Cross-country Interaction of Business Cycles in Statistical Modeling of Economic Growth

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Abstract

Economic growth as the percent rate of the increase in real gross domestic product is significantly determined by the stage of the macroeconomic business cycle. The analysis of the developed econometric models of the European country's economic growth for the period 2000-2012 shows that at the same stages of business cycles the rate of the economic growth is very different. This rate depends on the structure of economy that among other factors is determined by the factor of the influence of the economic cyclicity of other European countries – the main trade and economic partners. The result of this analysis was the matrix of «cyclicity export» - the table of the time periods of cyclicity influence of all EU countries on the rates of the economic growth of every European country. The same results were got for the EU countries and the Russian Federation on the quarterly databases of Eurostat and Rosstat.

Keywords: economic structure, export cyclicity, forecast, statistical regularity.

1. Introduction

Nowadays the significance of economic growth econometric models as a tool of forecasting and government regulation is growing up, but now in post crisis period of instability the short-and medium-term models of economic growth are presenting the most theoretical and practical interest.

There are a lot of attempts to develop an adequate macroeconomic model on the basis of one or a combination of several economic theories with the use of statistical databases.

One of the numerous examples is the work «Determinants of Economic Growth in East Asia: A Linear Regression Model» by Elizabeth Kowalski which is presented on the Internet (2, p.15). The author takes into consideration that the neoclassical, structuralist and market friendly theories establish many different variables which may act as the indicators of economic growth in East Asia and at the same time she focuses on only a few major indicators of economic growth to determine their relative importance to GDP growth. According to the author's opinion these indicators of economic growth (annual GDP growth, %) can be grouped in the following way: outward orientation, government indicators and macroeconomic indicators. For the specification of the outward orientation this author and many others use such variables as export of goods and services (% of GDP) and foreign direct investment (net inflows, % of GDP).

With regard to the necessity to include the outward orientation influence as a factor into the econometric model we believe that representing this factor by the aforesaid variables does not allow to consider the cross-country interaction of cyclical processes. And as we move off the lowest point of the global economic crises the impact of this factor becomes more sustainable and compound. To confirm this idea we can quote Angel Gurria – secretary general of the Organization for Economic Cooperation and Development, addressed the Gaidar Forum in Russia in January, 2013 : «Right now, the options are more difficult, it's not obvious: you have countries that are growing, countries that are in recession and countries that are so-so… What to do together? Everybody doing the same thing is difficult, because now everybody's in different situation» (1, p.14).

We see at least two reasons explaining this situation. It happens, firstly, because the classical midterm business cycles (Juglar, Kitchin and others) of market economics begin to re-establish and interact, and, secondly, because the post crisis waves of different economies get into resonance.

2. Results

In economic literature the sufficiently well described economic phenomena are the harmonization and synchronization of different business cycles. We have researched these variants of cyclical interaction over the European countries and the Russian Federation and the results were presented in our report in the 56th World Statistical Congress in Dublin (August, 2011). Further research brings us to the idea of the cross-country «export» and «import» cyclicity. It means that the cross-country interaction of the economic cycles can have at least two displays : 1- «absorption» of economic cycles which were born in other countries and as a result – the strengthening instability in the country which «imports» cyclicity; 2 – «dispersion» of the cyclicity of one country to the economy of the others. In this case the first one is the «exporter» of cyclicity. In reality, of course, the cross-country cyclical interaction is more complicated and every country can be either exporter or importer of cyclicity in different types of economic activities. But for the developing of economic growth models it is very important to assess and include the factor of the macro level cross-country economic cyclicity.

The quarterly seasonal adjusted time series of GDP rates (in fixed prices, %) of the European countries and the Russian Federation are available in the databases of Eurostat and Rosstat and we have got the trend-cyclical model of every series. For this purpose we have done the approximation of every time series by sinusoid with linear component:

$$\bar{y}t = a_0 + a_1 t + \sum_{t=o}^{m}(a_2 \sin(k_1 \cdot t + b_1) + a_3 \cos(k_2 t + b_2)).$$

The symbols of the formula are:

t – the number of the quarterly period in time-series ($t=1$ for the first quarter of 2001st year, $t=m$ for the last quarter of 2013th year in databases);

y_t – dependent variable (GDP growth rate);

$a_0, a_1, a_2, b_1, b_2, k_1, k_2$ – parameters of the regression model.

We have got the correlation coefficients between trend-cyclical components of the time-series taking into account the lagging of cyclicity influence of European economy on Russian economy $\left(EU_{(t-L)}/R_t\right)$ and on the contrary the lagging of cyclicity influence of Russian economy on European economy $\left(R_{(t-L)}/EU_t\right)$.

The comparison of the correlation coefficients in columns 1 and 2 (see the table) allows to make a conclusion that Russian economy exports the European cyclicity with the lags the length of which is one – three quarters.

Table. The correlation analysis of the cyclicity interaction lagging of European and Russian economies

The length of lagging (L), quarters	Correlation coefficient $\left(EU_{(t-L)}/R_t\right)$	Correlation coefficient $\left(R_{(t-L)}/EU_t\right)$
A	1	2
12	0,321	0,172
9	-0,289	-0,364
6	-0,198	-0,412
5	-0,280	-0,038
4	-0,106	0,120
3	0,729	-0,093
2	0,246	0,355
1	0,966	0,088

0	0,426	0,426

The matrix of export-import cyclicity has been developed for all European countries and the Russian Federation. The model of the economic growth of every country includes the factor of economic structure dynamics - the aggregate index of structural differences, and this factor is determined by the regression function with the arguments of cross-country export cyclicity. The estimation of the aggregate index of structural differences of every country was obtained with the help of quarterly database of economic activities additional value in fixed prices. The analysis of the model parameters shows that the predicted rates of the Russian Federation economic growth are determined by different factors in short-term and mid-term periods. In short-term period (1-2 years) the meaningful factor is the share of natural resources mining in gross domestic product. In the mid run (3-5 years) business cyclicity in real sector of European countries positively influences Russian economic growth according to the statistical estimation and calculated statistical regularities.

3. Conclusions
This conclusion is very important for evaluating the consequences of the Russian Federation joining the World Trade Organization. The forecast with the application of the developed models for the European countries has shown that the impact of the cyclicity of the Russian oil and gas price production indices could be decreased if the European countries economic structure changed quite significantly. The quantitative assessment of the required change in the economic structure was obtained for every European country with the calculation of cyclicity export.
The estimation of exporting cyclical components of GDP dynamics must be included as a predictor into the economic growth econometric model of the country importing cyclicity.
Further research is necessary to develop in the spheres of cross-country cyclical interaction analysis for different levels and types of economy and increasing the predicted quality of the economic growth models taking into account cross-country cyclical interaction.

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