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THE IMPACT OF EXTERNAL PUBLIC DEBT ON THE NATIONAL ECONOMY'S KEY MACROECONOMIC INDICATORS (CASE OF UKRAINE)

Abstract. The paper empirically explores the impact of external public debt in Ukraine on key macroeconomic indicators such as real GDP growth, real effective exchange rate, and current account balance. The problem of increasing external debt affects not only the problems of balance of payments fluctuations but also economic security and economic growth. We have tested the hypotheses regarding the impact of Ukraine's external public debt on these indicators in the short and long run. As an empirical tool for hypotheses testing vector autoregression models (VaR models) have been chosen. The results of constructed models show the acceleration of the external public debt growth provokes the GDP growth rate to fall with subsequent macrostabilization. The reaction of the GDP growth rate to the shock of the real effective exchange rate is more noticeable. The shock of real effective exchange rate has led to increase in external public debt with a further dampening to zero.Empirical data from the VaR model confirm that external debt has a negative impact on GDP and essentially behaves similarly to the shock of REER strengthening. Research results confirm the relationship between external public debt, real effective exchange rate, and GDP growth in Ukraine. Based on the models it was analyzed the external public debt and real effective exchange rate shocks influence the real gross domestic product growth rate. The growth of external public debt leads to the GDP growth rate fall by 1% during a year and a half with subsequent stabilization in the future. GDP growth fluctuations are explained mainly by their own fluctuations while external public debt is accounting for 2,5—8% of its fluctuations. Fluctuations in external public debt of 7—10% are explained by current account fluctuations in Ukraine. The described results of the model correspond to the concept of dependent economy.

Keywords: public debt, GDP, balance of payment, fluctuation, exchange rate.
JEL Classification E31, E47, E52, F43, F62
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ВПЛИВ ЗОВНІШНЬОГО ДЕРЖАВНОГО БОРГУ НА ОСНОВНІ МАКРОЕКОНОМІЧНІ ПОКАЗНИКИ НАЦІОНАЛЬНОЇ ЕКОНОМІКИ (ПРИКЛАД УКРАЇНИ)

Анотація. Емпірично підтверджено вплив зовнішнього державного боргу України на ключові макроекономічні показники, серед яких: зростання реального ВВП, реальний ефективний обмінний курс, баланс поточного рахунку. Збільшення зовнішнього боргу зачіпає не лише проблеми коливання платіжного балансу, а й економічну безпеку та економічне зростання. Перевірені гіпотези щодо впливу зовнішнього державного боргу на макроекономічні показники як у коротко-, так і довгостроковому періодах. Емпіричним інструментом для тестування гіпотез обрано модель векторної авторегресії (VaR-модель). Результати отриманих моделей вказують на те, що присокрення зростання зовнішнього державного боргу провокує зниження темпів зростання ВВП із подальшою макростабілізацією. Реакція темпів зростання ВВП на шок реального ефективного обмінного курсу є більш помітною. Шок реального ефективного обмінного курсу призвів до збільшення зовнішнього державного боргу з подальшим зниженням до нуля. Емпіричні дані VaR-моделі підтверджують, що зовнішній борг негативно впливає на ВВП і, по суті, поводиться аналогічно до шоку зміцнення REER. Результати досліджень підтверджують зв'язок між зовнішнім державним боргом, реальним ефективним обмінним курсом і зростанням ВВП в Україні. На основі моделей проаналізовано вплив зовнішнього державного боргу, реальних ефективних валютних курсів на реальний темп приросту ВВП. Зростання зовнішнього державного боргу призводить до зниження темпів зростання ВВП на 1 % протягом півтора року з подальшою стабілізацією в майбутньому.Динаміка зростання ВВП пояснюються переважно внутрішніми чинниками, тоді як вплив зовнішнього державного боргу оцінюється на рівні 2,5—8% коливань ВВП. Динаміка зовнішнього державного боргу на рівні 7—10% зумовлена коливаннями поточного рахунку національної економіки. Описані результати моделі відповідають концепції залежної економіки, яка притаманна Україні.

Ключові слова: державний борг, ВВП, платіжний баланс, коливання, обмінний курс.
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Introduction. The impact of public debt on public finance's sustainability and the country's economic development is one of the most researched problems in debt finance around the world. However, each country, accumulating debts, guides its own political and economic goals. Thus, the cases of individual countries in the debt policy are mostly unique and those that require special research.

General problems overview. The phenomenon of external public debt is an interesting issue to research because of two main reasons:

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1. External borrowing can increase a country's access to resources, so and external debt generates the «transfer» problem. The «transfer» problem refers to the possibility that a debtor country might end up better off after making payments to its creditor countries [1].

2. External borrowing is usually associated with vulnerabilities that may lead to debt crises [2]. In the third quarter of 2019, the ratio of global debt to gross domestic product hit an all-time high of over 322 %, with total debt reaching close to $253 trillion [3].

In this paper, the hypotheses regarding the impact of the external public debt of Ukraine on key macroeconomic indicators such as real GDP growth, real effective exchange rate of hryvnia to US dollar ($) and current account balance in the short and long run have been tested.

Literature review. The theoretical background of the paper appertains on classical approaches of public debt [4—7]. The highly rapid accumulation of public debt in the world economy during the last 30 years [8—10], has increased the need for a deeper evaluation of government debt impact.

The key reasons why emerging countries amass external debt are lack of savings, low levels of investment, low public revenue, balanced budget deficit [11—13]. But there are a lot of constraints for the accumulation of the public debt [14]: 1) a decrease in national savings as private saving rises by less than public saving falls, with a smaller domestic capital stock and lower output and income in the long run; 2) reduction in the average real wage and total labour income due to lower labour productivity; 3) worsening of the current account; 4) an increase in the long-run interest rate; 5) acceleration of inflation, 6) the deadweight loss of the taxes needed to service the debt; 7) reduction in the fiscal flexibility of the government; 8) stronger vulnerability to a crisis of international confidence.

Well-known researchers in public debt [7; 15; 16] argue that the long-term secular costs of high debt need to be weighed against the short-term expediency of Keynesian fiscal stimulus [1]. But several studies report that median GDP growth rates are not dramatically different from the level of public debt/GDP ratios [17; 18].

Some researchers discuss the EU experience of the external debt crisis and the U.S. public debt crisis [15; 19; 20; 46], while other ones focus attention on the experience of emerging economies [21; 22; 23; 24]. Empirical studies for low- and middle-income countries are less favorable for the growth effects of debt accumulation, regardless of the discussion on debt thresholds [25; 26].

The country's ability to accumulate the necessary funds in foreign currency to repay the external debt and to service it is a decisive factor of the external stability of the economy that is not directly related to economic growth [27]. If the country's external debt is not denominated in the national currency, the source of accumulation of these funds only is a current account surplus.However, it should not be forgotten that in terms of identifying external or economic instability, it is important to focus on external borrowing — investment or consumption. In particular, the consumption of external debt for consumption signals the presence of volatile trends in the economy [28].

All the drama and problems of accumulating public debt for a long period had most clearly reflected in the case of emerging economies [29; 30; 31; 32; 33; 34]. However, the global pandemic [35] and its foreseeable effects suggest that the debt crisis is affecting all economies without exception, especially in times of turbulence.

This study is also based on the works of well-known Ukrainian scientists who study the impact of public debt on various indicators of socio-economic development [14; 21; 22; 23; 36; 37; 38]. The use of VAR models in the process of macroeconomic modeling is based on the works [39; 40; 41].

Interpreting the external stability of the economy from the standpoint of solvency, we note that the ability of the economy to pay and service its debt on time can be assessed by interim restriction, which provides sufficient discounted value of the primary current account balance to repay and service the debt that will be the subject for future research.

Research methodology. External debt, GDP, and real effective exchange rate (REER) are directly and indirectly related. Therefore, the definition of causality is especially important. The

growth of external debt may be a consequence of the GDP's slowdown in the previous periods, the accumulation of balance of payment's deficits caused by the strengthening of the real effective exchange rate (REER). Also, external debt increases internal absorption, which degrades the balance of payments and strengthens the REER. Identifying the role of external debt in these linkages is important, because the more institutionally weak the public sector, the more likely that unproductive increases in absorption will result in subsequent external weakness.

The purpose of the paper is to explore empirically the impact of external public debt in Ukraine on key macroeconomic indicators such as the growth rate of Ukraine's real GDP, the real effective exchange rate of hryvna to dollar and current account balance.

To do this, it is necessary to test the hypotheses regarding the impact of Ukraine's external public debt on these indicators in the short and long run. Considering the importance of the interdependence of Ukraine's external public debt and current account balance, the reverse impact of these indicators should be explored.

As an empirical tool for testing hypotheses, it is necessary to choose vector autoregression models to appropriately test the influence of variables in the short and long run (Chernyak et al., 2014).

Thus, the following indicators were selected to testify the impact of external public debt on Ukraine's major macroeconomic indicators:

1. GDP_REAL_SA — real GDP growth, %;
2. DEBT_SA — external public debt growth, %;
3. DEBT_GDP_SA — ratio of external public debt to GDP, %;
4. REER_SA — real effective exchange rate of hryvna to US dollar;
5. CA_SA — ratio of current account balance to GDP, %.

Debt indicators have been chosen based on International Monetary Fund and International Organization of Supreme Audit Institutions recommendations.

Quarterly data for the period from the first quarter of 1996 to the second quarter of 2019 from International Financial Statistics and Balance of Payments databases of International Monetary Fund has been used for the simulations. Also, it should be noted that model variables have been used in logarithms.

Research findings. Therefore, to testify the impact of external public debt on GDP growth in Ukraine, the following vector autoregression model of second order has been constructed as model variables appeared to be stationary:

$$\begin{aligned} 1)\quad & GDP\_REAL\_SA = 1.28213777406^{*}GDP\_REAL\_SA(-1) - \\ & - 0.558789455875^{*}GDP\_REAL\_SA(-2) - 0.587319275808586^{*}DEBT\_SA(-1) + \\ & + 0.32172158728983^{*}DEBT\_SA(-2) + 2.92831254747; \end{aligned} \quad (1)$$

$$\begin{aligned} 2)\quad & DEBT\_SA = 0.746912638^{*}GDP\_REAL\_SA(-1) - 0.8668353596^{*}GDP\_REAL\_SA(-2) + \\ & + 1.51559479139^{*}DEBT\_SA(-1) - 0.520347302657^{*}DEBT\_SA(-2) + 1659.55204974. \end{aligned} \quad (2)$$

The order of the constructed model has been determined based on analysis of the information criteria values, Schwartz, Akaike and Hannan-Quinn information criteria (*Table 1*).

Table 1

The values of information criteria

Endogenous variables: GDP_REAL_SA DEBT_SA, Exogenous variable: C			
Lag	AIC	SC	HQ
0	30.57320	30.66028	30.60390
1	24.39423	24.65546	24.48632
2	23.80636*	24.24174*	23.95985*
3	23.91179	24.52132	24.12668
* lag order chosen AIC — Akaikeinformation criteria, SC — Schwartz information criteria, HQ — Hannan-Quinn information criteria			

Source: compiled by the authors based on [10; 42—44].

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Analysis of external public debt shock impact on the real gross domestic product growth rate in Ukraine has made conclude acceleration of the external debt growth provokes the GDP growth rate to fall by 1% with subsequent stabilization (Fig. 1).

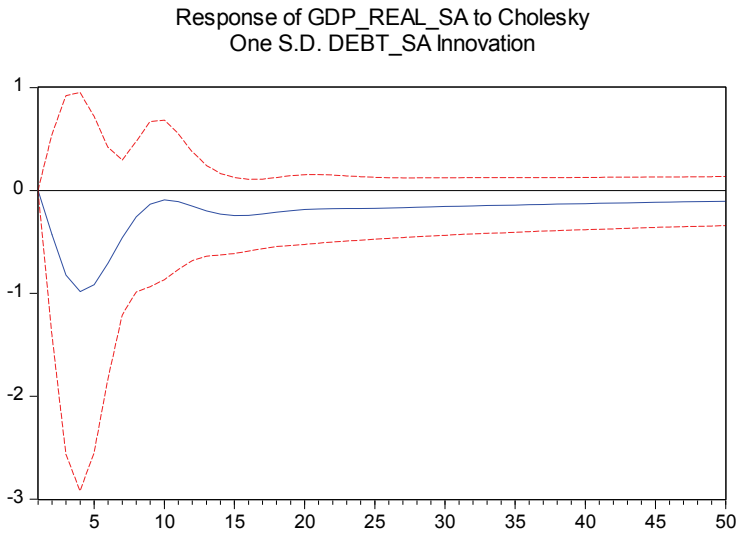

Fig. 1. **Dynamics of impulse response function of real GDP growth in Ukraine after the shock in external public debt**

Source: compiled by the authors based on [10; 42—44]

Moreover, the fluctuations of real GDP growth are mainly explained by its own fluctuations with external public debt accounting for 2.5% to almost 8% (*Table 2*).

Table 2

Variance Decomposition of real GDP growth in Ukraine

Period	Standard Error	GDP_REAL_SA	DEBT_SA
1	3.410626	94.12645	5.873551
2	5.478098	96.46316	3.536841
3	6.502905	97.48822	2.511781
4	6.821784	97.14601	2.853988
5	6.888014	95.76715	4.232845
6	6.969336	94.28232	5.717677
7	7.093934	93.37381	6.626189
8	7.198195	93.00617	6.993833
9	7.250901	92.88935	7.110648
10	7.265970	92.84277	7.157228
…			
20	7.306948	92.03840	7.961601

Source: compiled by the authors based on [10; 42—44].

To test the robustness of the results the real effective exchange rate has been included in the VAR model:

1) GDP_REAL_SA = 0.817898997363*GDP_REAL_SA(-1) – 1.12190182244e-05*DEBT_SA(-1) – 0.15472901105*REER_SA(-1) + 17.1648270184; (3)

2) DEBT_SA = 149.436949421*GDP_REAL_SA(-1) + 1.00088120402*DEBT_SA(-1) + 124.590827416*REER_SA(-1) – 10408.5761704; (4)

3) REER_SA = 0.241336471346*GDP_REAL_SA(-1) – 4.91192099299e-06*DEBT_SA(-1) + 0.505827391789*REER_SA(-1) + 50.8642091209. (5)

The analysis of the impulse response functions has showed that the GDP response to the external public debt shock is like the previous model. However, it should be noted that the reaction of GDP to the shock of real effective exchange rate is also significant and similar to the shock of external government debt (*Fig. 2*). Moreover, the reaction of the GDP growth rate to the shock of the real effective exchange rate is more noticeable.

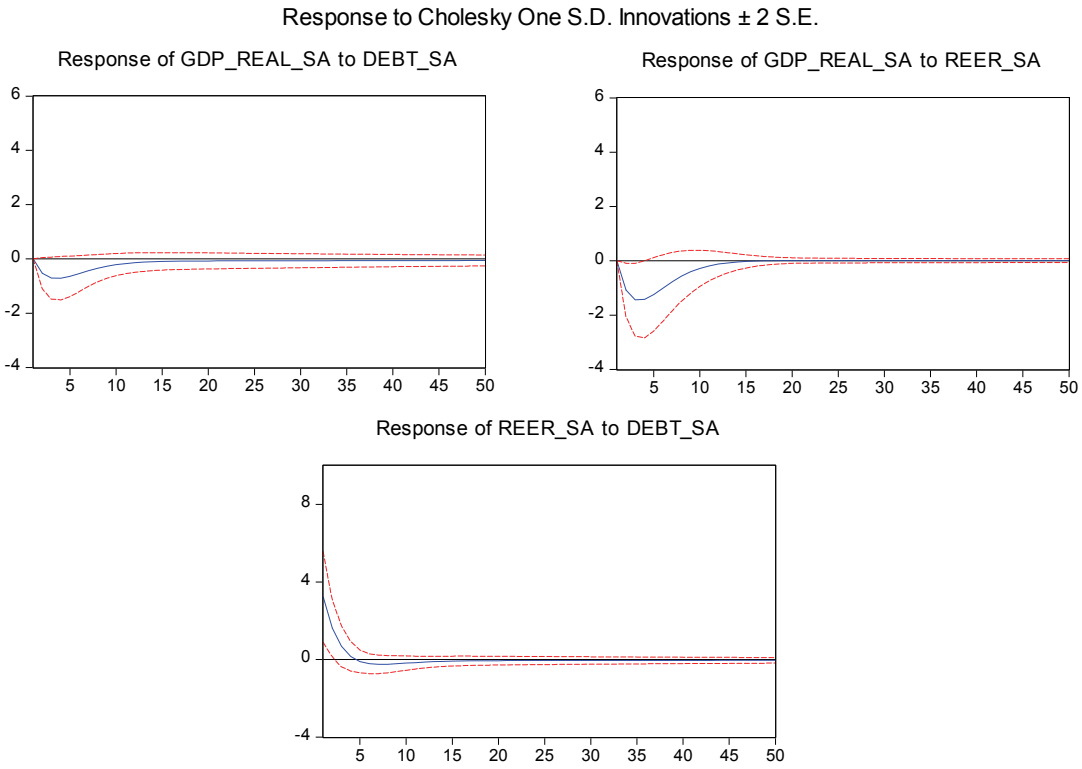

Fig.2. **Dynamics of impulse response functions of real GDP growth and real effective exchange rate in response to external public debt and real effective exchange rate shocks of Ukraine**

Source: compiled by the authors based on [10; 42—44].

The shock of real effective exchange rate, in turn, has led to increase in external public debt with a further dampening to zero since the fifth period.

The variance decomposition of real GDP growth in Ukraine indicates a significant effect of real effective exchange rate fluctuations on real GDP growth variance (*Table 3*).

Table 3

Variance Decomposition of real GDP growth in Ukraine for model including real effective exchange rate

Period	Standard Error	GDP_REAL_SA	DEBT_SA	REER_SA
1	3.850242	100.0000	0.000000	0.000000
2	5.063054	94.39045	1.074132	4.535415
3	5.789419	88.04427	2.325628	9.630100
4	6.229260	83.12677	3.335243	13.53798
5	6.484842	79.78670	4.059554	16.15374
6	6.626121	77.67946	4.551076	17.76947
7	6.700527	76.42162	4.873852	18.70452
8	6.738138	75.70543	5.081707	19.21286
9	6.756703	75.31411	5.214521	19.47137
10	6.765989	75.10772	5.299786	19.59249
11	6.771025	75.00207	5.355515	19.64242
12	6.774233	74.94935	5.393101	19.65755
13	6.776700	74.92373	5.419595	19.65668
14	6.778878	74.91170	5.439311	19.64899
15	6.780933	74.90643	5.454885	19.63869
16	6.782923	74.90447	5.467923	19.62761
17	6.784861	74.90411	5.479409	19.61648
18	6.786750	74.90450	5.489940	19.60556
19	6.788593	74.90520	5.499876	19.59492
20	6.790390	74.90600	5.509431	19.58457
…				
100	6.865697	74.92839	5.913482	19.15813

Source: compiled by the authors based on [10; 42—44].

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In the paper we have analysed the impact of external public debt on current account balance of Ukraine. It is known that the current account is one of the most important macroeconomic indicators in an open economy, as it reflects the effectiveness of macroeconomic policies pursued in the country and is the main source of information on the actions of economic agents and their expectations [22; 45].

Thus, a first-order vector autoregression model was constructed to analyse the impact external public debt on current account balance of Ukraine. The lag order has been determined based on Akaike, Schwartz, and Hannan-Quinn information criteria:

1) DEBT_GDP_SA_LN = 0.931532737448 · DEBT_GDP_SA_LN(-1) – 0.54383619893109 · CA_GDP_SA(-1) + 0.573282989142; (6)

2) CA_GDP_SA = -1.39908862312 · DEBT_GDP_SA_LN(-1) + 0.658250112992 · CA_GDP_SA(-1) + 7.25744250831. (7)

The analysis of impulse response functions has confirmed mutual influence of external public debt and current account balance in Ukraine (*Fig. 3*).

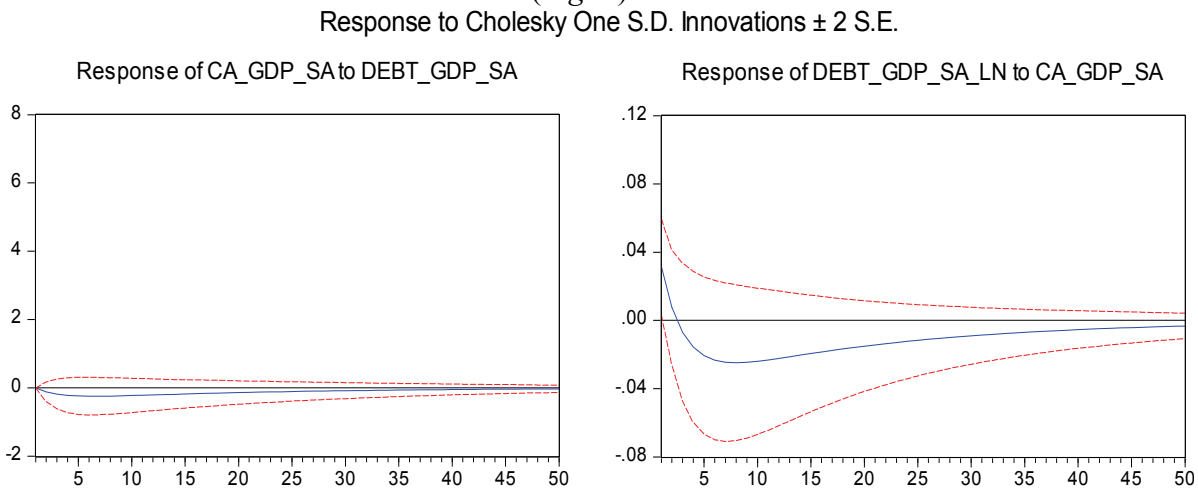

Fig. 3. **Dynamics of impulse response functions of external public debt and current account balance to the shocks in these variables**

Source: compiled by the authors based on [10; 42—44].

In addition, based on variance decomposition results fluctuations in external public debt in Ukraine are explained by current account fluctuations from 7 to 10% (*Table 4*).

Table 4

Variance decomposition of external public debt

Period	Standard Errors	DEBT_GDP_SA	CA_GDP_SA
1	0.087602	87.07060	12.92940
2	0.116327	92.22745	7.772550
3	0.136650	94.11416	5.885835
4	0.153071	94.26750	5.732500
5	0.166974	93.65167	6.348328
6	0.178956	92.77140	7.228601
7	0.189362	91.86214	8.137862
8	0.198442	91.02131	8.978694
9	0.206390	90.28077	9.719233
10	0.213367	89.64332	10.35668

Source: compiled by the authors based on [10; 42—44].

Discussion. The problem of acceptable public debt, as an indicator of economic stability and development, is relevant for any country. In Ukraine, the problem of increasing external public debt and its impact on the economy has become particularly urgent. Rising payments on external public and state-guaranteed debt and increasing internal uncertainty related to military, political, and

economic shocks raise questions about the appropriateness of external funds attraction and their possible impact on the country's key macroeconomic indicators.

In Ukraine, the difficulty is not only about the growth of external public debt and the irregularity of new debt revenues due to the delay in the implementation of the program with the IMF, but also about a decline in GDP growth.

In addition, we should note that public debt is not a negative economic phenomenon. However, there are certain threats related to the growth of public debt relevant both for developing and developed economies. Firstly, the growth of the country's external debt in crisis causes a deepening and lengthening the recession. Secondly, rising of the debt leads to the decline of the savings and a slowdown in investment growth (in particular, an outflow of investment capital is possible in case of the rapid growth of public debt). Given that capital investment prices are higher in poor countries than developed one, such a slowdown poses an additional threat to economic growth. Finally, it is an additional burden on the economy in future periods despite the direction of debt use.

Thus, the problem of increasing external debt affects not only the problems of balance of payments fluctuations but also economic security and economic growth. Research results confirm the relationship between external public debt, real effective exchange rate, and GDP growth in Ukraine. As we see, the growth of external public debt leads to the GDP growth rate fall by 1% during a year and a half with subsequent stabilization in the future.

The shock of the real effective exchange rate causes the fall of GDP growth rate almost to 2% in a five-year period. Moreover, external public debt rising leads to the real effective exchange rate increase up to 4%.

On the contrary, the shock in the external public debt ratio does not cause current account balance fluctuations significantly. However, there is a noticeable reverse effect. In turn, an increase in current account balance provokes a slight rise in the external public debt ratio.

In turn, constructed models might be used for other economies after choosing an appropriate lag order via information criteria and testing variables for unit root. In addition, based on these models it should be analyzed the external public debt and real effective exchange rate shocks influence the real gross domestic product growth rate. Besides this, the effect of external public debt on current account balance should be examined.

Conclusions. Based on the VAR model results we can make the following conclusions. Firstly, empirical data from the VAR model confirm that external debt has a negative impact on GDP and essentially behaves similarly to the shock of REER strengthening. This means that public sector expenditures financed through external debt have a negative impact on external sustainability. It follows that the best option for Ukraine's economy is fiscal consolidation and fiscal restraint. The importance of external resilience is due to the vulnerability of domestic investment to devaluations, as well as the fact that devaluations due to the transfer effect accelerate inflation. Thus, they do not help to compensate for the deterioration of the REER trajectory, but rather to strengthen it.

Secondly, external public debt increases lead to real GDP growth fall with subsequent stabilization. However, it should be noted that GDP growth response to the shock of the real effective exchange rate is also significant and like the shock of external public debt. Moreover, the reaction of GDP growth to the shock of real effective exchange rate is much more noticeable.

Thirdly, the shock of the real effective exchange rate has led to an increase in external public debt with further damping down to zero since the fifth period. Finally, it should be noted that GDP growth fluctuations are explained mainly by their own fluctuations while external public debt is accounting for 2.5—8% of its fluctuations.

In addition, fluctuations in external public debt of 7—10% are explained by current account fluctuations in Ukraine. The possibility of preventing the strengthening of REER stems from the need to adhere to price stability and fiscal balance, which will eliminate the preconditions for the negative impact of external debt on output. The described results of the model correspond to the concept of dependent economy.

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