete jumps in the nominal exchange rate associated with policy regime changes, partly by high the high inflation episodes, especially in Bulgaria, Romania and Russia. On the other hand, Croatia and the Czech Republic show particularly low relative volatilities. Country size and openness do not seem to have a bearing on the degree of volatility; it must be rather associated with the impact of single events. In general, countries with less volatile nominal effective exchange rate also appear to have less volatile price levels. While all series are highly persistent, the cyclical correlations and phase shifts show an entirely mixed pattern.

*Real effective exchange rates.* Absolute and relative volatilities are in general on the same order of magnitude as the ones for nominal rates. Bulgaria is an exception showing much more pronounced cyclical fluctuations in real exchange rates than in nominal exchange rates. Countries in which absolute volatility in real effective exchange rates exceeds or very close to the corresponding nominal figure are the Czech Republic, Poland and Slovenia. Real exchange rates in Bulgaria, Romania and Russia are again particularly volatile in absolute terms. Relative volatility is quite high in Poland, Russia and Slovenia, indicating that the exchange rate is rather a source than an absorber of shocks here. Comparing patterns in cyclicality in real with nominal exchange rates, we find significant sign switches in Romania; otherwise signs, and often phase shifts remain intact. Other than this, cyclicality and phase shifts again show no systematic behavior. Finally, real exchange rates are persistent, though the degree of persistence tends to be slightly lower than the one in nominal exchange rates.

[18] The cyclical properties of non-detrended inflation show virtually identical patterns.

# 5. Concluding remarks

CEE economic fluctuations exhibit a number of interesting patterns. First, industrial production is highly volatile, strongly procyclical, synchronous and persistent. Consumption is excessively volatile, even relative to output, typically procyclical, and persistent. Investment also tends to be volatile, procyclical, and in general coincidental. Government consumption is dominantly procyclical, and it is more volatile than in other countries. Net exports are countercyclical and are again highly volatile, although they are the least volatile component of GDP. Overall, investment is the most volatile component of GDP, followed by government consumption, private consumption and net exports. Exports are most procyclical in countries with open goods and capital markets and in major commodity exporter countries.

Employment is highly volatile, procyclical and persistent. Real wages are typically procyclical; they are also volatile, persistent. Productivity is procyclical and tends to be lagging the cycle. Volatility in productivity in CEE economies well exceeds the one in developed economies. Persistence in productivity is present, though not overwhelming. The cyclical behavior of labor market variables in CEE economies is in many respects similar to related patterns in industrial countries, emphasizing the role of real shocks.

Private sector credit is highly volatile, persistent, and procyclical in most countries. The money stock is in general volatile, highly persistent, procyclical, and rather leading or coincidental. The price level is countercyclical, and weakly leading or coincidental with GDP, supporting the importance of shocks of the supply type. The CPI is highly persistent in most countries. Inflation is not particularly persistent and volatile, and shows mixed cyclical patterns. Countries with less volatile nominal effective exchange rate also appear to have less volatile price levels. While nominal exchange rate series are highly persistent, cyclical correlations exhibit no common pattern. Net capital flows are mostly leading and procyclical and exhibit low persistence. Nominal interest rates are in general smooth and persistent. They also show positive lagging, and negative leading correlations with GDP. Volatilities in nominal and real effective exchange rates are often on the same order of magnitude. Phase shifts and cyclicality in real exchange rates show no systematic pattern.

Overall, economic variables in CEE countries tend to be more volatile both in absolute terms and relative to output than in developed economies. Nonetheless, many countries in our sample, including Croatia and the accession group (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia) show broadly similar cyclical behavior to industrial countries. The most frequent country outliers are Bulgaria, Romania and Russia, especially in labor market, price and exchange rate variables. Excluding these countries from the sample makes many of the observed patterns in cyclical dynamics quite homogenous.

In addition to the more detailed international comparison offered in Benczúr and Rátfai (2004), there are a number of directions to which the current analysis is extended. First, we plan to investigate further countries in the region, once the relevant data is becoming a meaningful object of investigation. Second, we plan to investigate further the robustness of our qualitative results to alternative de-trending procedures, such as the band-bass filter of Baxter and King. Third, we are about to examine economic fluctuations in CEE countries using the 'turning point' approach developed by Harding and

Pagan (2002). Fourth, we continue on seeking to cluster countries more systematically according to their cyclical patterns, and connect the results to country characteristics, such as size of the shadow economy, exchange rate regime, financial integration, fiscal and monetary policies etc. Fifth, in some of the countries quarterly data goes back before 1993:1, often to the mid- or late-1980s. For certain countries, even longer time series can be available at the annual frequency. What does such historical data show? While it is clear that one has to be very cautious when looking at old data in the former Soviet block, some pattern may still reveal.

# Appendix

*Real GDP.* For Bulgaria, the Czech Republic, Estonia, Hungary and Lithuania, real GDP is a fixed price GDP from the Statistical Office. For Croatia, it is the combination of fixed price GDP data of the Statistical Office (from 1997) and the Economic Institute in Zagreb (1995-1996). For Latvia, real GDP is the fixed price GDP series of the Statistical Office (from 1995), which is traced back to 1993 and 1994 with the GDP volume index of the IFS (series 99bvp). For Poland, the OECD Quarterly National Accounts data on fixed price GDP is extended using the Emerging Markets Economic Database data on fixed price GDP (annual changes). For Romania, it is the fixed price GDP from the Statistical Office (from 1998) and the Institute of Economic Forecasting in Bucharest (1994-1997). For Russia, 1995- and 2000-prices GDP series of the Emerging Markets Economic Database are chained together: starting from 2000-prices GDP at the end, annual changes of the 1995-prices GDP are traced back before 2000. For Slovakia, we use the fixed price GDP series of the Emerging Markets Economic Database. For Slovenia, it is the GDP volume index from the IFS (series 99bvp).

*Industrial production.* For Croatia, the Czech Republic, Hungary, Poland, Romania and Slovakia industrial production is a volume index (IFS series 66). For Slovenia, the quarterly series are obtained from the monthly index of industrial production of the Central Bank, each quarter being the 3-month average. For Estonia, the quarterly series are obtained from the monthly index of industrial production of the Statistical Office, each quarter being the 3-month average. For Latvia, the change in the constant-price industrial production index of the Statistical Office is cumulated. For Lithuania, we use the fixed price manufacturing value added data of the Statistical Office. For Bulgaria, the WIIW series of annual changes in the quarterly average of industrial production is matched with the corresponding level series of the Statistical Office. For Russia, the quarterly series are obtained from the monthly index of industrial output of the WIIW, quarters being the 3-month average.

*Private consumption.* Except for Poland, private consumption includes Non-Profit Institutions Serving Households (NPISH). There is insufficient coverage for Slovenia (starting only in 1999). For all other countries, private consumption is a fixed price GDP expenditure data, from the same sources as real GDP. For Russia, the chaining of the 1995- and the 2000-price series is applied to household consumption and the consumption of NPISH separately, and the two series are added up to yield private consumption.

*Investment.* Investment is gross fixed capital formation, in fixed prices. It is obtained from the same sources as real GDP. Investment data in Slovenia are unavailable.

Government consumption. Government consumption is government consumption expenditures in fixed prices. For Poland, it also includes Non-Profit Institutions Serving Households (NPISH). It is obtained from the same sources as real GDP. Government consumption data in Slovenia are unavailable.

Exports and imports. With the exception of Bulgaria and Slovenia, we use fixed price national accounts data on exports and imports of goods and services, from the same sources as real GDP. As fixed price exports data are available only from 1996 onwards, pre-1996 export data in Bulgaria are obtained as a fraction of real GDP, where the fraction is the share of nominal exports in GDP. For Slovenia, the month-

ly figures on merchandise exports in dollars are converted into local currency using monthly average exchange rates from the Central Bank. Quarterly observations then correspond to the 3-month sum of exports.

***Wages.*** For the Czech Republic, Latvia and Lithuania, wages are series 65 in the IFS. For Estonia, we use average quarterly wage series of the Statistical Office, expressed in national currency. For Croatia, Hungary, Romania, Slovakia and Slovenia, wages are the quarterly average of net nominal wages in the WIIW dataset. For Bulgaria, Poland and Russia, wages are the quarterly average of gross nominal wages in the WIIW dataset.

***Employment and productivity.*** For the Czech Republic, Latvia, Lithuania and Russia industrial employment is the index in the IFS (series 67). In the Czech Republic, the sample excludes medium-size firms (with 20-100 employees) in the years of 1995 and 1996. In Lithuania, industrial employment data is available only until 2001:1. For Estonia, we use the industrial employment data of the Statistical Office. For Hungary and Poland, the manufacturing employment data are from the ILO. In Poland, the relevant data missing in the labor force survey data in 1999:2 and 1999:3 are imputed from the establishment survey data. For Bulgaria, Croatia, Romania, Slovakia and Slovenia, monthly industrial employment is from the WIIW, in thousands for Croatia and Romania, index numbers for Bulgaria, Slovakia and Slovenia. Quarterly observations correspond to the last month of the quarter. Industrial productivity, the ratio of industrial production to industrial employment is computed in all countries except the Czech Republic and Lithuania.

For Slovakia, total employment is obtained by matching the relevant IFS data available until 2001:4, with subsequent recent rate of change data of the Statistical Office. For Hungary and Poland, the total employment data are from the ILO. In Poland, the relevant data missing in the labor force survey data in 1999:2 and 1999:3 are imputed from the establishment survey data. For the Czech Republic, Estonia and Lithuania, employment is total employment, as provided by the Statistical Office. For Bulgaria, Croatia, Romania, Russia and Slovenia, total monthly total employment in thousands is from the WIIW, with quarterly observations corresponding to the last month of the quarter. Total employment data with sufficiently long coverage in Latvia are unavailable. Total productivity, the ratio of GDP to total employment is computed in all countries except Latvia.

***Private sector credit.*** For Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Russia, Slovakia and Slovenia, this variable is bank claims on other resident sectors (series 22d). For Romania and Slovakia, we use the monthly series of the Central Bank, taking the last month in the quarter as the quarterly observation. Data on private sector credit with sufficiently long coverage in Poland are unavailable.

***Money.*** For Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Russia and Slovakia, M1 is the money series of the IFS (series 34) and M2 is the sum of the IFS series 34 (money) and 35 (quasi-money). For Estonia and Slovenia, M1 and M2 are the average of the monthly series provided by the Central Bank.

***CPI.*** For Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Poland, Romania, Slovakia and Slovenia, it is the consumer price index series (series 64) of the IFS. For Russia, it is cumulated from changes (series 64x) in the IFS. For Estonia, it is the consumer price index provided by the Statistical

Office. For Lithuania, we use the end-of-quarter observation of the monthly CPI-change series of the Central Bank.

*Inflation.* It is defined as the quarterly change in log of CPI. For the Czech Republic and Slovakia, the first observation is missing since there is no CPI data before 1993:1, the time for the breakup of Czechoslovakia.

*Net capital flows.* Net capital flows are obtained as the sum of the capital and financial accounts measured in US dollars. For Bulgaria, Croatia, Estonia, Hungary, Latvia, Lithuania, Romania, Russia, and Slovenia, the data are from the IFS (series 78bcd for the capital and 78bjd for the financial account). For the Czech Republic, the capital and financial account data are taken from the Central Bank. For Slovakia, the IFS data are matched with the relevant CB data. The data with sufficiently long coverage in Poland are unavailable.

*Nominal interest rate.* For Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Russia, Slovakia and Slovenia, the nominal interest rate is the annual lending rate in percentage in the IFS (series 60). For Romania, we use the last monthly observation in the quarter of the lending rate reported by the Central Bank.

*Nominal and real effective exchange rates.* For Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Russia and Slovakia, effective exchange rates are trade-weighted indices from the IFS (series nec and rec). For Estonia, we use the quarterly effective exchange rates series of the Central Bank. For Latvia, Lithuania and Slovenia, we use the monthly nominal and real effective exchange rate series of the Central Bank, taking the last month in the quarter as the quarterly observation. Real exchange rates are CPI-based.

# References


Agénor, Pierre-Richard, C. John McDermott and Eswar S. Prasad (2000): "Macroeconomic Fluctuations in Developing Countries: Some Stylized Facts," The World Bank Economic Review, pp. 251-285

Agresti, Anna-Maria and Benoit Mojon (2001): "Some Stylized Facts on the Euro Area Business Cycle," Working Paper #95, European Central Bank

Aguiar, Mark and Gita Gopinath (2004): "Emerging Market Business Cycles: The Cycle is the Trend", NBER WP #10734

Ahmed, Shaghil, Barry W. Ickes, Ping Wang and Byung Sam Yoo (1993): "International Business Cycles," The American Economic Review, Vol. 83, No. 3, pp. 335-359

Alper, C. Emre (2002): "Business Cycles, Excess Volatility and Capital Flows: Evidence from Mexico and Turkey", Russian and East European Finance and Trade, pp. 22-54

Artis, Michael J. and Wenda Zhang (1997): "International Business Cycles and the ERM: Is There a European Business Cycle?" International Journal of Finance and Economics 2, pp. 1-16

Artis, Michael J. and Wenda Zhang (1999): "Further Evidence on the International Business Cycles and the ERM: Is There a European Business Cycle?," Oxford Economic Papers 51, pp. 120-132

Artis, Michael J., Massimiliano Marcellino and Tommaso Proietti (2004): "Characterizing the Business Cycle for Accession Countries", manuscript

Backus, David K. and Patrick J. Kehoe (1992): "International Evidence on the Historical Properties of Business Cycles," American Economic Review 82, pp. 864-888

Basu, Susanto and Alan M. Taylor (1999): "Business Cycles in International Historical Perspective" ,Journal of Economic Perspectives Vol. 13, pp. 45-68

Benczúr, Péter and Attila Rátfai (2004): "Facts of Macroeconomic Fluctuations around the Globe", manuscript

Bjornland, Hilde Christiane (2000): "Detrending Methods and Stylized Facts of Business Cycles in Norway - An International Comparison", Empirical Economics, pp. 369-392

Bergman, U. Michael, Michael D. Bordo and Lars Jonung (1998): "Historical Evidence on Business Cycles. The International Experience", manuscript

Burgoeing, Raphael and Raimundo Soto (2002): "Testing Real Business Cycle Models in an Emerging Economy", manuscript

Canova, Fabio (1998): "Detrending and Business Cycle Facts", Journal of Monetary Economics, pp. 475-512.

Chadha, B. and Eswar S. Prasad (1994): "Are Prices Countercyclical? Evidence from the G7", Journal of Monetary Economics, pp. 239-57

Christodoulakis, Nicos, Sophia P. Dimelis and Tryphon Kollintzas (1993): "Comparison of Business Cycles in Greece and the EC: Idiosyncracies and Regularities", CEPR DP #809

Coricelli, Fabrizio and Valerio Ercolani (2002): "Cyclical and Structural Deficits on the Road to Accession: Fiscal Rules for an Enlarged European Union", CEPR DP #3672

Danthine, Jean Pierre and John B. Donaldson (1993): "Methodological and Empirical Issues in Real Business Cycle Theory", European Economic Review, pp. 1-35

Darvas, Zsolt and Szapáry, György (2005): "Business Cycle Synchronisation in the Enlarged EU: Comovements in the New and Old Members", CEPR DP No. 5179

Fiorito, Riccardo and Tryphone Kollintzas (1994): "Stylized Facts of Business Cycles in the G7 from a Real Business Cycle Perspective", European Economic Review, pp. 235-69

Harding, Don and Adrian Pagan (2002): "Dissecting the Cycle: A Methodological Investigation", Journal of Monetary Economics, pp. 233-251

Kaminsky, Graciela L., Carmen M. Reinhart and Carlos A. Végh (2004): "When It Rains, It Pours: Procyclical Capital Flows and Macroeconomic Policies", NBER Macroeconomic Annual, forthcoming

Kose, M. Ayhan, and Raymond Riezman (1998): "Trade Shocks and Macroeconomic Fluctuations in Africa", Working Paper

Kouparitsas, Michael A. (1997): "North-South Terms of Trade: An Empirical Investigation", Working Paper 97-5, Federal Reserve Bank of Chicago

Kydland, Finn E. and Edward C. Prescott (1990): "Business Cycles: Real Facts and Monetary Myth," Federal Reserve Bank of Minneapolis Quarterly Review, pp. 3-18

Kydland, Finn E. and Carlos Zaragaza (1997): "Is the Business Cycle of Argentina Different?", Federal Reserve Bank of Dallas Economic Review, pp. 21-36

Lucas, Robert E. Jr. (1977): "Understanding Business Cycles", Carnegie-Rochester Conference Series on Public Policy, pp. 7-29

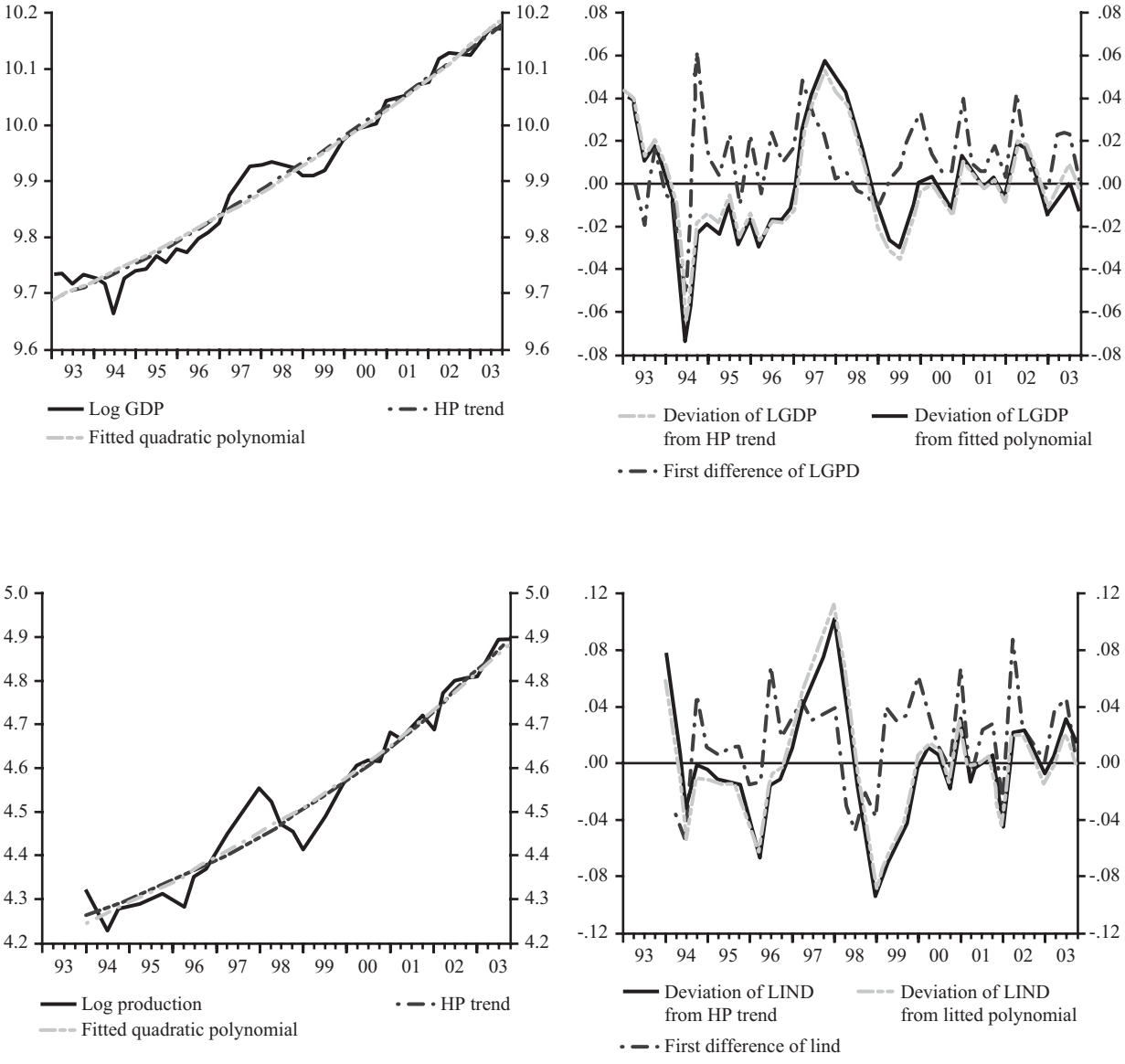
Marcet, Albert and Morten Ravn (2004): "The HP-Filter in Cross-Country Comparison", CEPR Discussion Paper #4244

Mendoza, Enrique (1995): "The Terms of Trade, the Real Exchange Rate and Economic Fluctuations", International Economic Review, pp. 101-137

Rodriguez-Mata, Margarita (1997): "Cyclical Patterns of the Costa Rican Economy", Working Paper, Central Bank of Costa Rica

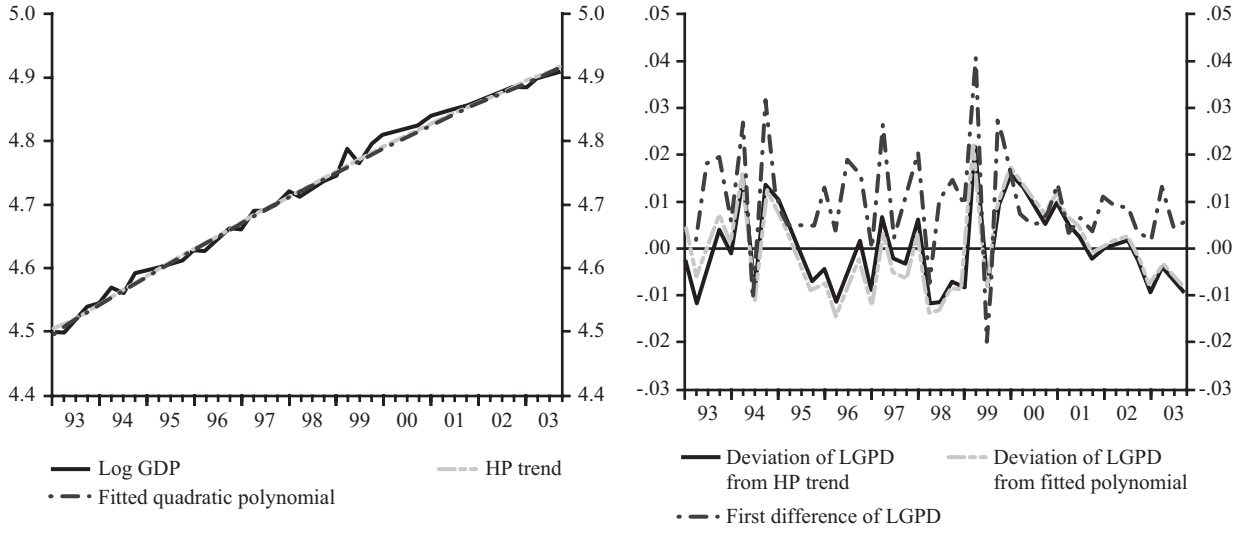
## Figure 1

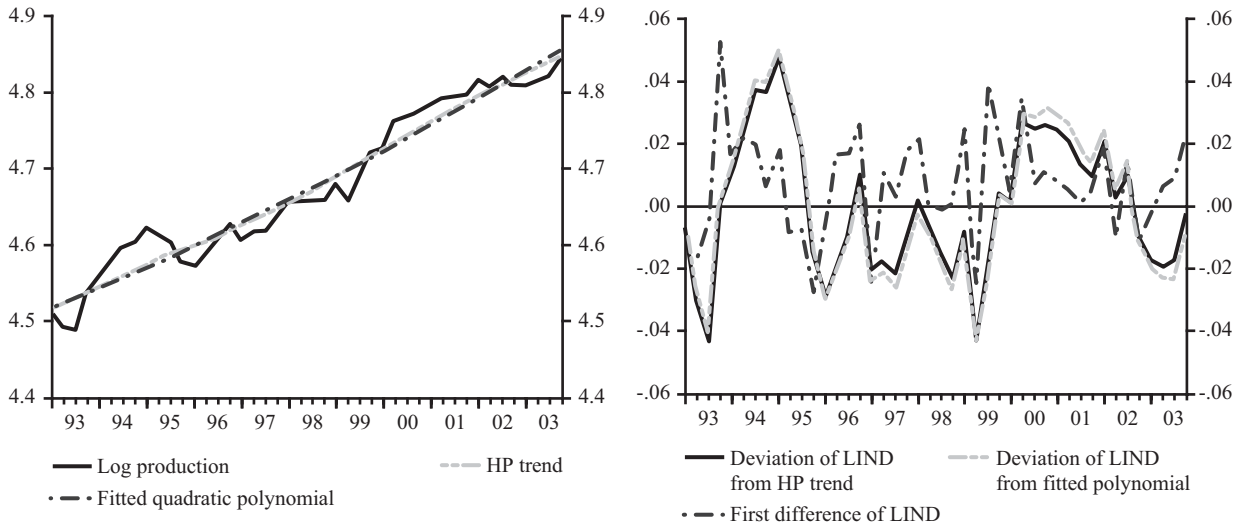
**Estonia**



## Figure 2

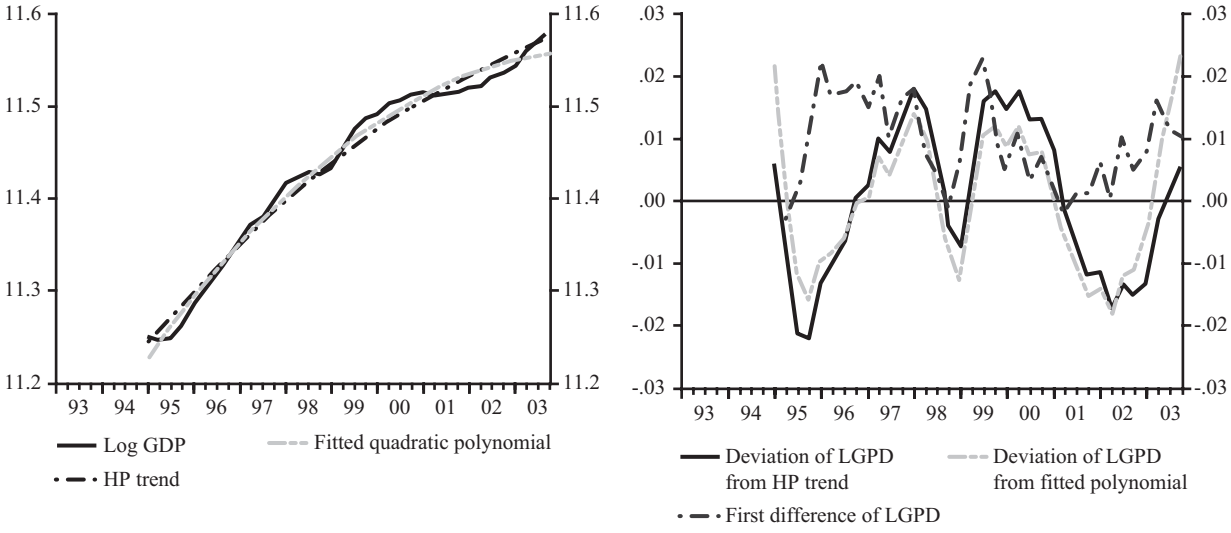
**Slovenia**

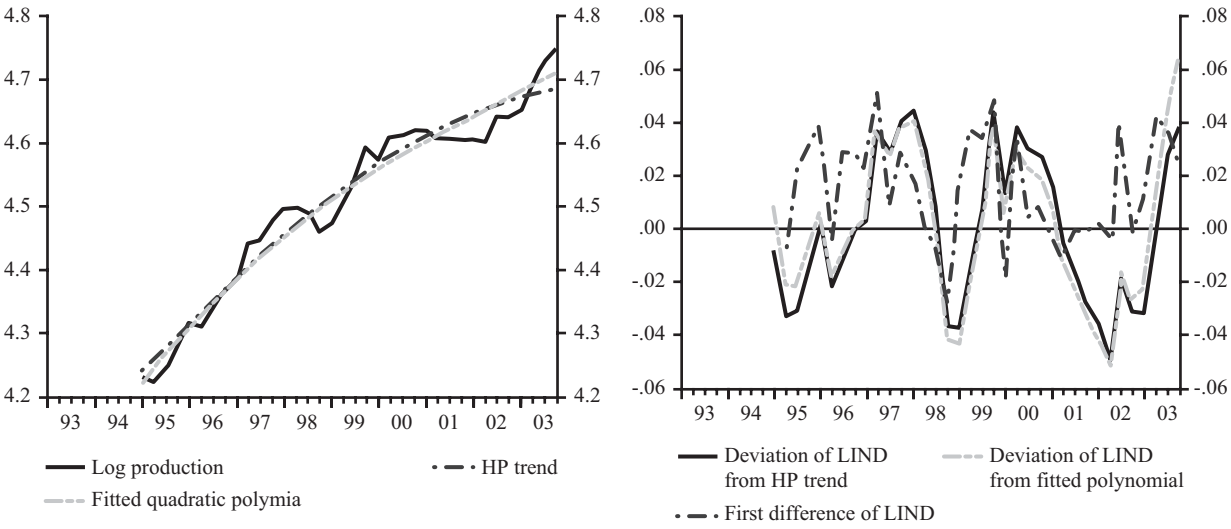


## Figure 3

**Poland**



## Table 1

**Summary statistics for output**

| Country | Sample Period | GDP Volatility | IP Volatility | Autocorrelation | | | |
|---|---|---|---|---|---|---|---|
| | | | | lag1 | lag2 | lag3 | lag4 |
| Argentina | 1970:1 / 1980:1 | 3.06 / 4.59 | 5.57 | | | | |
| | – | | | | | | |
| | 1990:4 | | | | | | |
| Chile | 1986:1 – 1998:4 | 2.00 | 4.53 | 0.68 | 0.51 | 0.27 | 0.00 |
| Colombia | 1978:1 – 1995:4 | | 2.33 | 0.51 | 0.27 | 0.17 | 0.02 |
| India | 1978:1 – 1995:4 | | 2.45 | 0.48 | 0.35 | 0.10 | 0.02 |
| Korea | 1978:1 – 1995:4 | | 3.47 | 0.71 | 0.44 | 0.20 | -0.14 |
| Malaysia | 1978:1 – 1995:4 | | 4.06 | 0.69 | 0.30 | 0.07 | -0.16 |
| Mexico | 1987:1 – 2000:2 | 2.34 | 3.31 | 0.72 | 0.40 | 0.14 | -0.13 |
| Morocco | 1978:1 – 1995:4 | | 2.77 | 0.06 | 0.25 | 0.08 | -0.18 |
| Nigeria | 1978:1 – 1995:4 | | 6.69 | 0.45 | 0.09 | -0.06 | -0.12 |
| Philippines | 1978:1 – 1995:4 | | 7.45 | 0.63 | 0.42 | 0.10 | -0.15 |
| Tunisia | 1978:1 – 1995:4 | | 2.72 | 0.63 | 0.42 | 0.13 | 0.06 |
| Turkey | 1987:1 – 2000:2 | 3.48 | 3.62 | 0.38 | 0.14 | 0.06 | -0.12 |
| Uruguay | 1978:1 – 1995:4 | | 4.94 | 0.63 | 0.50 | 0.27 | -0.01 |
| **Developing average** | | **2.77 / 3.10** | **4.15** | **0.55** | **0.34** | **0.13** | **-0.08** |
| Bulgaria | 1994:1 – 2003:4 | 4.20 | 6.73 | 0.66 | 0.31 | 0.02 | -0.17 |
| Croatia | 1994:1 – 2003:4 | 2.25 | 2.67 | 0.55 | 0.29 | 0.15 | 0.10 |
| Czech Republic | 1994:1 – 2003:4 | 1.81 | 2.80 | 0.73 | 0.52 | 0.34 | 0.28 |
| Estonia | 1993:1 – 2003:4 | 2.46 | 4.17 | 0.67 | 0.39 | 0.16 | -0.07 |
| Hungary | 1995:1 – 2003:4 | 1.05 | 3.75 | 0.58 | 0.27 | 0.05 | 0.12 |
| Latvia | 1993:1 – 2003:4 | 1.89 | 4.45 | 0.65 | 0.32 | 0.09 | 0.06 |
| Lithuania | 1995:1 – 2003:4 | 2.53 | 4.39 | 0.56 | 0.39 | 0.40 | 0.19 |
| Poland | 1995:1 – 2003:4 | 1.21 | 5.37 | 0.84 | 0.58 | 0.32 | 0.13 |
| Romania | 1994:1 – 2003:4 | 3.61 | 7.43 | 0.67 | 0.44 | 0.35 | 0.26 |
| Russia | 1995:1 – 2003:4 | 3.06 | 3.86 | 0.80 | 0.52 | 0.24 | 0.03 |
| Slovakia | 1993:1 – 2003:4 | 1.22 | 2.61 | 0.56 | 0.47 | 0.42 | 0.42 |
| Slovenia | 1993:1 – 2003:4 | 0.85 | 2.20 | 0.19 | 0.31 | 0.19 | -0.08 |
| **CEE average** | | **2.18** | **3.97** | **0.62** | **0.40** | **0.23** | **0.11** |
| US | 1960:1 – 1989:3 | 1.74 | 3.70 | 0.85 | 0.65 | 0.41 | 0.21 |
| Canada | 1960:1 – 1989:3 | 1.39 | 3.79 | 0.78 | 0.51 | 0.27 | 0.04 |
| Japan | 1960:1 – 1989:3 | 1.53 | 4.07 | 0.78 | 0.59 | 0.38 | 0.19 |
| Germany | 1960:1 – 1989:2 | 1.69 | 3.06 | 0.67 | 0.46 | 0.35 | 0.23 |
| France | 1960:1 – 1989:3 | 0.90 | 2.70 | 0.77 | 0.54 | 0.30 | 0.10 |
| UK | 1960:1 – 1989:1 | 1.54 | 2.85 | 0.55 | 0.37 | 0.20 | 0.07 |
| Italy | 1960:1 – 1989:3 | 1.70 | 3.58 | 0.80 | 0.52 | 0.22 | -0.04 |
| **G7 average** | | **1.50** | **3.39** | **0.74** | **0.52** | **0.30** | **0.11** |
| Belgium | 1960:1 – 1989:4 | 2.68 | 2.75 | 0.72 | 0.49 | 0.22 | -0.04 |
| Denmark | 1960:1 – 1989:4 | 2.30 | 2.24 | 0.26 | 0.05 | 0.00 | 0.13 |
| Greece | 1962:1 – 1990:4 | 2.85 | 3.04 | 0.64 | 0.36 | 0.17 | -0.01 |
| Ireland | 1976:1 – 1989:4 | 2.31 | 3.11 | 0.35 | 0.03 | 0.10 | 0.05 |
| Luxembourg | 1960:1 – 1989:4 | 3.20 | 5.07 | 0.54 | 0.30 | 0.11 | 0.00 |
| Netherlands | 1960:1 – 1989:4 | 1.79 | 2.27 | 0.32 | 0.09 | 0.11 | 0.06 |
| Portugal | 1968:1 – 1989:4 | 3.05 | 3.52 | 0.52 | 0.37 | 0.19 | 0.16 |
| Spain | 1975:1 – 1989:4 | 1.47 | 1.80 | 0.13 | 0.17 | 0.18 | 0.03 |
| **EU average** | | **2.12** | **3.07** | **0.52** | **0.31** | **0.18** | **0.06** |

*Note: GDP and Industrial Production (IP) are all Hodrick-Prescott filtered. Autocorrelations are computed in IP in the developing group, and in real GDP otherwise. 'EU average' includes G7 members of EU as well.*

*Sources: Kydland and Zarazaga (1997) for GDP and IP in Argentina (old / new estimates); Agenor et al (2000) for IP in all other developing countries; Alper (2003) for GDP in Mexico and Turkey; Burgoeing and Soto (2000) for GDP in Chile; Fiorito and Kollintzas (1994) for GDP and IP in G7 countries; Christodoulakis et al (1995) for GDP and IP in EU countries; authors' calculation for GDP and IP in CEE countries.*

## Table 2

**Industrial output**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 6.73 | 2.43 | 2.80 | 4.17 | 3.75 | 4.45 | 4.39 | 2.81 | 7.43 | 3.86 | 2.61 | 2.20 |
| FD | 4.80 | 2.43 | 2.45 | 3.37 | 2.39 | 3.39 | 5.37 | 2.08 | 4.10 | 2.92 | 2.30 | 1.69 |
| TP | 9.20 | 2.56 | 3.00 | 4.19 | 4.51 | 4.57 | 4.44 | 2.87 | 9.61 | 4.92 | 2.97 | 2.43 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.60 | 1.08 | 1.55 | 1.76 | 3.58 | 2.52 | 1.73 | 2.32 | 2.06 | 1.26 | 2.14 | 2.59 |
| FD | 1.28 | 1.14 | 1.87 | 1.71 | 2.81 | 2.35 | 2.29 | 2.80 | 1.39 | 1.42 | 2.03 | 1.54 |
| TP | 2.14 | 0.97 | 1.37 | 1.67 | 3.77 | 2.48 | 1.56 | 2.56 | 2.25 | 1.68 | 1.87 | 2.65 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.39 | 0.71 | 0.21 | 0.78 | 0.80 | 0.62 | 0.71 | 0.85 | 0.80 | 0.43 | 0.46 | 0.46 |
| FD | 0.37 | 0.60 | 0.03 | 0.76 | 0.64 | 0.41 | 0.59 | 0.75 | 0.42 | 0.17 | 0.36 | -0.01 |
| TP | 0.11 | 0.75 | 0.38 | 0.80 | 0.83 | 0.55 | 0.71 | 0.86 | 0.82 | 0.58 | 0.54 | 0.49 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.15 | -0.12 | -0.23 | -0.02 | 0.24 | -0.07 | -0.04 | 0.07 | 0.31 | -0.14 | 0.44 | -0.19 |
| -3 | -0.01 | 0.03 | 0.00 | 0.30 | 0.29 | 0.12 | 0.36 | 0.29 | 0.51 | -0.04 | 0.26 | -0.11 |
| -2 | 0.05 | 0.22 | 0.09 | 0.34 | 0.49 | 0.36 | 0.32 | 0.55 | 0.62 | 0.10 | 0.26 | 0.12 |
| -1 | 0.22 | 0.45 | 0.13 | 0.56 | 0.70 | 0.59 | 0.37 | 0.77 | 0.65 | 0.21 | 0.38 | 0.37 |
| +1 | 0.37 | 0.43 | 0.26 | 0.53 | 0.62 | 0.55 | 0.40 | 0.64 | 0.78 | 0.65 | 0.22 | 0.57 |
| +2 | 0.18 | 0.19 | 0.34 | 0.26 | 0.41 | 0.47 | 0.28 | 0.39 | 0.63 | 0.71 | 0.03 | 0.47 |
| +3 | 0.04 | 0.28 | 0.30 | 0.01 | 0.20 | 0.17 | 0.19 | 0.13 | 0.52 | 0.44 | -0.15 | 0.34 |
| +4 | 0.04 | 0.10 | 0.44 | -0.15 | 0.09 | -0.07 | -0.14 | -0.08 | 0.39 | 0.12 | -0.27 | 0.26 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.79 | 0.52 | 0.65 | 0.68 | 0.83 | 0.73 | 0.27 | 0.74 | 0.86 | 0.76 | 0.62 | 0.72 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of industrial output.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of industrial output and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of industrial output and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between leads (lags) in HP-filtered industrial output and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered industrial output.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered industrial output.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 3

**Private consumption**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 5.48 | 5.29 | 2.20 | 3.41 | 1.79 | 2.38 | 2.45 | 1.26 | 4.93 | 3.23 | 2.47 | |
| FD | 5.30 | 3.45 | 1.86 | 2.93 | 1.44 | 3.09 | 2.74 | 1.21 | 4.73 | 2.54 | 2.55 | |
| TP | 5.67 | 6.22 | 2.75 | 3.89 | 1.42 | 2.47 | 2.63 | 1.17 | 5.48 | 2.83 | 2.57 | |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.30 | 2.35 | 1.21 | 1.38 | 1.71 | 1.39 | 0.97 | 1.04 | 1.37 | 1.06 | 2.03 | |
| FD | 1.46 | 1.62 | 1.44 | 1.50 | 1.79 | 2.48 | 1.17 | 1.63 | 1.58 | 1.22 | 2.26 | |
| TP | 1.32 | 2.37 | 1.26 | 1.50 | 1.19 | 1.37 | 0.93 | 1.05 | 1.28 | 0.97 | 1.62 | |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.78 | 0.58 | 0.74 | 0.60 | 0.41 | 0.22 | 0.26 | 0.65 | 0.72 | 0.48 | 0.22 | |
| FD | 0.64 | 0.37 | 0.49 | 0.35 | 0.01 | 0.18 | 0.21 | 0.39 | 0.51 | 0.42 | 0.24 | |
| TP | 0.79 | 0.68 | 0.80 | 0.48 | 0.56 | 0.23 | 0.36 | 0.57 | 0.78 | 0.25 | 0.20 | |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.08 | 0.17 | 0.07 | 0.10 | -0.40 | 0.43 | 0.00 | 0.55 | 0.01 | -0.55 | 0.05 | |
| -3 | -0.08 | 0.28 | 0.14 | 0.25 | -0.30 | 0.42 | 0.28 | 0.67 | 0.06 | -0.35 | 0.11 | |
| -2 | 0.10 | 0.37 | 0.37 | 0.39 | -0.04 | 0.37 | 0.05 | 0.70 | 0.27 | -0.04 | 0.07 | |
| -1 | 0.44 | 0.52 | 0.56 | 0.54 | 0.28 | 0.23 | 0.05 | 0.68 | 0.61 | 0.20 | 0.10 | |
| +1 | 0.65 | 0.42 | 0.65 | 0.43 | 0.42 | 0.11 | 0.22 | 0.53 | 0.48 | 0.60 | 0.21 | |
| +2 | 0.44 | 0.35 | 0.69 | 0.31 | 0.35 | -0.23 | -0.03 | 0.23 | 0.44 | 0.59 | 0.45 | |
| +3 | 0.16 | 0.12 | 0.70 | 0.13 | 0.48 | -0.47 | 0.10 | 0.00 | 0.35 | 0.62 | 0.46 | |
| +4 | 0.06 | -0.08 | 0.54 | 0.01 | 0.36 | -0.61 | 0.18 | -0.07 | 0.20 | 0.45 | 0.36 | |
| Persistence[5] | | | | | | | | | | | | |
| | 0.56 | 0.81 | 0.66 | 0.65 | 0.73 | 0.18 | 0.28 | 0.58 | 0.55 | 0.75 | 0.48 | |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of private consumption.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of private consumption and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of private consumption and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between leads (lags) in HP-filtered private consumption and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered private consumption.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered private consumption.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 4

**Investment**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 14.36 | 8.50 | 4.58 | 12.37 | 3.11 | 10.45 | 9.39 | 8.01 | 8.37 | 9.10 | 10.19 | |
| FD | 15.41 | 5.34 | 3.27 | 13.81 | 3.80 | 14.05 | 8.40 | 9.33 | 11.86 | 10.45 | 7.97 | |
| TP | 15.62 | 10.94 | 5.29 | 12.62 | 3.17 | 10.43 | 10.57 | 7.13 | 8.83 | 8.78 | 11.21 | |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 3.42 | 3.78 | 2.53 | 5.02 | 2.96 | 6.12 | 3.71 | 6.62 | 2.32 | 2.98 | 8.36 | |
| FD | 4.25 | 2.50 | 2.54 | 7.08 | 4.72 | 11.25 | 3.58 | 12.58 | 3.97 | 5.02 | 7.05 | |
| TP | 3.64 | 4.17 | 2.42 | 4.89 | 2.65 | 5.78 | 3.72 | 6.34 | 2.07 | 3.00 | 7.05 | |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.39 | 0.71 | 0.87 | 0.69 | 0.51 | 0.20 | 0.72 | 0.60 | 0.39 | 0.71 | 0.46 | |
| FD | 0.19 | 0.51 | 0.54 | 0.45 | 0.24 | -0.08 | 0.35 | 0.23 | 0.61 | 0.24 | 0.19 | |
| TP | 0.44 | 0.79 | 0.91 | 0.68 | 0.55 | 0.15 | 0.80 | 0.51 | 0.47 | 0.68 | 0.50 | |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.14 | 0.31 | 0.31 | 0.05 | 0.17 | -0.02 | 0.02 | 0.30 | 0.16 | 0.15 | 0.13 | |
| -3 | 0.49 | 0.41 | 0.34 | 0.17 | 0.20 | -0.12 | 0.41 | 0.39 | 0.24 | 0.28 | 0.23 | |
| -2 | 0.43 | 0.47 | 0.46 | 0.23 | 0.19 | 0.07 | 0.41 | 0.58 | 0.24 | 0.37 | 0.34 | |
| -1 | 0.29 | 0.58 | 0.70 | 0.55 | 0.56 | 0.20 | 0.51 | 0.66 | 0.16 | 0.61 | 0.36 | |
| +1 | 0.35 | 0.58 | 0.78 | 0.43 | 0.19 | 0.16 | 0.66 | 0.47 | -0.16 | 0.71 | 0.47 | |
| +2 | 0.40 | 0.51 | 0.51 | 0.30 | -0.27 | 0.26 | 0.57 | 0.46 | -0.02 | 0.51 | 0.46 | |
| +3 | 0.39 | 0.44 | 0.30 | -0.01 | 0.02 | 0.16 | 0.59 | 0.40 | 0.30 | 0.34 | 0.49 | |
| +4 | 0.21 | 0.40 | 0.15 | -0.10 | -0.16 | 0.14 | 0.40 | 0.26 | 0.35 | 0.07 | 0.37 | |
| Persistence[5] | | | | | | | | | | | | |
| | 0.45 | 0.83 | 0.76 | 0.37 | 0.24 | 0.09 | 0.62 | 0.38 | -0.08 | 0.38 | 0.71 | |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of investment.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of investment and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of investment and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered investment and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered investment.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered investment.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 5

**Government consumption**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 8.05 | 3.05 | 2.76 | 3.90 | 2.14 | 2.71 | 5.64 | 2.07 | 4.85 | 1.34 | 5.89 | |
| FD | 8.57 | 3.24 | 2.93 | 4.29 | 2.87 | 2.81 | 7.97 | 2.86 | 5.97 | 1.44 | 6.63 | |
| TP | 8.41 | 2.99 | 2.81 | 4.40 | 2.05 | 2.85 | 5.95 | 2.08 | 4.97 | 1.35 | 6.07 | |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.92 | 1.36 | 1.52 | 1.59 | 2.04 | 1.59 | 2.23 | 1.71 | 1.34 | 0.44 | 4.83 | |
| FD | 2.36 | 1.52 | 2.27 | 2.20 | 3.55 | 2.25 | 3.40 | 3.85 | 2.00 | 0.69 | 5.86 | |
| TP | 1.96 | 1.14 | 1.29 | 1.70 | 1.72 | 1.58 | 2.10 | 1.85 | 1.17 | 0.46 | 3.82 | |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.53 | 0.00 | 0.29 | -0.19 | 0.25 | 0.13 | 0.54 | 0.30 | 0.42 | 0.24 | 0.25 | |
| FD | 0.34 | 0.01 | 0.18 | 0.13 | 0.00 | 0.24 | 0.38 | 0.06 | 0.13 | 0.22 | 0.02 | |
| TP | 0.51 | -0.02 | 0.42 | -0.26 | 0.23 | 0.11 | 0.61 | 0.33 | 0.36 | 0.21 | 0.28 | |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.15 | -0.64 | 0.30 | -0.28 | -0.01 | -0.36 | 0.29 | -0.01 | 0.33 | 0.42 | -0.05 | |
| -3 | 0.33 | -0.06 | 0.26 | -0.30 | -0.17 | -0.45 | 0.06 | 0.07 | 0.27 | 0.20 | 0.13 | |
| -2 | 0.45 | -0.06 | 0.37 | -0.19 | -0.01 | -0.32 | 0.10 | 0.06 | 0.20 | 0.10 | 0.06 | |
| -1 | 0.61 | 0.02 | 0.22 | -0.21 | 0.18 | -0.17 | 0.42 | 0.11 | 0.46 | 0.18 | 0.13 | |
| +1 | 0.24 | -0.10 | 0.26 | -0.23 | 0.14 | 0.26 | 0.15 | 0.46 | 0.31 | 0.19 | 0.33 | |
| +2 | -0.01 | -0.07 | 0.38 | -0.28 | 0.03 | 0.27 | 0.28 | 0.36 | 0.08 | 0.00 | 0.32 | |
| +3 | -0.10 | 0.18 | 0.30 | -0.24 | -0.26 | 0.39 | 0.31 | 0.10 | 0.07 | 0.02 | 0.27 | |
| +4 | -0.20 | 0.22 | 0.28 | -0.05 | -0.19 | 0.40 | -0.08 | 0.08 | -0.19 | -0.07 | 0.29 | |
| Persistence[5] | | | | | | | | | | | | |
| | 0.45 | 0.43 | 0.47 | 0.37 | 0.05 | 0.43 | 0.01 | 0.05 | 0.26 | 0.43 | 0.37 | |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of government consumption.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of government consumption and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of government consumption and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered government consumption and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered government consumption.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered government consumption.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 6

**Net exports to GDP**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 4.80 | 3.97 | 1.68 | 2.46 | 2.06 | 2.47 | 1.74 | 3.07 | 2.12 | 4.10 | 4.66 | 1.64 |
| FD | 5.05 | 4.33 | 1.88 | 2.68 | 1.98 | 2.75 | 2.22 | 4.16 | 2.42 | 3.07 | 4.07 | 2.32 |
| TP | 5.40 | 4.48 | 1.92 | 3.00 | 2.12 | 2.54 | 1.77 | 3.09 | 2.13 | 4.35 | 4.90 | 1.65 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.14 | 1.77 | 0.93 | 1.00 | 1.97 | 1.45 | 0.69 | 2.54 | 0.59 | 1.34 | 3.83 | 1.93 |
| FD | 1.39 | 2.03 | 1.46 | 1.37 | 2.45 | 2.20 | 0.95 | 5.61 | 0.81 | 1.47 | 3.60 | 2.11 |
| TP | 1.26 | 1.71 | 0.88 | 1.16 | 1.77 | 1.40 | 0.63 | 2.75 | 0.50 | 1.48 | 3.08 | 1.80 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.52 | -0.59 | -0.44 | -0.21 | -0.30 | 0.08 | -0.02 | -0.12 | 0.06 | -0.43 | -0.28 | -0.42 |
| FD | -0.50 | -0.27 | 0.24 | 0.23 | -0.31 | -0.01 | 0.24 | 0.03 | -0.03 | -0.39 | -0.06 | -0.53 |
| TP | -0.50 | -0.68 | -0.58 | -0.11 | -0.27 | 0.08 | -0.13 | -0.08 | 0.06 | -0.36 | -0.29 | -0.39 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.16 | -0.16 | -0.16 | -0.01 | -0.38 | 0.17 | 0.18 | -0.43 | 0.03 | 0.47 | -0.24 | -0.11 |
| -3 | -0.31 | -0.24 | -0.30 | -0.13 | -0.24 | 0.26 | -0.05 | -0.43 | 0.02 | 0.45 | -0.27 | -0.04 |
| -2 | -0.30 | -0.41 | -0.30 | -0.15 | -0.21 | 0.33 | 0.03 | -0.31 | 0.00 | 0.30 | -0.17 | -0.12 |
| -1 | -0.41 | -0.46 | -0.49 | -0.36 | -0.29 | 0.32 | -0.08 | -0.18 | -0.06 | -0.05 | -0.30 | 0.07 |
| +1 | -0.24 | -0.46 | -0.56 | -0.30 | 0.09 | -0.20 | -0.20 | -0.14 | 0.19 | -0.69 | -0.29 | 0.00 |
| +2 | -0.15 | -0.26 | -0.50 | -0.23 | 0.33 | -0.36 | -0.27 | 0.00 | 0.17 | -0.68 | -0.34 | -0.19 |
| +3 | -0.05 | -0.07 | -0.48 | -0.18 | 0.20 | -0.40 | -0.38 | 0.07 | 0.07 | -0.55 | -0.35 | -0.16 |
| +4 | 0.11 | -0.06 | -0.39 | -0.13 | 0.12 | -0.22 | -0.29 | 0.05 | -0.08 | -0.42 | -0.20 | 0.00 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.44 | 0.42 | 0.37 | 0.42 | 0.51 | 0.40 | 0.20 | 0.12 | 0.37 | 0.73 | 0.63 | 0.01 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of net exports to GDP.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of net exports to GDP and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of net exports to GDP and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered net exports to GDP and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered net exports to GDP.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered net exports to GDP.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 7

**Real imports**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 6.55 | 9.04 | 3.92 | 7.41 | 4.55 | 6.14 | 8.75 | 6.67 | 6.32 | 13.51 | 6.81 | 3.69 |
| FD | 8.47 | 6.83 | 3.30 | 5.28 | 3.02 | 6.02 | 6.86 | 7.38 | 6.47 | 9.73 | 7.02 | 5.05 |
| TP | 6.96 | 10.26 | 4.14 | 7.65 | 4.75 | 6.67 | 9.39 | 6.25 | 6.70 | 14.02 | 7.16 | 3.81 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.56 | 4.02 | 2.16 | 3.01 | 4.34 | 3.60 | 3.45 | 5.51 | 1.75 | 4.41 | 5.59 | 4.35 |
| FD | 2.33 | 3.21 | 2.56 | 2.71 | 3.74 | 4.82 | 2.92 | 9.94 | 2.17 | 4.67 | 6.20 | 4.51 |
| TP | 1.62 | 3.91 | 1.90 | 2.96 | 3.98 | 3.69 | 3.31 | 5.57 | 1.57 | 4.79 | 4.51 | 4.14 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.48 | 0.66 | 0.67 | 0.55 | 0.66 | 0.46 | 0.54 | 0.42 | 0.24 | 0.52 | 0.19 | 0.64 |
| FD | 0.51 | 0.39 | 0.00 | 0.37 | 0.35 | 0.29 | 0.30 | 0.18 | -0.09 | 0.42 | -0.13 | 0.70 |
| TP | 0.47 | 0.73 | 0.71 | 0.59 | 0.74 | 0.36 | 0.68 | 0.28 | 0.33 | 0.40 | 0.27 | 0.66 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.05 | 0.13 | 0.18 | -0.27 | 0.38 | 0.18 | 0.46 | 0.29 | 0.34 | -0.45 | 0.09 | -0.16 |
| -3 | 0.34 | 0.32 | 0.41 | -0.09 | 0.39 | 0.18 | 0.68 | 0.35 | 0.47 | -0.39 | 0.13 | -0.04 |
| -2 | 0.43 | 0.44 | 0.50 | 0.18 | 0.59 | 0.17 | 0.55 | 0.44 | 0.44 | -0.19 | 0.12 | 0.14 |
| -1 | 0.36 | 0.58 | 0.68 | 0.43 | 0.72 | 0.24 | 0.53 | 0.56 | 0.37 | 0.17 | 0.26 | -0.02 |
| +1 | 0.09 | 0.47 | 0.67 | 0.54 | 0.37 | 0.47 | 0.36 | 0.30 | 0.19 | 0.75 | 0.28 | 0.09 |
| +2 | -0.12 | 0.13 | 0.46 | 0.35 | 0.11 | 0.32 | 0.19 | 0.28 | 0.14 | 0.73 | 0.37 | 0.33 |
| +3 | -0.42 | -0.03 | 0.28 | 0.15 | -0.05 | 0.08 | 0.09 | 0.35 | 0.09 | 0.65 | 0.49 | 0.32 |
| +4 | -0.27 | -0.07 | 0.08 | -0.05 | -0.19 | -0.24 | -0.08 | 0.04 | 0.08 | 0.48 | 0.31 | 0.09 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.15 | 0.71 | 0.64 | 0.75 | 0.79 | 0.54 | 0.71 | 0.42 | 0.47 | 0.76 | 0.47 | 0.08 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of real imports.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of real imports and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of real imports and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered real imports and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered real imports.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered real imports.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 8

**Real exports**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 7.58 | 7.41 | 3.61 | 7.33 | 4.21 | 5.28 | 9.18 | 11.08 | 6.54 | 3.47 | 4.84 | 3.79 |
| FD | 8.44 | 8.39 | 3.36 | 5.40 | 3.39 | 3.36 | 6.99 | 15.21 | 6.07 | 3.87 | 3.96 | 3.15 |
| TP | 7.90 | 7.44 | 3.71 | 8.34 | 4.03 | 5.68 | 9.76 | 11.09 | 7.02 | 3.23 | 4.96 | 3.95 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.80 | 3.30 | 1.99 | 2.98 | 4.02 | 3.09 | 3.62 | 9.15 | 1.81 | 1.14 | 3.97 | 4.46 |
| FD | 2.33 | 3.94 | 2.61 | 2.77 | 4.21 | 2.69 | 2.98 | 20.49 | 2.03 | 1.86 | 3.50 | 2.81 |
| TP | 1.84 | 2.84 | 1.70 | 3.23 | 3.37 | 3.14 | 3.44 | 9.87 | 1.65 | 1.10 | 3.12 | 4.29 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.12 | 0.12 | 0.38 | 0.52 | 0.34 | 0.64 | 0.54 | 0.14 | 0.23 | 0.30 | -0.17 | 0.28 |
| FD | 0.00 | -0.03 | 0.20 | 0.55 | -0.08 | 0.46 | 0.47 | 0.10 | -0.23 | 0.09 | -0.36 | 0.36 |
| TP | -0.15 | 0.13 | 0.29 | 0.55 | 0.50 | 0.52 | 0.64 | 0.09 | 0.31 | 0.17 | -0.11 | 0.34 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.12 | 0.01 | 0.07 | -0.30 | 0.04 | 0.39 | 0.55 | -0.20 | 0.47 | 0.30 | -0.23 | -0.31 |
| -3 | -0.05 | 0.15 | 0.21 | -0.14 | 0.18 | 0.49 | 0.69 | -0.18 | 0.56 | 0.40 | -0.27 | -0.13 |
| -2 | 0.02 | 0.09 | 0.31 | 0.15 | 0.43 | 0.56 | 0.58 | -0.03 | 0.46 | 0.56 | -0.11 | 0.04 |
| -1 | -0.12 | 0.22 | 0.35 | 0.33 | 0.45 | 0.63 | 0.51 | 0.16 | 0.29 | 0.50 | -0.08 | 0.04 |
| +1 | -0.11 | -0.04 | 0.26 | 0.45 | 0.43 | 0.38 | 0.28 | 0.06 | 0.35 | 0.07 | -0.05 | 0.15 |
| +2 | -0.19 | -0.18 | 0.11 | 0.28 | 0.42 | 0.05 | 0.08 | 0.16 | 0.27 | -0.05 | -0.01 | 0.22 |
| +3 | -0.33 | -0.10 | -0.06 | 0.09 | 0.16 | -0.29 | -0.08 | 0.25 | 0.12 | 0.02 | 0.13 | 0.32 |
| +4 | -0.07 | -0.15 | -0.20 | -0.11 | -0.08 | -0.50 | -0.22 | 0.08 | -0.04 | -0.08 | 0.03 | 0.22 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.39 | 0.31 | 0.58 | 0.74 | 0.71 | 0.81 | 0.72 | 0.08 | 0.56 | 0.40 | 0.66 | 0.66 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of real exports.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of real exports and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of real exports and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered real exports and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered real exports.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered real exports.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 9

**Total employment**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 4.56 | 1.88 | 0.88 | 1.32 | 0.94 | | 2.15 | 1.39 | 2.34 | 0.74 | 1.64 | 1.00 |
| FD | 2.71 | 1.42 | 0.62 | 1.06 | 0.57 | | 1.76 | 0.97 | 1.34 | 0.70 | 1.08 | 0.58 |
| TP | 5.59 | 2.00 | 1.12 | 1.26 | 1.39 | | 2.24 | 1.51 | 2.90 | 0.75 | 1.86 | 1.44 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.09 | 0.83 | 0.48 | 0.54 | 0.90 | | 0.85 | 1.15 | 0.65 | 0.24 | 1.38 | 1.17 |
| FD | 0.73 | 0.67 | 0.48 | 0.54 | 0.69 | | 0.75 | 1.33 | 0.45 | 0.33 | 1.00 | 0.53 |
| TP | 1.30 | 0.76 | 0.52 | 0.49 | 1.16 | | 0.79 | 1.34 | 0.68 | 0.26 | 1.16 | 1.57 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.17 | -0.24 | 0.36 | 0.47 | 0.24 | | 0.13 | 0.36 | 0.54 | 0.33 | 0.54 | 0.27 |
| FD | -0.13 | -0.49 | 0.03 | 0.16 | -0.16 | | 0.02 | 0.03 | 0.23 | 0.40 | 0.01 | -0.12 |
| TP | -0.26 | -0.30 | 0.52 | 0.38 | 0.40 | | 0.26 | 0.30 | 0.66 | 0.44 | 0.67 | 0.51 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.38 | -0.62 | 0.48 | -0.10 | 0.53 | | -0.35 | 0.16 | -0.06 | 0.27 | 0.29 | 0.14 |
| -3 | -0.38 | -0.62 | 0.48 | 0.14 | 0.66 | | -0.25 | 0.18 | 0.10 | 0.24 | 0.30 | 0.26 |
| -2 | -0.34 | -0.44 | 0.38 | 0.28 | 0.71 | | -0.09 | 0.23 | 0.29 | 0.20 | 0.46 | 0.25 |
| -1 | -0.26 | -0.30 | 0.38 | 0.39 | 0.55 | | -0.01 | 0.26 | 0.46 | 0.27 | 0.53 | 0.29 |
| +1 | 0.01 | 0.17 | 0.35 | 0.48 | 0.20 | | 0.21 | 0.52 | 0.56 | 0.28 | 0.52 | 0.36 |
| +2 | 0.34 | 0.25 | 0.31 | 0.58 | 0.24 | | 0.26 | 0.54 | 0.54 | 0.23 | 0.46 | 0.36 |
| +3 | 0.57 | 0.35 | 0.23 | 0.46 | 0.27 | | 0.40 | 0.38 | 0.50 | 0.20 | 0.41 | 0.19 |
| +4 | 0.72 | 0.33 | 0.12 | 0.32 | 0.08 | | 0.37 | 0.12 | 0.50 | 0.25 | 0.22 | 0.13 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.87 | 0.73 | 0.76 | 0.75 | 0.85 | | 0.68 | 0.78 | 0.87 | 0.62 | 0.80 | 0.88 |

*Notes:*
*1 'Absolute Volatility' is measured as the standard deviation of employment.*
*2 'Relative Volatility' is measured as the ratio of the standard deviation of employment and real GDP.*
*3 'Cyclicality' is measured as the contemporaneous correlation between of employment and real GDP.*
*4 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered employment and real GDP.*
*5 'Persistence' is measured as the AR(1) coefficient in HP-filtered employment.*
*6 Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered employment.*
*7 All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 10

**Industrial employment**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 7.29 | 2.75 | | 4.79 | 2.15 | 3.29 | | 2.43 | 2.92 | 2.34 | 2.01 | 1.18 |
| FD | 4.40 | 1.91 | | 4.24 | 1.25 | 2.08 | | 1.66 | 1.84 | 1.08 | 1.28 | 0.84 |
| TP | 9.18 | 2.87 | | 5.34 | 3.27 | 3.44 | | 2.60 | 3.53 | 3.19 | 2.62 | 1.33 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.73 | 1.22 | | 1.95 | 2.05 | 1.74 | | 2.00 | 0.81 | 0.77 | 1.65 | 1.39 |
| FD | 1.23 | 0.90 | | 2.18 | 1.49 | 1.24 | | 2.27 | 0.62 | 0.53 | 1.13 | 0.76 |
| TP | 2.14 | 1.09 | | 2.07 | 2.73 | 1.83 | | 2.32 | 0.83 | 1.09 | 1.65 | 1.45 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.04 | -0.33 | | 0.01 | 0.15 | 0.63 | | 0.48 | 0.37 | 0.52 | 0.63 | 0.07 |
| FD | -0.11 | -0.37 | | -0.03 | -0.02 | 0.37 | | 0.23 | -0.04 | 0.29 | 0.35 | -0.12 |
| TP | -0.14 | -0.42 | | -0.11 | 0.31 | 0.62 | | 0.48 | 0.52 | 0.64 | 0.77 | 0.35 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.22 | -0.61 | | 0.14 | 0.35 | 0.21 | | 0.16 | -0.17 | 0.40 | 0.57 | -0.03 |
| -3 | -0.15 | -0.61 | | 0.14 | 0.45 | 0.35 | | 0.18 | -0.03 | 0.39 | 0.54 | -0.04 |
| -2 | -0.12 | -0.52 | | 0.16 | 0.47 | 0.55 | | 0.26 | 0.13 | 0.37 | 0.59 | -0.01 |
| -1 | -0.06 | -0.43 | | 0.03 | 0.38 | 0.66 | | 0.37 | 0.30 | 0.45 | 0.61 | -0.03 |
| +1 | 0.08 | -0.06 | | -0.01 | 0.17 | 0.52 | | 0.56 | 0.49 | 0.60 | 0.44 | 0.26 |
| +2 | 0.45 | 0.00 | | -0.28 | 0.13 | 0.33 | | 0.50 | 0.53 | 0.54 | 0.45 | 0.41 |
| +3 | 0.70 | 0.08 | | -0.46 | 0.13 | 0.07 | | 0.42 | 0.48 | 0.36 | 0.27 | 0.48 |
| +4 | 0.76 | -0.01 | | -0.54 | 0.01 | -0.19 | | 0.30 | 0.52 | 0.14 | 0.16 | 0.34 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.85 | 0.78 | | 0.62 | 0.85 | 0.84 | | 0.79 | 0.82 | 0.92 | 0.81 | 0.82 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of employment.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of employment and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of employment and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered employment and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered employment.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered employment.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 11

**Real wages**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 7.64 | 5.11 | 2.24 | 2.41 | 3.16 | 3.45 | 6.16 | 2.72 | 7.34 | 11.37 | 2.88 | 0.96 |
| FD | 6.56 | 3.60 | 1.62 | 3.47 | 2.54 | 2.58 | 4.43 | 1.43 | 5.10 | 6.61 | 1.69 | 1.02 |
| TP | 8.02 | 5.08 | 2.93 | 2.49 | 2.88 | 3.72 | 6.88 | 2.82 | 8.35 | 11.80 | 3.46 | 1.02 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.82 | 2.27 | 1.24 | 0.98 | 3.01 | 1.83 | 2.43 | 2.25 | 2.03 | 3.72 | 2.37 | 1.13 |
| FD | 1.81 | 1.69 | 1.25 | 1.78 | 2.80 | 1.54 | 1.89 | 1.89 | 1.71 | 2.96 | 1.49 | 0.93 |
| TP | 1.87 | 1.94 | 1.34 | 0.96 | 2.41 | 1.98 | 2.42 | 2.51 | 1.96 | 4.03 | 2.18 | 1.11 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.57 | 0.29 | 0.62 | 0.00 | -0.14 | 0.23 | 0.45 | 0.21 | 0.56 | 0.13 | 0.65 | 0.07 |
| FD | 0.33 | 0.34 | 0.17 | 0.01 | 0.30 | 0.06 | -0.06 | -0.28 | 0.18 | 0.23 | 0.30 | 0.36 |
| TP | 0.59 | 0.40 | 0.71 | -0.06 | -0.24 | 0.16 | 0.62 | 0.21 | 0.65 | 0.10 | 0.74 | -0.13 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.28 | 0.09 | 0.41 | -0.30 | 0.19 | -0.50 | -0.16 | 0.53 | 0.37 | -0.59 | 0.27 | -0.29 |
| -3 | -0.30 | 0.00 | 0.49 | 0.18 | 0.03 | -0.33 | 0.10 | 0.54 | 0.55 | -0.54 | 0.39 | -0.02 |
| -2 | -0.09 | -0.05 | 0.67 | 0.03 | -0.07 | -0.06 | 0.29 | 0.48 | 0.67 | -0.42 | 0.49 | -0.28 |
| -1 | 0.27 | 0.13 | 0.62 | 0.02 | -0.18 | 0.18 | 0.35 | 0.36 | 0.69 | -0.19 | 0.53 | -0.14 |
| +1 | 0.74 | 0.20 | 0.56 | 0.00 | -0.27 | 0.24 | 0.61 | 0.09 | 0.34 | 0.44 | 0.67 | -0.20 |
| +2 | 0.67 | 0.13 | 0.48 | -0.13 | -0.34 | 0.31 | 0.68 | 0.02 | 0.08 | 0.60 | 0.67 | -0.08 |
| +3 | 0.38 | -0.01 | 0.46 | -0.18 | -0.47 | 0.37 | 0.71 | -0.04 | -0.05 | 0.59 | 0.65 | -0.31 |
| +4 | 0.32 | -0.04 | 0.20 | 0.15 | -0.36 | 0.35 | 0.67 | -0.06 | -0.15 | 0.48 | 0.53 | -0.12 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.64 | 0.80 | 0.76 | -0.01 | 0.80 | 0.73 | 0.77 | 0.94 | 0.77 | 0.87 | 0.86 | 0.44 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of real wages.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of real wages and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of real wages and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered real wages and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered real wages.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered real wages.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 12

**Productivity**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 6.71 | 3.26 | 1.61 | 2.18 | 1.03 | | 3.10 | 1.46 | 3.06 | 2.70 | 1.45 | 1.12 |
| FD | 4.78 | 3.08 | 1.42 | 2.07 | 1.05 | | 2.91 | 1.21 | 2.98 | 1.92 | 1.53 | 1.30 |
| TP | 7.70 | 3.74 | 1.77 | 2.40 | 1.04 | | 3.11 | 1.54 | 3.22 | 2.68 | 1.40 | 1.25 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.60 | 1.45 | 0.89 | 0.89 | 0.98 | | 1.22 | 1.21 | 0.85 | 0.88 | 1.22 | 1.32 |
| FD | 1.32 | 1.45 | 1.10 | 1.06 | 1.30 | | 1.24 | 1.64 | 1.00 | 0.92 | 1.41 | 1.19 |
| TP | 1.80 | 1.42 | 0.81 | 0.93 | 0.87 | | 1.10 | 1.37 | 0.75 | 0.91 | 0.87 | 1.36 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.74 | 0.83 | 0.89 | 0.84 | 0.64 | | 0.73 | 0.44 | 0.76 | 0.97 | 0.23 | 0.52 |
| FD | 0.83 | 0.92 | 0.90 | 0.86 | 0.85 | | 0.80 | 0.59 | 0.90 | 0.94 | 0.70 | 0.90 |
| TP | 0.74 | 0.86 | 0.90 | 0.87 | 0.61 | | 0.72 | 0.43 | 0.73 | 0.97 | 0.21 | 0.14 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.13 | 0.43 | 0.19 | -0.02 | 0.03 | | 0.40 | -0.04 | 0.41 | -0.06 | 0.02 | -0.18 |
| -3 | 0.26 | 0.46 | 0.24 | 0.11 | -0.20 | | 0.50 | 0.09 | 0.37 | 0.20 | 0.04 | -0.07 |
| -2 | 0.42 | 0.46 | 0.48 | 0.32 | -0.09 | | 0.38 | 0.23 | 0.31 | 0.51 | -0.08 | 0.02 |
| -1 | 0.59 | 0.57 | 0.63 | 0.56 | 0.26 | | 0.47 | 0.41 | 0.45 | 0.78 | -0.10 | -0.11 |
| +1 | 0.40 | 0.29 | 0.60 | 0.48 | 0.27 | | 0.33 | 0.18 | 0.37 | 0.78 | -0.08 | -0.16 |
| +2 | -0.04 | 0.07 | 0.41 | 0.10 | -0.08 | | 0.16 | -0.07 | 0.11 | 0.49 | -0.03 | -0.04 |
| +3 | -0.38 | -0.09 | 0.25 | -0.10 | -0.33 | | 0.08 | -0.12 | 0.05 | 0.18 | 0.00 | 0.01 |
| +4 | -0.60 | -0.11 | 0.23 | -0.28 | -0.06 | | -0.08 | -0.03 | -0.08 | -0.09 | 0.19 | -0.21 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.76 | 0.57 | 0.63 | 0.56 | 0.47 | | 0.59 | 0.66 | 0.53 | 0.78 | 0.47 | 0.35 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of productivity.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of productivity and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of productivity and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered productivity and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered productivity.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered productivity.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 13

**Industrial productivity**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 7.41 | 3.80 | | 6.44 | 4.09 | 3.08 | | 2.71 | 6.86 | 2.95 | 2.24 | 2.15 |
| FD | 6.92 | 3.24 | | 5.60 | 3.07 | 3.14 | | 2.42 | 4.68 | 2.56 | 2.15 | 1.97 |
| TP | 7.59 | 4.19 | | 6.79 | 4.28 | 3.23 | | 2.73 | 7.79 | 3.19 | 2.37 | 2.17 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.76 | 1.69 | | 2.73 | 3.90 | 1.74 | | 2.24 | 1.90 | 0.96 | 1.84 | 2.53 |
| FD | 1.89 | 1.52 | | 2.85 | 3.53 | 2.17 | | 3.25 | 1.57 | 1.24 | 1.90 | 1.79 |
| TP | 1.77 | 1.60 | | 2.71 | 3.58 | 1.75 | | 2.43 | 1.83 | 1.09 | 1.49 | 2.37 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.39 | 0.69 | | 0.50 | 0.66 | 0.42 | | 0.41 | 0.72 | 0.15 | -0.03 | 0.43 |
| FD | 0.32 | 0.67 | | 0.52 | 0.52 | 0.26 | | 0.48 | 0.39 | 0.07 | 0.18 | 0.04 |
| TP | 0.30 | 0.75 | | 0.51 | 0.64 | 0.34 | | 0.45 | 0.78 | 0.26 | -0.18 | 0.34 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.08 | 0.36 | | -0.09 | 0.04 | -0.05 | | -0.08 | 0.32 | -0.50 | 0.01 | -0.17 |
| -3 | 0.13 | 0.46 | | 0.13 | 0.04 | 0.02 | | 0.11 | 0.53 | -0.36 | -0.17 | -0.09 |
| -2 | 0.16 | 0.52 | | 0.10 | 0.21 | 0.16 | | 0.28 | 0.62 | -0.15 | -0.22 | 0.13 |
| -1 | 0.26 | 0.59 | | 0.35 | 0.45 | 0.37 | | 0.41 | 0.57 | -0.07 | -0.09 | 0.39 |
| +1 | 0.26 | 0.32 | | 0.33 | 0.50 | 0.35 | | 0.13 | 0.66 | 0.38 | -0.14 | 0.45 |
| +2 | -0.28 | 0.12 | | 0.36 | 0.33 | 0.29 | | -0.08 | 0.49 | 0.51 | -0.36 | 0.28 |
| +3 | -0.66 | 0.12 | | 0.35 | 0.13 | -0.01 | | -0.27 | 0.38 | 0.30 | -0.41 | 0.08 |
| +4 | -0.72 | 0.07 | | 0.32 | 0.09 | -0.13 | | -0.36 | 0.22 | 0.05 | -0.45 | 0.08 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.59 | 0.65 | | 0.61 | 0.74 | 0.49 | | 0.61 | 0.78 | 0.65 | 0.56 | 0.60 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of productivity.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of productivity and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of productivity and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered productivity and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered productivity.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered productivity.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 14

**Private sector credit**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 52.76 | 8.10 | 6.10 | 10.54 | 4.35 | 21.21 | 11.85 | 5.01 | 19.53 | 10.88 | 4.65 | 4.34 |
| FD | 36.46 | 4.79 | 4.48 | 5.94 | 2.87 | 12.25 | 6.72 | 2.47 | 9.87 | 8.27 | 2.19 | 2.43 |
| TP | 59.17 | 9.49 | 6.93 | 11.72 | 5.48 | 23.47 | 11.18 | 7.31 | 26.12 | 10.87 | 5.30 | 4.43 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 12.56 | 3.65 | 3.37 | 4.28 | 4.15 | 11.43 | 4.68 | 4.14 | 5.41 | 3.56 | 3.79 | 5.11 |
| FD | 10.05 | 2.22 | 3.51 | 3.05 | 3.20 | 7.26 | 2.86 | 3.37 | 3.34 | 3.93 | 2.01 | 2.22 |
| TP | 13.80 | 3.65 | 3.17 | 4.54 | 4.58 | 12.48 | 3.94 | 6.51 | 6.12 | 3.71 | 3.34 | 4.84 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.21 | 0.56 | 0.29 | 0.31 | 0.16 | 0.36 | 0.20 | 0.64 | 0.66 | -0.11 | 0.66 | -0.12 |
| FD | 0.16 | 0.21 | 0.13 | -0.01 | 0.28 | 0.27 | 0.06 | 0.30 | 0.22 | -0.07 | 0.31 | -0.10 |
| TP | 0.18 | 0.67 | 0.38 | 0.33 | 0.32 | 0.37 | 0.17 | 0.18 | 0.72 | -0.14 | 0.73 | -0.09 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.59 | -0.24 | -0.13 | -0.21 | 0.60 | -0.53 | -0.55 | 0.27 | 0.13 | -0.43 | 0.33 | 0.15 |
| -3 | -0.45 | -0.11 | 0.02 | -0.08 | 0.60 | -0.39 | -0.41 | 0.49 | 0.38 | -0.46 | 0.42 | 0.11 |
| -2 | -0.17 | 0.14 | 0.14 | 0.07 | 0.58 | -0.19 | -0.25 | 0.65 | 0.54 | -0.42 | 0.49 | 0.07 |
| -1 | -0.05 | 0.40 | 0.25 | 0.23 | 0.34 | 0.04 | -0.04 | 0.68 | 0.62 | -0.29 | 0.57 | -0.09 |
| +1 | 0.37 | 0.62 | 0.26 | 0.51 | 0.00 | 0.60 | 0.34 | 0.65 | 0.63 | 0.13 | 0.66 | -0.06 |
| +2 | 0.55 | 0.61 | 0.21 | 0.59 | -0.03 | 0.69 | 0.39 | 0.68 | 0.52 | 0.24 | 0.62 | 0.06 |
| +3 | 0.61 | 0.55 | 0.15 | 0.51 | -0.20 | 0.70 | 0.53 | 0.64 | 0.38 | 0.29 | 0.66 | 0.15 |
| +4 | 0.61 | 0.55 | 0.11 | 0.40 | -0.31 | 0.58 | 0.55 | 0.49 | 0.26 | 0.17 | 0.43 | 0.29 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.77 | 0.84 | 0.77 | 0.86 | 0.89 | 0.87 | 0.87 | 0.90 | 0.89 | 0.75 | 0.91 | 0.85 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of private sector credit.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of private sector credit and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of private sector credit and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered private sector credit and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered private sector credit.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered private sector credit.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 15

**M1**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 40.74 | 9.01 | 9.32 | 6.73 | 5.27 | 6.30 | 8.07 | 5.76 | 5.87 | 12.29 | 8.55 | 4.76 |
| FD | 18.44 | 5.14 | 5.75 | 4.94 | 3.36 | 4.97 | 4.45 | 3.82 | 5.11 | 6.80 | 6.50 | 2.82 |
| TP | 46.77 | 10.93 | 12.99 | 7.21 | 6.35 | 6.58 | 9.66 | 7.65 | 7.49 | 14.83 | 11.23 | 4.74 |
| RelativeVolatility[2] | | | | | | | | | | | | |
| HP | 9.70 | 4.06 | 5.15 | 2.73 | 5.03 | 3.39 | 3.18 | 4.76 | 1.63 | 4.02 | 7.01 | 5.61 |
| FD | 5.14 | 2.38 | 3.30 | 2.53 | 4.19 | 2.95 | 1.90 | 5.22 | 1.65 | 3.31 | 5.74 | 2.52 |
| TP | 10.91 | 4.20 | 5.96 | 2.79 | 5.31 | 3.50 | 3.40 | 6.81 | 1.76 | 5.06 | 7.06 | 5.15 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.32 | 0.64 | 0.29 | 0.16 | 0.56 | 0.30 | 0.74 | 0.23 | 0.17 | 0.67 | 0.51 | 0.22 |
| FD | -0.07 | 0.29 | 0.17 | -0.02 | 0.43 | 0.00 | 0.34 | 0.23 | -0.06 | 0.27 | 0.18 | 0.22 |
| TP | -0.26 | 0.72 | 0.47 | 0.15 | 0.60 | 0.27 | 0.80 | 0.30 | 0.40 | 0.44 | 0.68 | 0.01 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.20 | 0.45 | 0.66 | 0.33 | 0.24 | -0.50 | 0.12 | 0.85 | 0.13 | -0.09 | 0.69 | -0.16 |
| -3 | 0.16 | 0.52 | 0.61 | 0.36 | 0.32 | -0.36 | 0.29 | 0.78 | 0.27 | 0.08 | 0.70 | -0.04 |
| -2 | 0.10 | 0.62 | 0.53 | 0.46 | 0.52 | -0.01 | 0.46 | 0.69 | 0.33 | 0.32 | 0.55 | 0.05 |
| -1 | -0.05 | 0.61 | 0.40 | 0.36 | 0.64 | 0.12 | 0.64 | 0.48 | 0.24 | 0.54 | 0.61 | 0.15 |
| +1 | -0.59 | 0.54 | 0.22 | 0.08 | 0.33 | 0.45 | 0.70 | -0.03 | 0.13 | 0.70 | 0.28 | 0.16 |
| +2 | -0.79 | 0.34 | 0.12 | -0.08 | 0.13 | 0.50 | 0.74 | -0.27 | 0.32 | 0.62 | 0.16 | 0.14 |
| +3 | -0.81 | 0.22 | 0.01 | -0.24 | -0.12 | 0.49 | 0.61 | -0.41 | 0.52 | 0.52 | 0.11 | 0.01 |
| +4 | -0.68 | 0.00 | 0.00 | -0.50 | -0.37 | 0.27 | 0.38 | -0.48 | 0.50 | 0.41 | -0.03 | -0.10 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.92 | 0.85 | 0.92 | 0.77 | 0.82 | 0.68 | 0.86 | 0.84 | 0.72 | 0.87 | 0.73 | 0.89 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of M1.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of M1 and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of M1 and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered M1 and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered M1.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered M1.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 16

**M2**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 28.43 | 9.10 | 4.76 | 6.11 | 1.92 | 9.00 | 4.12 | 3.60 | 5.84 | 13.13 | 2.45 | 5.97 |
| FD | 15.46 | 4.65 | 2.82 | 4.69 | 1.83 | 5.50 | 3.04 | 3.04 | 5.63 | 5.51 | 2.24 | 3.18 |
| TP | 30.79 | 10.35 | 6.23 | 6.02 | 2.08 | 9.14 | 4.16 | 2.53 | 6.03 | 15.76 | 2.63 | 6.92 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 6.77 | 4.10 | 2.63 | 2.48 | 1.83 | 4.85 | 1.62 | 2.98 | 1.62 | 4.29 | 2.01 | 7.03 |
| FD | 4.27 | 2.16 | 2.20 | 2.41 | 2.12 | 3.26 | 1.29 | 4.08 | 1.80 | 2.43 | 1.98 | 2.84 |
| TP | 7.18 | 3.97 | 2.85 | 2.33 | 1.74 | 4.86 | 1.47 | 2.26 | 1.41 | 5.38 | 1.66 | 7.52 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.48 | 0.59 | 0.74 | 0.14 | 0.35 | 0.35 | 0.44 | 0.26 | -0.42 | 0.62 | 0.15 | -0.07 |
| FD | -0.33 | 0.13 | 0.43 | 0.07 | 0.20 | 0.04 | 0.18 | 0.25 | -0.34 | 0.10 | -0.04 | -0.03 |
| TP | -0.45 | 0.70 | 0.78 | 0.16 | 0.37 | 0.33 | 0.41 | -0.08 | -0.18 | 0.36 | 0.32 | -0.33 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.21 | 0.33 | 0.53 | 0.12 | 0.20 | -0.57 | -0.13 | -0.04 | -0.22 | 0.22 | 0.48 | -0.19 |
| -3 | 0.16 | 0.44 | 0.63 | 0.10 | 0.20 | -0.37 | 0.03 | 0.08 | -0.13 | 0.40 | 0.57 | -0.24 |
| -2 | 0.11 | 0.58 | 0.71 | 0.24 | 0.33 | 0.01 | 0.12 | 0.15 | -0.23 | 0.57 | 0.39 | -0.18 |
| -1 | -0.11 | 0.62 | 0.73 | 0.22 | 0.43 | 0.22 | 0.32 | 0.19 | -0.44 | 0.65 | 0.34 | -0.06 |
| +1 | -0.73 | 0.56 | 0.61 | 0.16 | 0.14 | 0.48 | 0.45 | 0.40 | -0.22 | 0.56 | 0.13 | -0.05 |
| +2 | -0.84 | 0.49 | 0.41 | 0.18 | 0.04 | 0.53 | 0.48 | 0.56 | 0.01 | 0.47 | -0.03 | -0.05 |
| +3 | -0.74 | 0.40 | 0.21 | 0.01 | -0.13 | 0.49 | 0.41 | 0.67 | 0.17 | 0.41 | -0.10 | -0.06 |
| +4 | -0.52 | 0.24 | 0.04 | -0.33 | -0.41 | 0.31 | 0.27 | 0.67 | 0.29 | 0.33 | -0.23 | -0.09 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.88 | 0.90 | 0.85 | 0.77 | 0.62 | 0.81 | 0.74 | 0.86 | 0.78 | 0.93 | 0.63 | 0.93 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of M2.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of M2 and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of M2 and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered M2 and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered M2.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered M2.*
*7 All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 17

**CPI**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 45.64 | 1.02 | 1.51 | 5.26 | 2.01 | 4.46 | 4.16 | 2.40 | 14.09 | 20.97 | 2.22 | 2.19 |
| FD | 27.06 | 0.78 | 1.14 | 3.23 | 1.77 | 2.72 | 2.29 | 1.73 | 7.48 | 8.72 | 1.29 | 1.23 |
| TP | 47.61 | 1.22 | 1.36 | 6.34 | 1.56 | 5.68 | 3.87 | 2.43 | 15.32 | 27.00 | 2.41 | 2.59 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 10.86 | 0.46 | 0.83 | 2.14 | 1.92 | 2.37 | 1.64 | 1.98 | 3.90 | 6.86 | 1.82 | 2.58 |
| FD | 7.46 | 0.37 | 0.87 | 1.66 | 2.06 | 1.63 | 0.97 | 2.16 | 2.46 | 3.55 | 1.14 | 1.12 |
| TP | 11.10 | 0.46 | 0.62 | 2.45 | 1.31 | 3.02 | 1.36 | 2.16 | 3.59 | 9.22 | 1.51 | 2.83 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.58 | -0.30 | -0.21 | -0.35 | -0.27 | -0.51 | 0.20 | 0.00 | -0.73 | 0.42 | -0.44 | 0.13 |
| FD | -0.45 | -0.08 | -0.06 | -0.21 | -0.27 | -0.44 | -0.07 | 0.37 | -0.37 | -0.07 | -0.15 | -0.01 |
| TP | -0.59 | -0.55 | -0.34 | -0.32 | -0.64 | -0.47 | 0.50 | 0.06 | -0.80 | 0.13 | -0.47 | -0.19 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.24 | -0.38 | -0.65 | 0.28 | -0.33 | -0.14 | 0.32 | -0.27 | -0.31 | 0.42 | -0.04 | -0.40 |
| -3 | 0.16 | -0.36 | -0.64 | 0.09 | -0.25 | -0.19 | 0.30 | -0.31 | -0.56 | 0.50 | -0.10 | -0.38 |
| -2 | 0.05 | -0.33 | -0.56 | -0.08 | -0.31 | -0.30 | 0.32 | -0.26 | -0.72 | 0.56 | -0.18 | -0.16 |
| -1 | -0.19 | -0.35 | -0.33 | -0.25 | -0.28 | -0.47 | 0.29 | -0.15 | -0.76 | 0.54 | -0.25 | 0.06 |
| +1 | -0.80 | -0.20 | -0.07 | -0.35 | -0.16 | -0.47 | 0.22 | 0.12 | -0.56 | 0.26 | -0.55 | 0.24 |
| +2 | -0.85 | -0.18 | -0.03 | -0.33 | -0.17 | -0.38 | 0.22 | 0.15 | -0.33 | 0.14 | -0.60 | 0.24 |
| +3 | -0.67 | -0.15 | 0.09 | -0.29 | -0.16 | -0.32 | 0.14 | 0.15 | -0.14 | 0.07 | -0.66 | 0.31 |
| +4 | -0.44 | -0.22 | 0.21 | -0.29 | -0.13 | -0.27 | 0.11 | 0.10 | 0.03 | 0.06 | -0.51 | 0.20 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.86 | 0.73 | 0.85 | 0.95 | 0.92 | 0.94 | 0.93 | 0.96 | 0.89 | 0.95 | 0.84 | 0.91 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of CPI.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of CPI and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of CPI and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered CPI and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered CPI.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered CPI.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 18

**Inflation**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 24.30 | 0.76 | 0.81 | 1.37 | 0.86 | 1.35 | 1.04 | 0.70 | 7.10 | 7.08 | 1.15 | 0.75 |
| FD | 28.12 | 1.19 | 1.07 | 1.31 | 0.88 | 1.63 | 1.04 | 0.83 | 7.00 | 5.48 | 1.62 | 0.91 |
| TP | 25.04 | 0.76 | 0.83 | 1.42 | 0.97 | 1.38 | 1.03 | 0.71 | 7.47 | 8.26 | 1.21 | 0.80 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 5.71 | 0.34 | 0.45 | 0.57 | 0.82 | 0.71 | 0.41 | 0.58 | 1.97 | 2.31 | 0.94 | 0.87 |
| FD | 7.65 | 0.55 | 0.84 | 0.66 | 1.10 | 0.98 | 0.44 | 1.12 | 2.27 | 2.64 | 1.46 | 0.82 |
| TP | 5.79 | 0.29 | 0.38 | 0.56 | 0.81 | 0.73 | 0.36 | 0.63 | 1.75 | 2.82 | 0.75 | 0.87 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.74 | 0.08 | 0.14 | 0.00 | 0.36 | -0.24 | -0.21 | 0.45 | 0.15 | -0.52 | -0.23 | 0.12 |
| FD | -0.62 | 0.03 | -0.21 | 0.23 | 0.02 | -0.13 | -0.05 | 0.21 | 0.02 | -0.35 | -0.19 | -0.23 |
| TP | -0.76 | 0.06 | 0.18 | -0.05 | 0.23 | -0.31 | -0.38 | 0.51 | 0.13 | -0.39 | -0.29 | 0.27 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.11 | -0.21 | -0.27 | -0.12 | -0.32 | -0.12 | -0.09 | -0.21 | -0.57 | 0.23 | -0.37 | 0.09 |
| -3 | -0.15 | 0.04 | -0.04 | -0.28 | -0.10 | 0.15 | -0.09 | -0.05 | -0.39 | 0.13 | -0.23 | 0.04 |
| -2 | -0.20 | 0.04 | 0.06 | -0.36 | -0.08 | 0.02 | -0.15 | 0.21 | -0.24 | 0.01 | -0.27 | 0.44 |
| -1 | -0.46 | -0.03 | 0.25 | -0.19 | 0.28 | -0.38 | -0.24 | 0.42 | -0.12 | -0.24 | -0.17 | 0.27 |
| +1 | -0.43 | 0.14 | 0.27 | 0.01 | 0.31 | 0.11 | -0.16 | 0.27 | 0.39 | -0.66 | -0.06 | 0.29 |
| +2 | -0.07 | -0.01 | 0.05 | 0.10 | -0.02 | 0.31 | -0.22 | -0.03 | 0.48 | -0.49 | -0.03 | 0.01 |
| +3 | 0.34 | -0.03 | 0.23 | 0.13 | 0.29 | 0.25 | -0.26 | -0.09 | 0.37 | -0.30 | -0.05 | 0.16 |
| +4 | 0.45 | -0.16 | 0.18 | 0.04 | 0.38 | 0.03 | -0.22 | -0.07 | 0.34 | -0.09 | 0.32 | -0.17 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.35 | -0.21 | 0.13 | 0.53 | 0.45 | 0.22 | 0.53 | 0.30 | 0.56 | 0.72 | 0.03 | 0.27 |

*Notes:*
*1 'Absolute Volatility' is measured as the standard deviation of inflation.*
*2 'Relative Volatility' is measured as the ratio of the standard deviation of inflation and real GDP.*
*3 'Cyclicality' is measured as the contemporaneous correlation between of inflation and real GDP.*
*4 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered inflation and real GDP.*
*5 'Persistence' is measured as the AR(1) coefficient in HP-filtered inflation.*
*6 Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered inflation.*
*7 All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 19

**Net capital flows**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 1.60 | 1.75 | 1.43 | 1.30 | 1.93 | 1.57 | 1.19 | | 0.99 | 1.08 | 2.38 | 1.03 |
| FD | 2.08 | 2.70 | 1.77 | 1.60 | 2.56 | 2.34 | 2.05 | | 1.38 | 1.11 | 3.46 | 1.57 |
| TP | 1.65 | 1.80 | 1.47 | 1.38 | 1.99 | 1.59 | 1.22 | | 1.01 | 1.20 | 2.39 | 1.04 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 0.38 | 0.78 | 0.79 | 0.53 | 1.84 | 0.83 | 0.47 | | 0.27 | 0.35 | 1.95 | 1.21 |
| FD | 0.58 | 1.27 | 1.39 | 0.82 | 3.22 | 1.40 | 0.84 | | 0.46 | 0.54 | 3.06 | 1.43 |
| TP | 0.38 | 0.69 | 0.68 | 0.53 | 1.66 | 0.85 | 0.43 | | 0.23 | 0.41 | 1.50 | 1.13 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.05 | 0.35 | 0.12 | 0.30 | 0.02 | -0.28 | 0.37 | | 0.17 | 0.37 | 0.12 | 0.05 |
| FD | 0.23 | 0.45 | -0.01 | -0.04 | -0.38 | -0.10 | 0.15 | | 0.06 | 0.28 | -0.01 | -0.08 |
| TP | -0.01 | 0.41 | 0.12 | 0.27 | 0.09 | -0.30 | 0.42 | | 0.23 | 0.17 | 0.14 | 0.01 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.30 | 0.32 | 0.46 | 0.05 | -0.07 | -0.06 | 0.00 | | -0.14 | -0.54 | 0.16 | -0.12 |
| -3 | 0.31 | 0.21 | 0.36 | 0.31 | 0.12 | -0.11 | 0.33 | | -0.06 | -0.46 | 0.04 | -0.18 |
| -2 | 0.06 | 0.03 | 0.08 | 0.49 | 0.26 | -0.10 | 0.05 | | 0.06 | -0.24 | 0.00 | -0.26 |
| -1 | 0.05 | -0.06 | 0.13 | 0.34 | 0.32 | -0.03 | 0.28 | | 0.15 | 0.06 | 0.21 | 0.14 |
| +1 | -0.42 | 0.11 | 0.12 | 0.37 | 0.22 | -0.40 | 0.23 | | 0.13 | 0.51 | 0.06 | 0.09 |
| +2 | -0.45 | 0.13 | -0.06 | 0.22 | 0.24 | 0.07 | 0.19 | | 0.17 | 0.48 | 0.05 | -0.02 |
| +3 | -0.20 | -0.17 | -0.11 | -0.03 | 0.23 | 0.41 | 0.23 | | 0.18 | 0.31 | 0.03 | 0.07 |
| +4 | -0.14 | -0.02 | -0.27 | -0.12 | -0.15 | 0.21 | 0.16 | | 0.23 | 0.21 | -0.07 | 0.07 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.11 | -0.20 | 0.23 | 0.26 | 0.12 | -0.09 | -0.35 | | -0.03 | 0.47 | -0.04 | -0.20 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of M1 velocity.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of M1 velocity and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of M1 velocity and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered M1 velocity and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered M1 velocity.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered M1 velocity.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 20

**Nominal interest rate**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 9.94 | 1.05 | 0.24 | 0.57 | 0.55 | 1.18 | 1.37 | 0.64 | 3.28 | 10.49 | 0.54 | 0.98 |
| FD | 7.05 | 1.14 | 0.14 | 0.45 | 0.26 | 0.80 | 0.37 | 0.45 | 2.87 | 7.97 | 0.34 | 1.10 |
| TP | 10.71 | 1.05 | 0.28 | 0.63 | 0.73 | 1.41 | 2.10 | 0.67 | 3.47 | 10.72 | 0.61 | 1.07 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 2.37 | 0.47 | 0.14 | 0.23 | 0.53 | 0.64 | 0.54 | 0.53 | 0.91 | 3.43 | 0.44 | 1.15 |
| FD | 1.97 | 0.53 | 0.11 | 0.23 | 0.29 | 0.48 | 0.12 | 0.50 | 0.96 | 2.97 | 0.30 | 1.00 |
| TP | 2.50 | 0.40 | 0.13 | 0.24 | 0.61 | 0.75 | 0.74 | 0.60 | 0.81 | 3.66 | 0.38 | 1.17 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | -0.68 | -0.14 | 0.20 | 0.37 | 0.15 | 0.17 | -0.09 | 0.15 | -0.18 | 0.23 | 0.12 | 0.13 |
| FD | -0.66 | -0.06 | 0.24 | 0.12 | -0.04 | 0.11 | 0.10 | 0.23 | 0.01 | 0.10 | -0.23 | 0.11 |
| TP | -0.67 | -0.08 | 0.34 | 0.40 | -0.03 | 0.22 | -0.17 | 0.16 | -0.30 | 0.13 | 0.08 | 0.35 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | 0.07 | 0.18 | -0.52 | -0.41 | -0.64 | 0.08 | -0.15 | -0.80 | -0.44 | 0.49 | -0.43 | 0.01 |
| -3 | -0.07 | -0.10 | -0.39 | -0.22 | -0.60 | 0.24 | -0.19 | -0.75 | -0.50 | 0.40 | -0.26 | 0.00 |
| -2 | -0.31 | -0.07 | -0.20 | -0.09 | -0.43 | 0.17 | -0.17 | -0.57 | -0.55 | 0.39 | -0.06 | 0.11 |
| -1 | -0.64 | -0.20 | -0.05 | 0.12 | -0.16 | 0.19 | -0.11 | -0.25 | -0.44 | 0.33 | 0.10 | 0.03 |
| +1 | -0.33 | 0.15 | 0.35 | 0.54 | 0.29 | 0.18 | -0.10 | 0.47 | 0.13 | 0.11 | 0.29 | 0.09 |
| +2 | 0.19 | 0.23 | 0.54 | 0.68 | 0.38 | 0.23 | -0.04 | 0.61 | 0.26 | -0.02 | 0.43 | 0.08 |
| +3 | 0.54 | 0.31 | 0.68 | 0.62 | 0.46 | 0.42 | 0.05 | 0.55 | 0.17 | -0.08 | 0.50 | 0.15 |
| +4 | 0.70 | 0.36 | 0.66 | 0.56 | 0.59 | 0.44 | 0.14 | 0.42 | 0.14 | -0.19 | 0.61 | 0.06 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.75 | 0.25 | 0.86 | 0.71 | 0.92 | 0.83 | 0.98 | 0.83 | 0.61 | 0.88 | 0.82 | 0.31 |

*Notes:*
*[1] 'Absolute Volatility' is measured as the standard deviation of M2 velocity.*
*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of M2 velocity and real GDP.*
*[3] 'Cyclicality' is measured as the contemporaneous correlation between of M2 velocity and real GDP.*
*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered M2 velocity and real GDP.*
*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered M2 velocity.*
*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered M2 velocity.*
*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 21

**Nominal effective exchange rate**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 45.88 | 2.53 | 2.98 | 6.21 | 3.44 | 7.98 | 8.09 | 4.54 | 10.79 | 22.97 | 3.41 | 2.74 |
| FD | 24.45 | 1.58 | 2.33 | 3.53 | 2.86 | 5.06 | 4.70 | 3.17 | 8.49 | 13.35 | 2.70 | 2.18 |
| TP | 50.32 | 3.10 | 3.26 | 6.46 | 2.88 | 8.66 | 9.18 | 5.53 | 11.26 | 24.95 | 3.60 | 2.83 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 10.92 | 1.13 | 1.64 | 2.52 | 3.28 | 4.52 | 3.19 | 3.75 | 2.99 | 7.51 | 2.80 | 3.22 |
| FD | 6.81 | 0.74 | 1.83 | 1.81 | 3.43 | 3.50 | 2.00 | 4.21 | 2.66 | 6.34 | 2.39 | 1.99 |
| TP | 11.73 | 1.18 | 1.49 | 2.50 | 2.41 | 4.70 | 3.23 | 4.93 | 2.64 | 8.52 | 2.27 | 3.09 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.67 | 0.60 | 0.12 | -0.70 | -0.06 | -0.21 | -0.45 | -0.36 | 0.51 | 0.04 | 0.45 | -0.23 |
| FD | 0.50 | 0.23 | -0.21 | -0.23 | 0.27 | -0.13 | -0.13 | -0.27 | 0.28 | 0.05 | 0.35 | -0.03 |
| TP | 0.61 | 0.69 | 0.30 | -0.72 | -0.02 | -0.13 | -0.53 | -0.56 | 0.60 | -0.03 | 0.40 | -0.27 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.23 | 0.38 | 0.38 | -0.08 | 0.04 | -0.26 | -0.68 | -0.45 | 0.26 | -0.68 | 0.16 | -0.03 |
| -3 | -0.09 | 0.55 | 0.35 | -0.32 | -0.08 | -0.45 | -0.73 | -0.50 | 0.42 | -0.63 | 0.28 | 0.00 |
| -2 | 0.06 | 0.42 | 0.22 | -0.50 | 0.01 | -0.51 | -0.73 | -0.51 | 0.58 | -0.53 | 0.22 | -0.20 |
| -1 | 0.32 | 0.46 | 0.14 | -0.66 | -0.05 | -0.52 | -0.62 | -0.43 | 0.60 | -0.31 | 0.32 | -0.24 |
| +1 | 0.82 | 0.61 | 0.24 | -0.65 | -0.27 | -0.01 | -0.24 | -0.17 | 0.26 | 0.40 | 0.38 | -0.21 |
| +2 | 0.80 | 0.39 | 0.36 | -0.53 | -0.27 | 0.06 | 0.01 | -0.02 | 0.06 | 0.58 | 0.32 | -0.14 |
| +3 | 0.61 | 0.12 | 0.26 | -0.32 | -0.24 | -0.01 | 0.16 | 0.16 | -0.02 | 0.60 | 0.19 | -0.14 |
| +4 | 0.39 | -0.15 | 0.13 | 0.01 | -0.15 | 0.05 | 0.37 | 0.29 | -0.02 | 0.46 | 0.13 | -0.12 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.88 | 0.82 | 0.71 | 0.86 | 0.82 | 0.81 | 0.85 | 0.76 | 0.75 | 0.85 | 0.69 | 0.67 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of the nominal effective exchange rate.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of nominal effective exchange rate and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of nominal effective exchange rate and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered nominal effective exchange rate and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered nominal effective exchange rate.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered nominal effective exchange rate.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table 22

**Real effective exchange rate**

| | Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute Volatility[1] | | | | | | | | | | | | |
| HP | 8.27 | 1.96 | 3.09 | 4.29 | 2.83 | 4.27 | 4.45 | 5.04 | 8.64 | 15.02 | 3.14 | 2.90 |
| FD | 7.33 | 1.70 | 2.42 | 3.07 | 1.87 | 2.83 | 3.28 | 3.31 | 5.57 | 8.76 | 2.77 | 2.24 |
| TP | 8.84 | 2.07 | 3.22 | 4.37 | 2.91 | 4.80 | 4.50 | 5.27 | 9.26 | 17.38 | 3.17 | 3.40 |
| Relative Volatility[2] | | | | | | | | | | | | |
| HP | 1.97 | 0.87 | 1.71 | 1.74 | 2.70 | 2.40 | 1.76 | 4.16 | 2.39 | 4.91 | 2.57 | 3.41 |
| FD | 1.95 | 0.80 | 1.90 | 1.57 | 2.31 | 1.69 | 1.40 | 4.52 | 1.85 | 4.27 | 2.45 | 2.04 |
| TP | 2.06 | 0.79 | 1.48 | 1.69 | 2.43 | 2.61 | 1.59 | 4.69 | 2.17 | 5.93 | 1.99 | 3.71 |
| Cyclicality[3] | | | | | | | | | | | | |
| HP | 0.54 | 0.28 | -0.08 | -0.27 | -0.33 | -0.06 | -0.09 | -0.32 | -0.59 | 0.19 | 0.07 | -0.08 |
| FD | 0.50 | 0.03 | -0.28 | -0.14 | 0.09 | -0.18 | -0.03 | -0.09 | -0.11 | 0.08 | 0.18 | 0.02 |
| TP | 0.56 | 0.30 | 0.05 | -0.20 | -0.38 | 0.10 | -0.11 | -0.56 | -0.65 | 0.06 | 0.01 | -0.28 |
| Leads and Lags[4] | | | | | | | | | | | | |
| -4 | -0.13 | 0.32 | -0.04 | 0.13 | -0.09 | -0.26 | -0.63 | -0.52 | -0.19 | -0.58 | 0.13 | -0.27 |
| -3 | 0.25 | 0.44 | -0.07 | 0.06 | -0.19 | -0.28 | -0.53 | -0.59 | -0.42 | -0.50 | 0.19 | -0.20 |
| -2 | 0.44 | 0.22 | -0.16 | -0.13 | -0.17 | -0.30 | -0.46 | -0.58 | -0.49 | -0.39 | 0.03 | -0.22 |
| -1 | 0.67 | 0.13 | -0.13 | -0.24 | -0.27 | -0.14 | -0.28 | -0.46 | -0.51 | -0.16 | 0.09 | -0.15 |
| +1 | 0.05 | 0.43 | 0.15 | -0.36 | -0.46 | 0.04 | 0.11 | -0.10 | -0.63 | 0.55 | -0.07 | -0.01 |
| +2 | -0.36 | 0.26 | 0.32 | -0.30 | -0.44 | 0.05 | 0.31 | 0.04 | -0.48 | 0.72 | -0.15 | 0.02 |
| +3 | -0.58 | 0.00 | 0.33 | -0.16 | -0.39 | 0.00 | 0.38 | 0.19 | -0.23 | 0.69 | -0.31 | 0.04 |
| +4 | -0.58 | -0.29 | 0.30 | 0.15 | -0.25 | 0.02 | 0.52 | 0.29 | -0.01 | 0.56 | -0.26 | -0.02 |
| Persistence[5] | | | | | | | | | | | | |
| | 0.65 | 0.63 | 0.69 | 0.76 | 0.81 | 0.81 | 0.75 | 0.79 | 0.80 | 0.84 | 0.62 | 0.71 |

*Notes:*

*[1] 'Absolute Volatility' is measured as the standard deviation of the real effective exchange rate.*

*[2] 'Relative Volatility' is measured as the ratio of the standard deviation of real effective exchange rate and real GDP.*

*[3] 'Cyclicality' is measured as the contemporaneous correlation between of real effective exchange rate and real GDP.*

*[4] 'Lead (lag)' is measured as the correlation between the leads (lags) in HP-filtered real effective exchange rate and real GDP.*

*[5] 'Persistence' is measured as the AR(1) coefficient in HP-filtered real effective exchange rate.*

*[6] Bold figures indicate the largest correlation coefficient (in absolute value) in HP-filtered real effective exchange rate.*

*[7] All data are at the quarterly frequency, de-seasonalized and de-trended. De-trending methods include the Hodrick-Prescott filter (HP), log first-differencing (FD) and fitting a quadratic time-trend polynomial (TP).*

## Table A1

| Bulgaria | Croatia | Czech Rep. | Estonia | Hungary | Latvia | Lithuania | Poland | Romania | Russia | Slovakia | Slovenia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP | SO | SO and EIZ | SO | SO | SO | SO and IFS | SO | OECD and EMED | SO and IEFB | EMED | EMED | IFS |
| Industrial production | WIIW and SO | IFS | IFS | SO, 1994:1 - | IFS | SO, 1995:1 - | SO | IFS | IFS | WIIW | IFS | IFS |
| Consumption | SO | SO and EIZ | SO | SO | SO | SO, 1995:1 - | SO | OECD and EMED | SO and IEFB | EMED | EMED | N/A |
| Investment | SO | SO and EIZ | SO | SO | SO | SO, 1995:1 - | SO | OECD and EMED | SO and IEFB | EMED | EMED | N/A |
| Government consumption | SO and EIZ | SO | SO | SO | SO | SO, 1995:1 - | SO | OECD and EMED | SO and IEFB | EMED | EMED | N/A |
| Exports | IFS and SO | SO and EIZ | SO | SO | SO | SO, 1995:1 - | SO | OECD and EMED | SO and IEFB | EMED | EMED | CB, -2003:2 |
| Imports | IFS and SO | SO and EIZ | SO | SO | SO | SO, 1995:1 - | SO | OECD and EMED | SO and IEFB | EMED | EMED | CB, - 2003:2 |
| Nominal wage | WIIW | WIIW | IFS | SO | WIIW | IFS | IFS | WIIW | WIIW | WIIW | WIIW | WIIW |
| Industrial employment | WIIW | WIIW | IFS | SO | ILO | IFS | IFS, - 2002:1 | IFS | WIIW | IFS | WIIW | WIIW |
| Total employment | WIIW | WIIW | SO | SO | ILO | N/A | SO | ILO | WIIW | WIIW | IFS and SO | WIIW |
| Private sector credit | IFS | IFS | IFS | IFS | IFS | IFS, 1993:3 - | IFS | IFS | CB | IFS | CB, 1995:1-2003:1 | IFS |
| Money | IFS | IFS | IFS | CB | IFS | IFS, 1993:3 - | IFS | IFS | IFS | IFS | IFS | CB, - 2003:2 |
| CPI | IFS | IFS | IFS | SO | IFS | IFS | SO | IFS | IFS | IFS | IFS | IFS |
| Net capital flows | IFS | IFS | CB | IFS | IFS | IFS | IFS | N/A | IFS | IFS | CB and IFS | IFS |
| Nominal interest rate | IFS | IFS | IFS | IFS | IFS | IFS | IFS | IFS | WIIW | IFS | IFS | IFS |
| Nominal effective exchange rate | IFS | IFS | IFS | CB | IFS | CB, 1994:1 - | CB | IFS | IFS | IFS | IFS | CB |
| Real effective exchange rate | IFS | IFS | IFS | CB | IFS | CB, 1994:1 - | CB | IFS | IFS | IFS | IFS | CB |
| Range | 1994:1 - 2003:4 | 1994:1 - 2003:4 | 1994:1 - 2003:4 | 1993:1 - 2003:4 | 1995:1 - 2003:4 | 1993:1 - 2003:4 | 1995:1 - 2003:4 | 1995:1 - 2003:4 | 1994:1 - 2003:4 | 1995:1 - 2003:4 | 1993:1 - 2003:4 | 1993:1 - 2003:4 |

*A. Unless otherwise indicated, the sample period is determined by the availability of fixed price GDP data in a particular country, as shown in the last row of the table.*

*B. Data sources and abbreviations: International Financial Statistics (IFS) of the IMF, the International Labor Organization database (ILO), local Central Banks (CB), local Statistical Offices (SO), the Economic Institute, Zagreb (EIZ), the Institute of Economic Forecasting, Bucharest (IEFB), the Emerging Market Economic database (EMED), the OECD database (OECD), and the Vienna Institute for International Economic Studies database (WIIW). N/A indicates missing or inadequately short series.*

# Appendix

MNB Füzetek 2003-tól. A teljes lista elérhető:
http://www.mnb.hu/engine.aspx?page=mnbhu_mnbfuzetek
Working papers since 2003. The full list of working papers is available at:
http://english.mnb.hu/engine.aspx?page=mnben_mnbfuzetek

2003/1
BENCZÚR, Péter: The behavior of the nominal exchange rate at the beginning of disinflations
*A nominálárfolyam viselkedése monetáris rezsimváltás után (csak angol nyelven)*
2003/2
VÁRPALOTAI, Viktor: Numerikus módszer gazdasági adatok visszabecslésére
*Numerical Method for Estimating GDP Data for Hungary (available only in Hungarian)*
2003/3
VÁRPALOTAI, Viktor: Dezinflációs számítások dezaggregált kibocsátási résekre alapzó makromodellel
*Disinflation Simulations with a Disaggregated Output Gap Based Model (available only in Hungarian)*
2003/4
VÁRPALOTAI, Viktor: Dezaggregált költségbegyűrűzés-alapú ökonometriai infláció-előrejelző modell
*Disaggregated Cost Pass-Through Based Econometric Inflation-Forecasting Model for Hungary*
2003/5
JAKAB M., Zoltán–KOVÁCS, Mihály András: Explaining the Exchange Rate Pass-Through in Hungary: Simulations with the NIGEM Model
*Az árfolyam-begyűrűzés meghatározói: szimulációk a NIGEM modellel (csak angol nyelven)*
2003/6
VADAS, Gábor: A háztartások megtakarításának és lakásberuházásának modellezése portfólió-választási keretben
*Modelling households' savings and dwellings investment – a portfolio choice approach*
2003/7
PULA, Gábor: Capital Stock Estimation in Hungary: A brief description of methodology and results
*Tőkeállomány becslése Magyarországon a PIM módszerrrel. Módszertani leírás és eredmények (csak angol nyelven)*
2003/8
DARVAS, Zsolt–VADAS, Gábor: Univariate Potential Output Estimations for Hungary
*Potenciális kibocsátás becslése Magyarországon egyváltozós módszerekkel (csak angol nyelven)*
2003/9
BENCZÚR, Péter: Nominális sokkok átmeneti reálhatása egy kétszektoros növekedési modellben
*Real Effects of Nominal Shocks: a 2-sector Dynamic Model with Slow Capital Adjustment and Money-in-the-utility*
2003/10
MÉRŐ, Katalin–ENDRÉSZ VALENTINYI, Marianna: The Role of Foreign Banks in Five Central and Eastern European Countries
*A külföldi bankok szerepe öt kelet-közép-európai országban (csak angol nyelven)*

2003/11

VILÁGI, Balázs: Az optimális eurókonverziós ráta meghatározása egy sztochasztikus dinamikus általános egyensúlyi modellben

*The Optimal Euro Conversion Rate in a Stochastic Dynamic General Equilibrium Model*

2003/12

MÓRÉ, Csaba–NAGY, Márton: A piaci struktúra hatása a bankok teljesítményére: empirikus vizsgálat Kelet-Közép-Európára

*Relationship between Market Structure and Bank Performance: Empirical Evidence for Central and Eastern Europe (available only in Hungarian)*

2003/13

BENCZÚR, Péter–SIMON, András–VÁRPALOTAI, Viktor: Fiskális makropolitika és a növekedés elemzése kalibrált modellel

*A Calibrated Model of Growth and Intertemporal Consumption Allocation in a Catching-up Country*

2004/1

DARVAS, Zsolt–SZAPÁRY, György: Konjunktúraciklusok együttmozgása a régi és új EU-tagországokban

*Business Cycle Synchronization in the Enlarged EU: Comovements in the New and Old Members*

2004/2

NASZÓDI, Anna: A sávmódosítások árfolyamhatásának vizsgálata opciós modell keretei között

*Target zone rearrangements and exchange rate behavior in an option-based model*

2004/3

TARJÁNI, Hajnalka: Estimating the Impact of SBTC on Input Demand Elasticities in Hungary

*A szakképzettséget felértékelő technológiai változás hatásának becslése a termelési tényezők keresletrugalmasságára Magyarországon (csak angol nyelven)*

2004/4

ORBÁN, Gábor–SZAPÁRY, György: A Stabilitási és Növekedési Egyezmény az új tagállamok szemszögéből

*The Stability and Growth Pact from the Perspective of New Member States*

2004/5

VILÁGI, Balázs: Duális infláció és reálárfolyam a nyitott gazdaságok új makroökonómiája megközelítésében

*Dual inflation and real exchange rate in new open economy macroeconomics*

2004/6

BILBIIE, Florin O.–STRAUB, Roland: Fiscal Policy, Business Cycles and Labor-Market Fluctuations

*Fiskális politika, üzleti ciklusok és munkaerő-piaci fluktuáció (csak angol nyelven)*

2004/7

VADAS Gábor–P. KISS, Gábor: Légy résen – az államháztartási egyenleg ciklikus buktatói

*Mind The Gap – Watch the Ways Cyclical Adjustment of the Budget Balance*

2004/8

HORVÁTH, Csilla–KREKÓ, Judit–NASZÓDI, Anna: Kamatátgyűrűzés Magyarországon

*Interest rate pass-through in Hungary*

2004/9

MÓRÉ, Csaba–NAGY, Márton: Verseny a magyar bankpiacon

*Competition in the Hungarian Banking Market*

2004/10

LUBLÓY, Ágnes: A magyar bankközi piac rendszerkockázati vonatkozásai

*Systemic Risk Implications of the Hungarian Interbank Market (available only in Hungarian)*

2004/11

ENDRÉSZ VALENTINYI, Marianna: Structural Breaks and Financial Risk Management

*Strukturális törések és pénzügyi kockázatkezelés (csak angol nyelven)*

2004/12

KÁTAY, Gábor–WOLF, Zoltán: Investment Behavior, User Cost and Monetary Policy Transmission – the Case of Hungary

*Beruházások, tőkeköltség és monetáris transzmisszió Magyarországon (csak angol nyelven)*

2005/1

VONNÁK, Balázs: Estimating the Effect of Hungarian Monetary Policy within a Structural VAR Framework

*A magyar monetáris politika hatása az árakra és a kibocsátásra – becslés strukturális VAR-modellkeretben (csak angol nyelven)*

2005/2

BENCZÚR, Péter–RÁTFAI, Attila: Economic Fluctuations in Central and Eastern Europe – The Facts

*Gazdasági fluktuációk Kelet-Közép-Európában – A tények (csak angol nyelven)*

Working Paper 2005/2
Economic Fluctuations in Central and Eastern Europe – the Facts
Print: D-Plus
H-1033 Budapest, Szentendrei út 89–93.