
VAR - MODELS OF SHOCKS IN THE BUSINESS CYCLES OF FINAL CONSUMPTION EXPENDITURE OF HOUSEHOLDS

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Abstract: The article has experimented with a methodology for using vector autoregressive models (VAR) to study the impact of shocks in the business climate and economic activity on the business cycles of final consumption expenditure of households. It refers to six countries in Central and Eastern Europe (Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia) for the period 2000 to 2015. The results show that the expectations for the financial situation of households over the next 12 months and the level of employment have a stimulating effect on the business cycle of final consumption expenditure of households. The expectations for unemployment, inflation and savings over the next 12 months have a negative impact on the business cycles.

Keywords: business cycle, business climate, economic activity, final consumption expenditure of households, VAR, impulse responses.

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Introduction

The economic development of countries passes through periods of boom and decline characterized by variable length, depth and consequences. In science this phenomenon is called business cycle. The cycles are

inherent in the modern economic system. Knowledge is required for them to be successfully managed.

Object of surveying is the final consumption expenditure of households in GDP. Subject of study are the shocks in business cycles in the final consumption expenditure of households caused by the business climate and economic activity in Bulgaria and five countries in Central and Eastern Europe for the period 2000 to 2015.

The scientific goal of this paper is to build VAR models for the shocks in business climate and economic activity, and to measure their impact on the business cycles in the final consumption expenditure of households in Central and Eastern Europe¹.

1. Methodology

The methodology includes: 1) business cycles in the final consumption expenditure of households; 2) macro indicators of the business climate and economic activity of households; 3) econometric modelling of shocks in the business cycles of final consumption of households by using VAR-models.

1.1. Business cycles of final consumption expenditure of households

The business cycle has been studied and described by A. Burns and W. Mitchell in the monograph "Analysis of business cycles." According to them, "business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in the form of private enterprises; cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; business cycles vary in length from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own".²

Gross domestic product (GDP) is a summary indicator of the degree of development of the national economy. It characterizes the value of goods and services for final consumption produced by resident economic entities. Final consumption has its own structure. It includes consumption expenditure of

¹ Bulgaria, Czech republic, Hungary, Poland, Romania and Slovakia

² **Burns, A. F. and Mitchel, W.** (1946) Measuring Business Cycles. NBER Studies in Business Cycles, №2, New York: Columbia University Press, p.3.

households, government and non-profit institutions serving households (NPISHs).³ Final consumption expenditure of households is structurally important in the volume of GDP. In 2015 its share amounted to 60.47%.⁴ The impact of shocks in the business climate and economic activity on the business cycle of the final consumption expenditure of households is modelled by vector autoregressive models (VAR).

1.2. Macroeconomic indicators of business climate and economic activity

The choice of macro indicators is an important milestone in the study of business cycles. **First**, business climate and economic activity indicators are chosen according to three selection criteria. They are: economic logic, cyclic behaviour, frequency and period of publication. **Second**, business climate and economic activity indicators are classified as pro-cyclical, counter-cyclical and non-cyclical according to their change in the business cycle.⁵ **Third**, based on the time period that is being measured, business cycle indicators are classified as leading, lagging and coincident.⁶ **Fourth**, business climate is the environment which creates conditions for the production and consumption of goods and services. Their changes affect economic activity and are expressed in growth or decline of the economic activity indicators. These fluctuations are shocks. They influence the business cycle of final consumption expenditure of households. In Eurostat, business climate is observed by 16 qualitative variables defined by consumers.⁷ They include consumer expectations related to the final consumption expenditures of households for the next 12 months. Information is collected through opinion polls.⁸ Of these, the following macro indicators are chosen: 1) expectations about the financial situation of households over the next 12 months (EFS); 2) inflation expectations for the next 12 months (IE); 3) expectations for unemployment in the next 12 months (UE) and 4) consumer expectations in terms of savings over the next 12 months (ECS). The four variables determine the expectations for

³ Radilov, D. Ikonicheska statistika. Nauka i ekonomika, 2013, s. 154, 158-159.

⁴ <http://nsi.bg/bg/content/2212/bvp-%3F-razhodi-za-krayno-potreblenie-natsional-no-nivo>.

⁵ Use of Macro Accounts in Policy Analysis (2002), Department of Economic and Social Affairs, Statistics Division, United Nations, New York, p. 228.

⁶ Zarnowitz, V. (1993) Business Cycles, Indicators and Forecasting. University of Chicago Press, 1993, p. 283.

⁷ <http://ec.europa.eu/eurostat/data/database> European and national indicators for short-term analysis

⁸ The Joint Harmonised EU Programme of Business and Consumer Surveys, User Guide, 21 March 2014, pp. 11-15.

future trends in consumption of households and directly affect the business cycle of their final consumption. The business climate, as noted, is crucial for the environment in which production and consumption arise, whereas the indicators of economic activity express the subsequent amendments therein. Time coordination is an important condition for the indicators of economic activity. According to it, they are leading, approximately coincident and lagging. When choosing indicators of economic activity, we can use their classification in the national accounts that are linked to business activity.⁹ The total number of indicators is 52. We choose 4, which are directly related to the business cycle of final consumption expenditure of households. These are: 1) the level of employment (LE); 2) the turnover index in retail trade (TIRT); 3) Value Added Tax (VAT) and 4) social benefits (SB). The data for these indicators in Bulgaria and selected countries are taken from Eurostat. All time series made up of indicators for business climate and economic activity are quarterly and seasonally adjusted, according to practice accepted by Eurostat.¹⁰

1.3. Econometric modelling of shocks in the business cycles of final consumption expenditure of households by using VAR - models

The study uses universal models that have no requirements for the properties of endogenous variables (unrestricted VAR models).¹¹ The indicators of business climate and economic system are endogenous with respect to the cyclicity of final consumption.

$$(1) y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t,$$

where:

y_t - equations based on the number of variables in the model;

A_i - matrix of size (K x K) of VAR model coefficients;

u_t - matrix of the residual components of the equations.

Once we choose how many variables will compile VAR models, it is necessary to decide to which lag they will be included. When examining the cyclicity of final consumption, we will rely on the theoretical concept that the current levels of consumption are also influenced by its values from pre-

⁹ Use of Macro Accounts in Policy Analysis (2002), Department of Economic and Social Affairs, Statistics Division, United Nations, New York, p. 226 - 229.

¹⁰ <http://ec.europa.eu/eurostat/data/database/> Economy and finance

¹¹ Hansen, Br. (2010) Econometrics. University of Wisconsin, p. 174.

vious periods. The choice of lag is based on the information criteria of Akaike (AIC) and Schwarz (SC).¹²

$$(2) AIC(m) = \log \det(\tilde{\sum} u(m)) + \frac{2}{T} mK^2$$

$$(3) SC(m) = \log \det(\tilde{\sum} u(m)) + \frac{\log T}{T} mK^2$$

After selecting the lag, the constructed VAR-models are checked for stability.¹³ While checking the stability of the VAR - model, it transforms into autoregressive model of first order and is decided as a template. The resulting "roots" are checked with respect to whether they are stationary or mobile.

The parameters of vector autoregressive models are estimated by least squares (OLS). The application of this method requires meeting the following conditions:

- 1) residual components (u_t) in each vector autoregressive model should not be autocorrelated;
- 2) in residual components heteroskedasticity should not be observed;
- 3) residual components should be normally distributed;
- 4) there shouldn't be multicollinearity between the independent variables in the model.¹⁴

The interpretation of the parameters of vector autoregressive models poses significant difficulties. To facilitate the process, the impulse responses (IRs) functions are used. The impulse responses function gives us information about how the "shock" caused by one standard deviation (or a change by unit) would affect the current or future values of each variable in the VAR- models.¹⁵

2. Empirical results

The empirical results for the impact of shocks in the business climate and economic activity on the business cycles of final consumption expenditure of households include: 1) Bulgaria; 2) selected countries of Central and Eastern Europe.

¹² **Lutkepohl, H. and M. Kratzig** (2004). Applied Time Series Econometrics. Cambridge University Press, p. 110-112.

¹³ Ibid. p.88.

¹⁴ **Radilov, D.** i dr. (2010) Statistika. Nauka i iekonomika, Ikonomicheski universitet – Varna, s. 240-245.

¹⁵ **Gujarati, D.** (2004) Basic Econometrics. Fourth Edition, The McGraw-Hill Companies, pp. 854-854.

2.1. The impact of shocks in the business climate and economic activity on the business cycle of the final consumption expenditure of households in Bulgaria

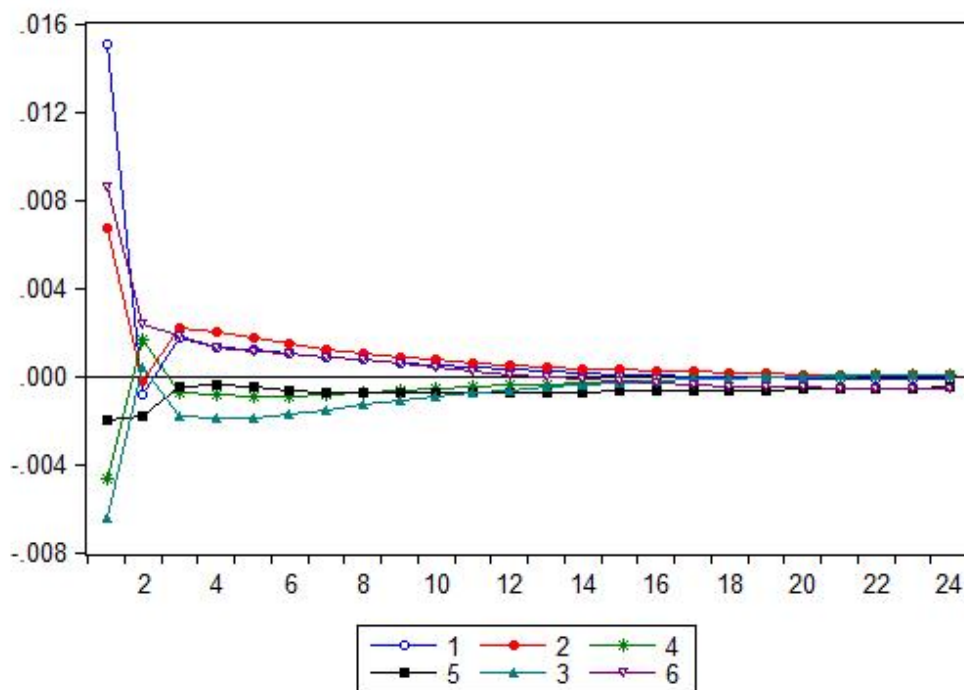
In Bulgaria, vector autoregressive models will be built to study the shocks in the indicators of business climate and economic activity and their impact on the business cycle of final consumption expenditure of households. Each of the VAR - models has been tested for stability and autocorrelation, as well as heteroskedasticity and normality in the residuals (Table 1)

Table 1. Characteristics of VAR - models

Business cycles in the final consumption expenditure of households	Variables included		Lag	Stability test of the VAR-model	Tests for the residuals of VAR - models		
	Business climate	Economic activity			For heteroskedasticity	For normality	For autocorrelation
Bulgaria	EFS; ECS; UE; IE	LE	1	Yes	No	Yes	No
Czech republic	EFS; ECS; UE; IE	TIRT; VAT; SB	1	Yes	No	Yes	No
Hungary	EFS; ECS; UE; IE	SB; TIRT	1	Yes	No	Yes	No
Poland	EFS; ECS; UE; IE	LE	1	Yes	No	Yes	No
Romania	EFS; ECS; UE	TIRT; LE	1	Yes	No	Yes	No
Slovakia	ECS; UE	TIRT; VAT; LE	1	Yes	No	Yes	No

We will look at the impulse responses (IRs) for the VAR - model built for Bulgaria. It includes four variables drawn from data about the business climate: 1) expectations about the financial situation of households over the next 12 months; 2) inflation expectations for the next 12 months; 3) expectations for unemployment in the next 12 months and 4) consumer expectations in terms of savings over the next 12 months. Of all the indicators of economic activity, we have included only the level of employment.

Figure 1. Impulse response function (RI) for the business cycle of the final consumption expenditure of households in Bulgaria (1-TIRT, 2-EFS, 3-UE, 4-IE, 5-ECS, 6-LE)



The interpretation of impulse responses for Bulgaria will be carried out in three stages: **First**, examining how shocks in the final consumption of households influence the business cycle; **Second**, examining how shocks in the indicators of business climate affect the business cycle; **Third**, examining the impact of shocks in the indicators of economic activity on the business cycle.

An object of interest is the impulse response of the business cycle caused by shock in the final consumption expenditure of households in Bulgaria. By definition, this indicator always takes a certain minimum level called autonomous, under which it cannot be lowered. Therefore, we can say with good reason that current consumption depends on its level from previous periods. The shock in the final consumption expenditure of households will reach maximum value as early as the next quarter. After another quarter the effect of it will completely disappear (Fig. 1). Then another increase will follow which will reach its peak for one quarter and will gradually decrease, until it disappears completely in the 14th quarter.

A second phase will examine the shocks in the indicators of business climate that have been included in VAR - models and their impact on the business cycle. Consumer expectations in Bulgaria can be optimistic or pessimistic. In this case, the shock is assumed to reflect the rise, or optimism among consumers. The positive expectations for the financial situation of households boost their consumption. The shock on the business cycle is felt as early as the first quarter after its manifestation. Repeated peak is recorded during the third quarter. It decreases gradually and completely subsides in 16th quarter. The other three indicators of business climate have a negative impact on the business cycle of the final consumption expenditure of households in Bulgaria.

The jump in unemployment expectations leads to a decline in the business cycle. It is felt even in the first quarter. This negative effect disappears in the second quarter, when is followed by a new downturn. It deepens until about the sixth quarter after the manifestation of shock.

Inflation expectations and the expectations for the savings of households in Bulgaria over the next 12 months show that their rise adversely affects the business cycle. That impact is felt just in the first quarter after the manifestation of shock. With the inflation expectations the effect is strong, but with the expectations for savings the shock causes little effect. With the first it calms down until about the 14th quarter, while with the latter it is still felt even after the 24th quarter.

Consumer expectations in Bulgaria influence the business cycle. The greatest effect of their attitudes is observed as early as the first quarter, when the strongest peak occurs. This effect decreases with time, but continues to be felt after 14 quarters after its manifestation.

When measuring the impulse response of the shock in the level of employment on the business cycle of final consumption expenditure of households in Bulgaria, we recognize that it manifests itself most strongly as early as in the first quarter. In the second quarter the effect of it decreases and disappears completely in 12th quarter.

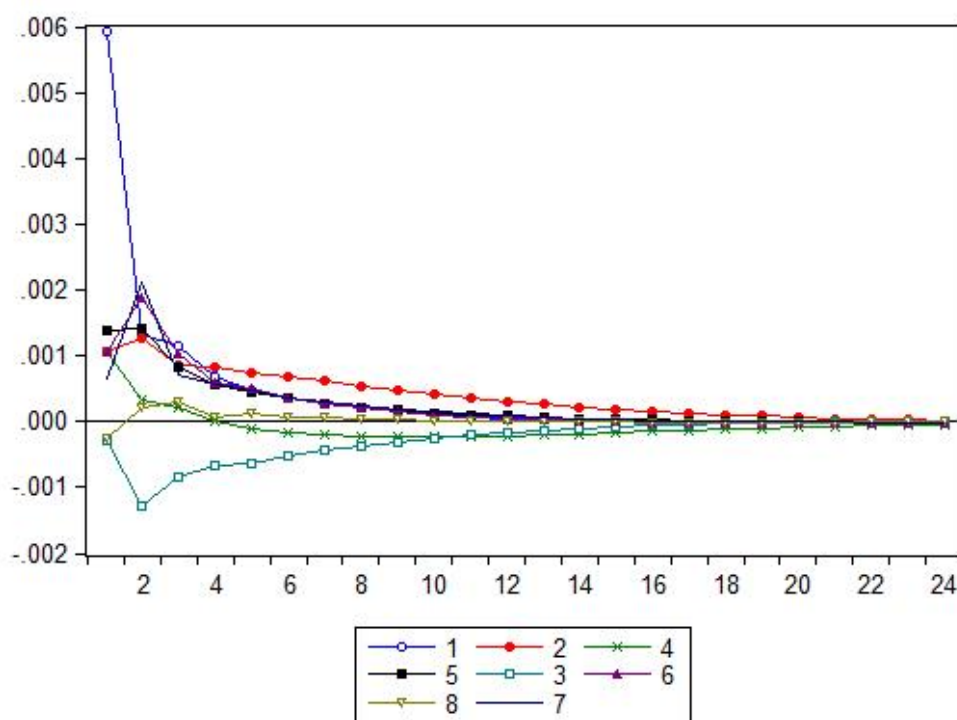
2.2. The impact of shocks in the business climate and economic activity on the business cycle of final consumption in selected countries of Central and Eastern Europe

Vector autoregressive models have been built for the countries of Central and Eastern Europe to study the impact of shocks in the indicators of business climate and economic activity on the business cycle of final consumption expenditure of households in these countries.

The shock of final consumption expenditure of households in the Czech Republic has the greatest impact on the business cycle. It manifests itself in the first quarter and rises dramatically until about the 6th quarter. Then the effect of this shock begins to decline and disappears completely in the 14th quarter.

The indicators of business climate give a moderate impact by their shocks on the business cycle (Fig. 2). Unlike Bulgaria, however, only the expectations for unemployment have a negative effect. The peak with them occurs during the second quarter, then it gradually subsides and disappears completely in the 14th quarter.

Figure 2. Impulse response function for the business cycle of the final consumption expenditure of households in the Czech Republic
(1- FCH, 2-EFS, 3-UE, 4-IE, 5-ECS, 6-TIRT, 7-VAT, 8-SB)



The expectations about the financial position of households have a positive effect on the course of the business cycle in the Czech Republic. The peak due to the shock reaches its maximum in the second quarter and subsides relatively slowly, until it disappears completely in the 18th quarter. The reaction of the business cycle of final consumption of households in the Czech

Republic is interesting, under the influence of shocks in inflation expectations and the expectations for savings. The effect of the shock in inflation expectations is relatively weak. It reaches its peak in the first quarter, its influence being completely exhausted in the fourth quarter. Then a slight negative effect on the business cycle follows. It continues until 14th quarter. Inflation expectations of the households in the Czech Republic differ in their manifestation from those in Bulgaria. This is due to the different effect which a rise in prices has in both countries. In Bulgaria the households are relatively poorer. The minimum price increase is a signal for them to cut their consumption. At the opposite spectrum are the households in the Czech Republic. The higher income and better business environment affect positively the business cycle. The positive consumer sentiment offsets for a brief moment of time the negative impact of rising prices.

The shock in expectations about household savings has a positive effect on the business cycle of the final consumption expenditure of households in the Czech Republic. The peak lasts two quarters and then gradually disappears by the 14th quarter. The expectations for savings, and inflation expectations of consumers in the Czech Republic, give a positive impact on the business cycle.

The shocks in the indicators of economic activity in the Czech Republic are the most powerful concerning the turnover index in retail trade and value added tax. They reach a peak in the second quarter, then its manifestation slowly disappears by the 14th quarter. The shock in social benefits has a minimal effect on the business cycle in the Czech Republic. It appears in the third quarter and subsides in the fourth quarter after its manifestation.

A summary of the results of shock effects in the indicators of business climate and economic activity over the business cycle of the final consumption of households in the Czech Republic shows that they largely have a positive impact.

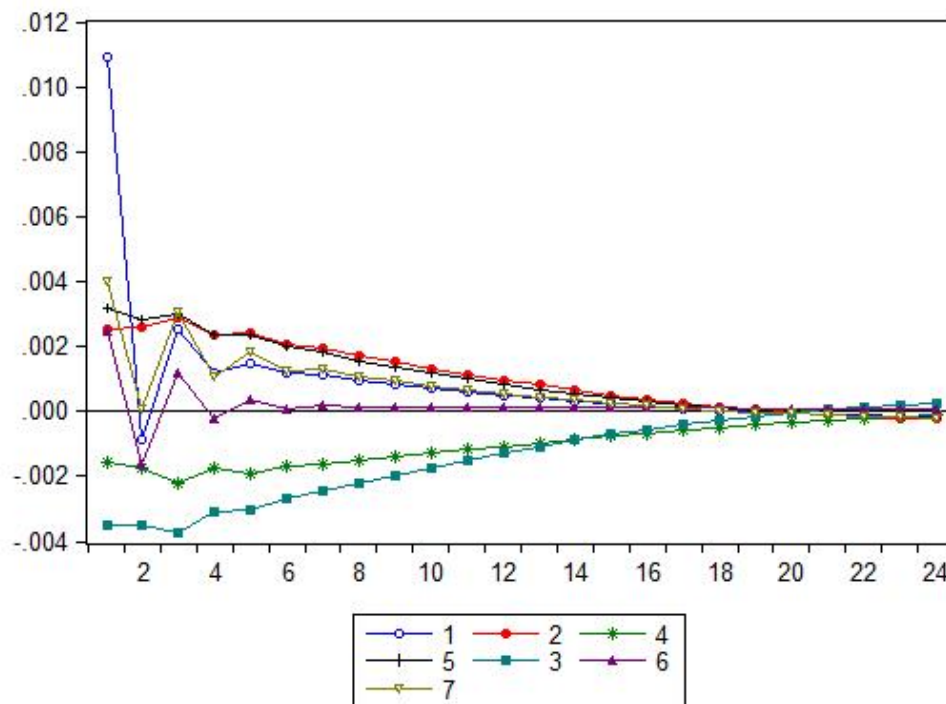
It also becomes clear upon examination of the shocks in the indicators of business climate and economic activity over the business cycle of the final consumption of households in Hungary that a part of the revealed trends coincide (Fig. 3). The business cycle is most strongly influenced by the shocks in the final consumption of households. The shock occurs most dramatically as early as the first quarter and then declines rapidly and is followed by a second peak in the third quarter.

The peak of shocks in the indicators of business climate is considered to occur in the third quarter, with the effect disappearing in the 20th quarter.

The shocks in the expectations for financial situation and household savings have a positive effect on the business cycle whereas the expectations

for unemployment and inflation expectations of households affect it negatively.

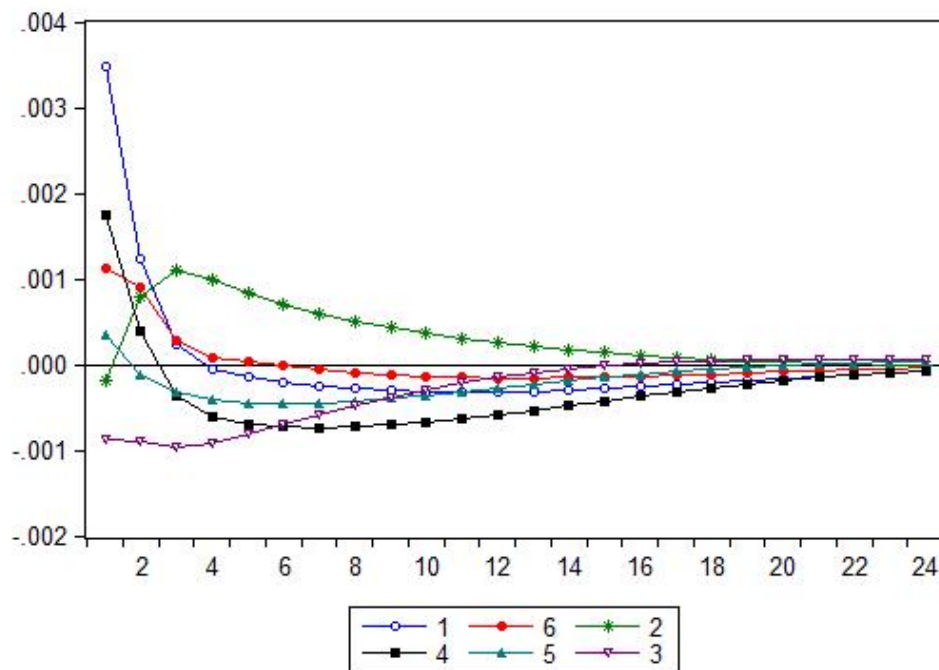
Figure 3. Impulse response function for the business cycle of the final consumption expenditure of households in Hungary (1-FCH, 2-EFS, 3-UE, 4-IE, 5-ECS, 6-TIRT, 7-SB)



The shocks in the indicators of business climate vary in Hungary and the Czech Republic, which are economically better developed compared to Bulgaria. Only the expectations about financial situation of households shows a positive effect and stimulate the business cycle.

The shocks in the indicators of economic activity for Hungary show the greatest impact in the first quarter. The influence of index turnover in retail trade disappears completely after the sixth quarter. With the social benefits, a second peak is observed in the third quarter, and its impact on the business cycle continues until the 18th quarter. All shocks in the indicators of business climate and economic activity in Hungary affect the business cycle as early as the first quarter.

Figure 4. Impulse response function for the business cycle of the final consumption expenditure of households in Poland (1-FCH, 2-EFS, 3-UE, 4-IE, 5-ECS, 6-LE)

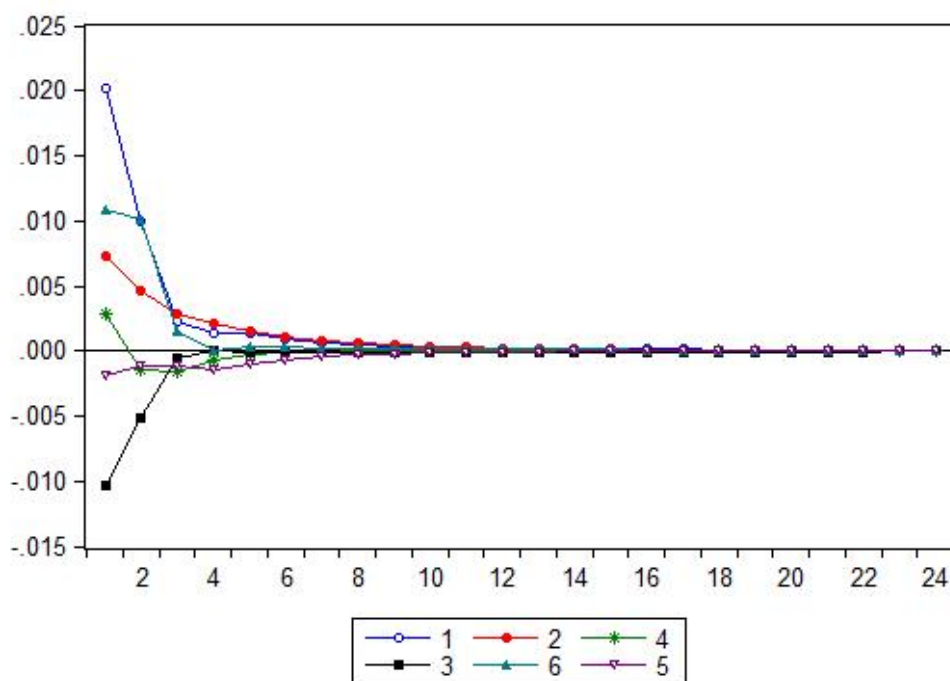


The study of the impulse response for Poland (Fig. 4) shows that the strongest effect of shocks in the final consumption expenditure of households is observed on the business cycle. The peak is reached in the first quarter and its positive impact disappears in the fourth quarter. As far as the shocks in indicators of business climate are concerned, the indicator for the expected financial situation of households shows the most positive impact. Compared to Bulgaria, its effect is felt after the first quarter and reaches its maximum in the 3rd. Then it decreases and disappears completely in the twentieth quarter. A shock in the indicator of expectations for unemployment has adverse effects on the business cycle. Its peak is reached in the third quarter and in the 15th quarter it completely subsides. The other two indicators of inflation expectations and expectations for the savings of households in Poland have parallel manifestation. The shocks in them have a positive effect on the business cycle as early as in the first quarter. Then there is a decline, which is felt in the second quarter. The peak with regard to the inflation expectations is reached in the 6th quarter and that for the expectations for household savings - in the fifth quarter. The business cycle of the individual final consumption expendi-

ture of households in Poland is affected by the indicators of business climate. The shocks in the expectations for unemployment and financial situation of households give rise to certain movements in the business cycle that can be foreseen. The shock in the indicator for the level of employment in Poland has a strong influence on the business cycle of the individual final consumption expenditure of households as early as the first quarter. This peak decreases quickly and disappears in the sixth quarter.

The indicators of business climate over the business cycle have long-term effects compared to the indicators of economic activity. This trend has been observed in all countries reviewed.

Figure 5. Impulse response function for the business cycle of the final consumption expenditure of households in Romania (1-FCH, 2-EFS, 3-UE, 4-ECS, 5-LE, 6-ITRT)

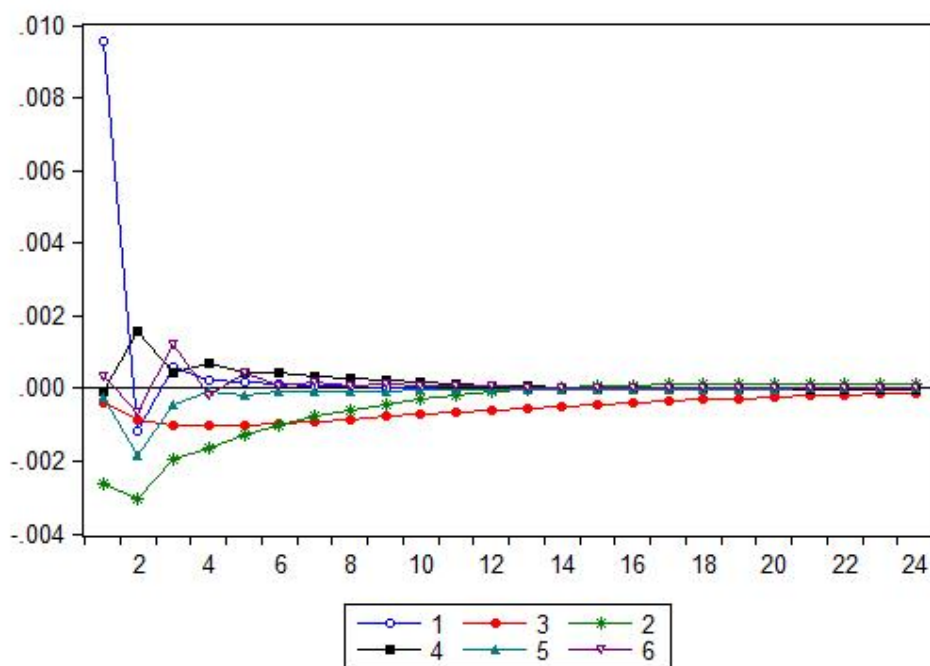


The shocks in the indicators of business climate and economic activity have the least impact on the business cycle of the final consumption expenditure of households in Romania (Fig. 5). Respectively, the level of consumption in previous periods has the strongest influence on the business cycle.

The business climate indicators, unlike those in other countries have little influence on the business cycle. The shocks in them have an effect in the

first quarter which disappears fairly quickly. There are some interesting peculiarities with regards to the indicators of economic activity. They reach the highest peak in the first quarter after its manifestation. In relation to the employment level we can say that the shock does not have a significantly effect and quickly subsides. In comparison, the turnover index in retail trade has a stronger effect, which reaches a peak as early as the third quarter.

Figure 6. Impulse response function for the business cycle of the final consumption expenditure of households in Slovakia (1-FCH, 2-UE, 3-ECS, 4-LE, 5-ITRT, 6-VAT)



It can be concluded, after the analysis of the impulse response function that the level of household consumption from previous periods has the greatest effect on the business cycle. This observation has also been confirmed for Slovakia (Fig. 6). The peak occurring as early as the first quarter is very strong. It disappears after the seventh quarter. The shocks in the indicators of business climate have a negative effect on the business cycle. The reason for this is the registered decline in unemployment expectations and the expectations for household savings.

The shocks in economic activity indicators in Slovakia have little impact on the business cycle. They reach a peak in the second quarter, but then quickly return to its original level.

Conclusion

The features of the impact caused by shocks in the business climate and economic activity on business cycles in the individual final consumption expenditure of households in Bulgaria and other countries of Central and Eastern Europe can be summarized as follows:

First, the shocks in the individual final consumption of households from previous periods have the strongest effect on the business cycle. The sharp increases in their levels have a favourable impact in future periods. These processes are explained by the inertia in the economy. The shock impact on the business cycle for Bulgaria and for all comparable countries reaches its peak as early as the first quarter. There are differences in the duration of their influence on the business cycle. In Bulgaria, the Czech Republic and Hungary the shock continues to operate until about the 14th quarter after its manifestation. In Romania, the effect of shocks disappears after the eighth quarter, and in Slovakia - in the second quarter. In Poland, the shock in the individual final consumption does not affect the business cycle after the fourth quarter.

Second, of all indicators of business climate, only the shock in expectations for the financial situation of households over the next 12 months shows a positive effect on the business cycle in Bulgaria and the countries of Central and Eastern Europe. Income is the main determinant that determines when and how much the households will consume. The expectations regarding the improvement of their financial condition, signal that households are willing to increase their consumption. This positive effect of the shock occurs for all countries reviewed. For Bulgaria and Romania, the shock of the expected financial situation of households reaches its peak in the first quarter; for the Czech Republic - in the second quarter, and for Hungary and Poland - only in the third quarter. The impact of this shock vanishes for all countries in about 16-18 quarters.

Third, of all the shocks in the economic activity indicators, only the level of employment has a positive effect on the business cycle. It is a major determinant that affects the business cycle in Bulgaria, Poland and Slovakia. The peak in Bulgaria and Poland is reached in the 1st quarter, while in Slovakia - in the second quarter. The effect of shock in the indicator lasts until the

12-14th quarter for all countries, and only for Poland it disappears after the 6th quarter.

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- JEL classification of publications on economic topics (<http://ideas.repec.org/j/index.html>);
- main body (main text);
- tables, graphs and figures are software inserted in the text (they should allow linguistic corrections and translation in English). Numbers and text in them should be written with font Times New Roman 12 pt;
- formulas are inserted with Equation Editor;

5. Rules for footnote citations: When citing, meet the requirements of BDS 17377-96 Bibliographic Citations shown here:

<http://www.uni-svishtov.bg/dialog/Bibl.%20Citirane.pdf>.

Each author is responsible for promoting ideas, content and technical layout of the text.

6. Manuscripts of lecturers without an academic rank should be accompanied by a transcript of the minutes of the Department meeting at which the proposed paper was discussed.

Authors of papers published in Narodnostopanski arhiv journal are responsible for the authenticity of the materials.

From the Editorial Board