System of composite indicators of the economic activity of Serbia (VIPAS) in short-term forecasting of GDP

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Abstract

The context of increasingly dynamic economic flows and positions of small open economies entails inevitable issues for the economic activity of Serbia, being the anticipation of values of a large number of macroeconomic variables and the quality of their data for the purpose of a more exhaustive and better monitoring of the process of implementation of the economic policy of the Government of Serbia in the current year. A combined application of econometric models and systems of leading indicators is a powerful analytical tool in forecasting time series, testing potential measures of the economic policy and checking certain theoretical assumptions of the economic system.

The Statistical Office of the Republic of Serbia (SORS) carried out a substantial survey of economic flows of the national economy with the aim of diagnosing, selecting and evaluating the macroeconomic indicators that would be the most suitable to describe structural and cyclical trends of the national economy on monthly level and to make an analysis of GDP forecasting for the current year.

In this process, through the survey and monitoring, a central macroeconomic database (B2) was created, consisting of integrated individual databases by areas involving all significant macroeconomic areas of the national economy in the complete and detailed structures of each sub-area (approximately 3000 variables, i.e. time series on monthly level, and about 2500 variables on quarterly level). The database is more or less composed of the following segments:

1) **Real sector** (physical volume of industry, turnover of the physical volume of industry, movement of stocks of finished goods in industrial production, retail trade, construction, transport and telecommunications, tourism and catering trades, prices, wages and salaries and employment, unemployment, international trade flows, etc.).

2) **Overall structure of fiscal flows and public debt**,

3) **Overall structure of balance of payments**,

4) **Monetary sector and foreign exchange reserves**

5) **Business Expectation Survey** (survey carried out by SORS for the purposes and according to survey standards of the European Commission)

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6) **Data on climate parameters** (source: Republic Hydro meteorological Service of Serbia) and agricultural flows and factors.

All data series have been divided into two main groups: hard indicators (official statistical data) and soft indicators (data obtained from the Business Expectation Survey).

The principal criteria in the initial coverage of indicators were their economic relevance and data availability on monthly level with sufficiently long and up-dated time series.

In the following stage, one started the process of creating a macroeconomic system of leading indicators of the economic activity of Serbia (VIPAS), made of three key indicators: VIPAS 1, VIPAS 2 and VIPAS 3, and two additional derived indicators: export indicator of the economic activity of Serbia (IZIPAS) and impulse indicator of the economic activity of Serbia (IMIPAS). A system for forecasting agricultural production (AGRIPAS) was also developed, as part of the system of composite indicators.

The developed system of composite leading indicators (VIPAS) plays an important role in anticipating the climate of economic flows by GDP sectors for about 6 – 9 months onwards on average and in making short-term quantitative assessment of GDP growth rates, as a final result of the whole forecasting process.

The developed system of composite leading indicators of the economic activity of Serbia (VIPAS) is the product of an original analytical survey work of the Statistical Office of the Republic of Serbia.

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Leading Indicators System of Serbian economy

In order to provide better diagnostics, selection and evaluation of macroeconomic indicators that can best describe Serbian economy movements on a monthly basis and to realize the GDP forecast for the current year, the SORS has begun to develop a system of composite leading indicators. These are indicators with high ability to predict the cyclical trends of domestic GDP with a high level of reliability and to serve for quarterly and annual forecasts of GDP growth rate in the short term (up to one year).

In this context, the macroeconomic system of the leading indicators (VIPAS) of economic activity of Serbia was formed, and consists of three main indicators: VIPAS 1, VIPAS 2 and VIPAS 3, as well as two additional implemented indicators: the export indicator of economic activity of Serbia (IZIPAS) and the impulse indicator of economic activity of Serbia (IMIPAS). All of these indicators are a product of original analytical research work and do not present plagiarism or copies of other indicators of domestic or international institutions.

• VIPAS 1- deductive approach:

The first step in the development of this indicator was the production of a reference indicator of the economic activity of Serbia (labeled as KIPAS) which describes the dynamics of the industry sector, retail trade and the total approved building permits and as such represents a substitute for GDP on a monthly basis.

At a further stage in the development of the leading indicator VIPAS 1, research and recording, a large central macroeconomic database (B2) was formed, covering all significant areas of macroeconomics of the domestic economy in the complete and detailed structures of each sub-sector (in total about 3000 variables or time series on monthly level):
1) Real sector (physical volume of industry, turnover of physical volume of industry, movement of finished products of industrial production, retail trade, construction, transport and telecommunications, tourism and catering, prices, wages and employment, unemployed persons, trade syndicates)
2) The overall structure of fiscal flows and public debt
3) The overall structure of the balance of payments
4) Monetary sector and foreign reserves and
5) Survey on economic climate conditions (the SORS survey, conducted under European Comission supervision)

All series are divided into two basic groups: hard indicators (official statistics) and soft indicators (data obtained as a result of the business expectations survey).
The basic criteria in the initial coverage of the indicators were their economic relevance and availability on a monthly basis, with sufficiently long and up-to-dated time series. After a detailed analysis of the seasonal component, the autolayer detection and the cyclic indication procedure, using the Bry-Boschan algorithm, the detection of the time-series turning points of each variable was performed.

It is important to note that all the series in the preliminary analysis were linked to the approximated GDP at the monthly level, i.e. the above mentioned reference composite indicator of the economic activity of Serbia (KIPAS), and based on it additional qualitative statistics were computed.

The macroeconomic indicators that were candidates for computing the composite leading indicator had a different time span, i.e. length of the time series, and therefore, after selecting and including into the composite leading indicator VIPAS influenced its temporal availability, i.e. the beginning of the series.

Namely, it was necessary to have at least 60% of the data of all selected indicators available so that the process of weighted aggregation could be successfully implemented in each month. That is why the composite leading indicator of VIPAS has begun since January 2007.

The following 12 indicators with the best qualitative statistical diagnostic in the monitoring and predicament of the economic activity were selected:

• Intermediate products (except energy), physical volume
• Non-durable consumer goods, physical volume
• Manufacturing, physical volume
• Real earnings in the sector of administrative and auxiliary service activities
• Real VAT growth
• Effective money and deposits abroad, NBS foreign exchange reserves
• Expected economic situation in the next 6 months in the manufacturing industry
• Business Climate Index of the Manufacturing Industry (BCI)
• Expected liquidity in the chemical industry in the coming months
• Consumer confidence index of total services
• Total indicator of economic confidence (ESI index), sector of total industry, services, retail trade and construction
• Index of new orders in industry

All 12 leading indicators aggregated into one composite leading indicator VIPAS 1 gave excellent performance of qualitative tests versus the reference indicator KIPAS, on a monthly basis. It is important to mention that VIPAS 1, from it very beginning (from January 2007 to March 2017) anticipated all 4 turning points of the cycle of the reference indicator KIPAS, without any false signal and missed detection. Also, the VIPAS 1 leads the KIPAS indicator to about 9 months (or three quarters), with a very small range of deviations between these lags and a high degree of agreement of 0.91.

• VIPAS 2- inductive approach

VIPAS 2 represents the application of the procedure described above, but procedure starts from calculation of the leading indicators of each separate area included in the reference indicator KIPAS, i.e. industry, trade, and number of building permits. As previously detected, the weighted effect of these areas within one indicator has a high degree of cycle matching with the cycle of GDP.

Therefore, a leading composite indicator of economic activity of Serbia (VIPAS 2), characterized by a high degree of agreement with the GDP cycle, was formed as weighted average of following indicators: industrial indicator of the economic activity of Serbia (INDIPAS), the trade indicator of economic activity of Serbia (TIPAS)

and the construction indicator of economic activity of Serbia (GRIPAS). Formed on this way, VIPAS 2 indicator presents the expected cycle of GDP in the next 2-3 quarters and in combination with the econometric model allows the annual growth rate of GDP per quarter to be carried out.

➢ *Industrial Indicator of Economic Activity of Serbia (INDIPAS)*

Industrial Indicator of Economic Activity of Serbia (INDIPAS) is a leading indicator of industrial production, and has the final goal to forecast GVA of the total industry. In calculation of INDIPAS the first step includes forming a reference indicator which represents the physical volume of total industry. Next step includes detection of the variables whic have the highest degree of corelation with this reference indicator and longest time lag in sense of prediction. The indicator thus obtained indicates the conjuncture of the physical volume of industrial production cycle for the following 2-3 quarters, and in combination with the econometrical model provides opportunity not only to predict the growth rate of the physical volume of the total industry for the coming period, but also the GVA of the total industry. The following variables with the best performances are detected and selected for final composition of the composite industrial indicator of economic activity of Serbia (INDIPAS):

- the physical volume of the beverage production sector
- import of the agriculture, forestry and fisheries sector
- import of the sector of production of metal products, except machinery
- import of the production sector of non-mentioned machines and equipment
- Import of organic chemical products
- import of machinery specialized for industrial production
- new orders in the manufacturing sector
- confidence indicator in the chemical industry sector
- the expected trend in the sector of consumer goods production (permanent and non-durable)
- and the expected trend of contracted works in the construction sector

➢ *Trade Indicator of Economic Activity of Serbia (TIPAS)*

The Trade Indicator of Economic Activity of Serbia (TIPAS) was calculated according to the best-quality variables in the context of leading qualities corelated with the GVA of trade. As such, it is the leading composite indicator of GVA of trade, with ability to leads about 2 quarters. The following variables are included in its composition:

- Manufacturing industry, physical volume
- Production in the food industry, physical volume
- Production in the textile industry, physical volume
- Turnover index in the manufacturing industry - total
- Imports of meat and meat products
- Real growth of VAT inflows
- Retail trade in food and beverages at current prices

- Physical volume of freight land transport
- Physical volume of freight river traffic

➤ *Construction Indicator of Economic Activity of Serbia (GRIPAS)*

The construction indicator of economic activity of Serbia (GRIPAS) also belongs to the class of leading composite indicators for predicting the economic growth of construction industry. The detection and selection process resulted with following variables included in GRIPAS:

- Production of electrical equipment, physical volume
- Export of goods and services to Germany
- Export of goods and services to Slovenia
- Import of cellulose and recycled paper
- NBS securities
- Number of arrivals of domestic and foreign tourists
- Confidence Indicator Industry Index (total Industry)
- Expected production in the chemical industry in the coming months
- Expected price of construction of buildings in the coming months
- Overall indicator of economic confidence (ESI index), sector of total industry, services, retail trade and construction.

• VIPAS 3- balance approach

VIPAS 3 is a balance indicator which combines the results of the previously presented industry indicators (INDIPAS), trade (TIPAS), construction (GRIPAS), suplemented with two additional indicators: total service indicators (UPAS) and agricultural forecasting system (AGRIPAS). The obtained results of the above mentioned indicators enable a final evaluation of all sectors of the production side of GDP in the total annual growth rate for the current year.

➤ *Indicator of total Services activity of Serbia (UPAS)*

This indicator is calculated on the basis of the leading indicator of GVA of trade, and as such it represents its indirect result. The final quantitative evaluation of the annual growth rate is carried out in combination with the econometric model.

➤ *Agricultural Production Forecasting System (AGRIPAS)*

The main task of this system is the forecast of the GVA of agricultural production. The forecast of agricultural sector movements based on the AGRIPAS system consists of two interconnected main models - model of plant production and model of livestock production, by structure. In the implementation of the plant production model it was necessary to calculate the indicator of plant production (AGRIPAS B), which consists of two

separate models - wheat production and maize production. In the formation of econometric models of wheat production and maize production models, climate effects in sowing periods and periods of accelerated vegetative growth, estimation of harvest areas, determination of dry years of these crops as well as the effects of other autonomous factors were carefully analyzed and taken into account.

The animal husbandry model is based on the structural model of cattle growth (AGRIPAS S) and the primary animal husbandry model, which is largely dependent on the results of the milk production model.

• Auxiliary indicators of the GDP of Serbia - IZIPAS and IMIPAS

These indiators serve as auxiliary mechanism in the forecast of GDP of Serbia for the current year. They do not belong to the class of leading indicators, but are based on econometric models.

➢ *Export Indicator of Economic Activity of Serbia (IZIPAS)*

In the system of composite indicators for GDP forecast, the export indicator of economic activity of Serbia (IZIPAS) was developed, as result of analytical and research work. IZIPAS is based on weighted dynamics of the economic activity of the largest foreign trade partners of Serbia (Italy, Germany, BiH and Romania). IZIPAS is thus constructed as a composite coincident indicator of GDP of the countries that are the largest export markets of the Republic of Serbia and shows a high degree of cyclical agreement with the movement of GDP of the domestic economy. The measurement of the dynamics of Serbia's GDP through this method depends entirely on the dynamics of the economic activity of the largest foreign trade partners and therefore export markets of exporters from Serbia. Taking into account the lack of impact of agricultural production and in order to incorporate this indicator in the GDP forecast, the value of the contribution of GVA of agricultural production will be added to it, based on the application of the specially developed agricultural production forecast system (AGRIPAS).

➢ *Impulse indicator of economic activity of Serbia (IMIPAS)*

In the system of composite indicators for GDP forecast an alternative method of GDP forecast based on the development of a structural endogenous binding of three successive cumulative quarterly econometric models of GDP has also been developed. It is triggered by the impulse of the first quarter of each year. This method actually measures the elasticity of cumulative growth inertia among the quarters andprojects it by the end of the year by activating all three models at the same time. This model is therefore called the impulse indicator of economic activity of Serbia (IMIPAS). The model has an integrated agricultural component that can not be separated and measured in this way, but it will be done on the basis of the mentioned AGRIPAS system.

Conclusion

The economic cycle, which is also called the business cycle, represents periodic ups and downs of economic activity measured by fluctuations in real GDP and other macroeconomic indicators in relation to their estimated long-term trend.

In order to gain a better understanding of the national economy, the work on detecting economic circulation points has recently initiated in SORS. Turning points have an important role in the Early Warning System as they define the position of the economy in the long-term economic cycle. In 2017 various filtration techniques were implemented on GDP quarterly data, the turning points were detected for each of them and their economic interpretation was given. In 2018, further work in this area continued with production of so-called leading indicators, whose role is to inform decision-makers about the coming short-term and mid-term fluctuations in the economy. Leading indicators are created on the basis of data with higher frequency than GDP (usually monthly series) thus achieving faster detection of possible changes in the economic cycle and allowing an adequate and timely response to these changes. Potential candidates for such indicators are data on industrial production, earnings, turnover, but also more complex indicators such as the economic climate indicators for Serbia.