

## APPLICATION OF VAR-MODELS FOR RESEARCH HOUSEHOLD LIQUIDITY EFFECT IN MONETARY TRANSMISSION

*Detailed research of monetary transmission mechanism in specific conditions of the Ukraine economy is still actual in the analysis of short-run impact of monetary policy on the real economy. Purpose of this research was to investigate the channel of monetary transmission, associated with household liquidity effect. The dynamics of the share of national currency deposits in liabilities of banking system causes the real output growth in short-run. Identified interrelations indicate the role of the banking system in formation of consumer demand.*

**Keywords:** transmission mechanism of monetary policy, effect of household liquidity, the vector autoregression (VAR) model.

In analyzing the short-term aspects of the impact of monetary policy on the real sector remains an actual issue detailed research of monetary transmission's mechanism in a particular national economy. Monetary policy has a quite complicated transmission mechanism, the character of which depends on the effectiveness of economic policy in general. The structure of the transmission mechanism consists of channels, which are the kind of chains of macroeconomic variables by which monetary factors and the monetary policy can be transmitted into the real economy, and depends on the specific economic conditions, the behavior of economic agents, the structure of the financial system and methods of monetary regulation [1]. Nowadays the issue of monetary transmission mechanism and the related question of which transmission channels play the more important role in transmitting monetary policy shocks to the real economy is an discussed topic in many publications devoted to the monetary policy.

One of the main channels of monetary transmission mechanism is a credit channel. The important role it plays in countries with banking financial system, i.e. those countries where financial resources are distributed mainly through the banking sector. In the economic literature there are various approaches to the structuring of the credit channel [1]. Sometimes, for example, there identifies five variants the transmission: bank lending channel, balance sheet channel, cash flow channel, unanticipated price level channel, and a channel associated with household liquidity effect. Channel of monetary transmission associated with the effect of household liquidity, operate through the main component of aggregate output – consumption. In particular, the rise in prices of financial assets causes an increase in the net assets of households (assuming that their debts are fixed in

nominal terms, and savings are held in financial assets). Accordingly, likelihood of financial difficulties are reduced, and households will increase consumption expenditures of durable goods and real estate [2].

One variant of the transmission mechanism, essentially closest to the effect of household liquidity, is the welfare channel or wealth effect. Just as in the case of the liquidity effect, the growth of money supply, which leads to an increase in stock prices, causes an increase in household wealth. Correspondingly, their current consumption (in this case – for all kinds of goods) and then aggregate demand increase and eventually – output is growing [2]. The existence of welfare channel with short positive effect for real output was confirmed for Russian and Belarusian economies in [3–4]. At the same time, in case of Hungary, Poland and Romania were obtained statistically significant estimates of the negative response of output in the case of monetary transmission channel associated with the liquidity effect of households, i.e. mechanism of channel action is inverse to theoretical: liquidity growth causes a decrease rather than increase in output [5]. Such a situation is explained by the authors as a consequence of the fact that real income growth has expanded the demand for imported goods rather than domestic production (especially in the traditional interpretation of the channel assumes a growth in demand is on durable goods), that, thus, led to a slowdown in the growth of national economy.

For assessing the impact of monetary policy on the most important macroeconomic indicators through a specific transmission channel, usually to include in the number of endogenous variables of VAR-model special variable associated with this channel of monetary transmission. Then the conclusion of the predominating type of mechanism is based

on the construction and analysis of impulse-response functions to monetary shock of special variable for this channel (associated with it), and also through the impulse functions with response of considered macroeconomic indicators to changes in monetary policy and the dynamics of the “characteristic” variable.

In studying the mechanism of monetary transmission within the framework of VAR-approach in the first step should be investigate how measures of monetary policy impact on some intermediate variables responsible for the transmission, such as loans, deposits, money aggregates, etc. The second step is to determine how the behavior of variables affects the general economic situation, i.e. on aggregate demand, unemployment, etc. It is worth noting that sometimes a relationship between the actions of the central bank and the intermediate goals of monetary policy assumed evident and is not subject to verification. However, seems more correct to carry out the analysis for assessing the whole chain of dependencies from monetary policy measures till macroeconomic indicators which characterizing the various transmission mechanism [4].

The article presents the results of empirical research in part of the justification of presence of household liquidity effect in the monetary transmission mechanism of Ukraine economy using vector autoregression approach (VAR approach), proposed by Sims in 1970.

Based on the results of similar studies for the estimation of VAR-models used logarithms of economic indicators. For real output variable in model were introduced deviation of real GDP from trend. This was all done in order to improve the statistical characteristics of the models. The complete procedure of pretreatment for initial data was as follows: taking the logarithm of time series, further removing the seasonal components using the procedure TRAMO/SEATS, and then from log-series without seasonality subtracted its trend component, which stood out from him with a Hodrick-Prescott filter.

Information base for estimating VAR-models contain quarterly data from 2006 to 2013, which were downloaded from the website of the National Bank of Ukraine. All calculations and empirical analysis carried out in the standard software package EViews 6.0. For empirical verification of the hypothesis concerning the existence in Ukraine economy lending channel was estimated VAR-model containing as composition of their endogenous variables three indicators: real output as target variable (GDP gap), indicator of the money supply (the logarithm of one of monetary aggregates), and indicator characterizing welfare of households. As the target variable that defines a channel of welfare, i.e.

the liquidity ratio of households, was selected the ratio of deposits to liabilities of the banking system. As known, the choice of variables, responsible for specific channel, is quite conventional. Evident that deposits can not always be considered as liquid assets to make payments, and the choice of this indicator as a channel target variable was based on the results of similar research [2; 5]. To improve the quality of developed models also was introduced into them the official exchange rate of Hryvnia against foreign currency (euro).

The hypothesis of nonstationarity series was tested by the ADF and KPSS tests. In the case of M0 in first differences was conducted Phillips-Perron test, since the time series has regular fluctuations. The time series of real output, as a target variable, is stationary, and some other variables are represented by non-stationary time series. So the estimation of vector autoregression models was performed without error correction, and nonstationary variables were considered in the respective differences (estimation results based on ADF-test and PP-test for  $\Delta M_0$ , as well as notations of variables VAR-model, are presented in Table). Furthermore, given the stationarity of the target variable GDP, it was decided to use the monetary aggregates in first differences, because this variables in levels are the TS-series. Our decision will not affect the results of testing hypothesis of the existence the wealth channel in the monetary transmission of the Ukrainian economy, but was also more appropriate taking into account the principles of time series analysis.

Since the applying the method of vector autoregression involves a number of restrictions and its results are not always adequate to assess the relationship between the considered indicators, previously was carried out testing Granger causality for monetary aggregates, both in levels and in first differences, and real output. Granger causality measures the information content of an explanatory variable corresponding to the future movement of an endogenous variable. Based on the results of Granger causality test the hypothesis about the influence of money supply shocks on real output is taken in case of aggregate M0. At the same time, the hypothesis of absence of the influence variable real output on money supply is rejected when considering each of the monetary aggregates. Based on the results of the testing as an indicator of money supply in vector autoregression models will be used measure of money in circulation, as aggregate, which the most controlled and operated by the monetary authorities of the country and, accordingly, reflecting the expansion or contraction of the money supply as a result of carried out monetary policy.

Table. Augmented Dickey Fuller, ADF, test results for unit root

Variable	Indicator	ADF test		
		Specification	Critical value $\tau$ -5 %	ADF-stat.
GDP	Deviations of real GDP from trend (gap)	N,0	-1,953	-2,297
M0	Money aggregate M0	T,4	-3,595	-4,281
DM0*	First differences of money aggregate M0	T	-3,574	-6,899
HD	Share of household deposits (in national currency) in total credit of the banking system	T,3	-3,588	-2,940
DHD	First differences of share of household deposits (in national currency) in liabilities of banking system	N,0	-1,953	-3,154
CR	Exchange rate of the national currency to the euro	N,0	-1,953	1,821
DCR	First differences of exchange rate of the national currency to the euro	N,0	-1,953	-4,480

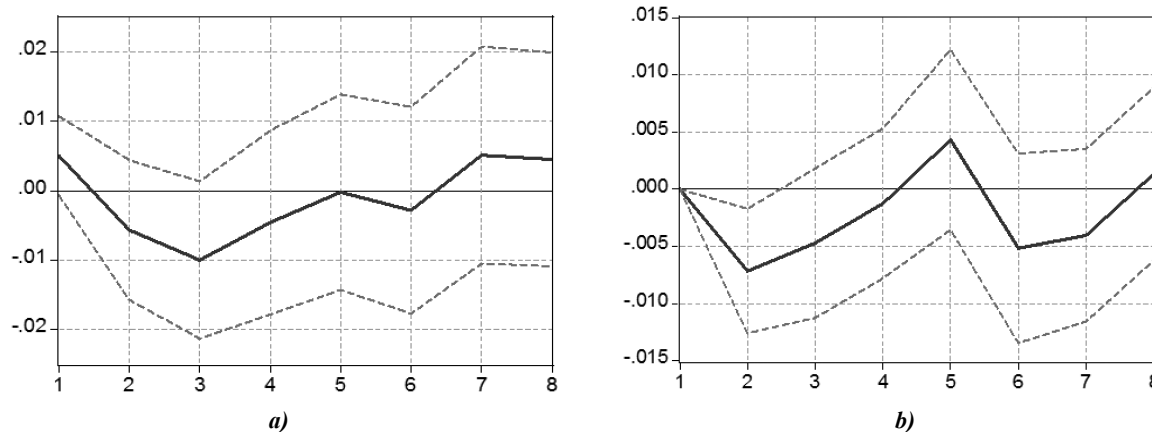
The optimal lag length of VAR-models was determined based on the Lag Order Selection Criteria and by following test values: *FPE* – Final prediction error; *AIC* – Akaike information criterion, *SIC* – Schwarz information criterion; *HQ* – Hannan-Quinn information criterion. The results of testing indicated the optimality of models with lags order one or four. Taking into account the results of the test of causality, the choice was made in favor of a model with a large number of parameters. On the basis of Wald test all models include lagged endogenous variables up to fourth order.

Conclusion of a statistically significant effect intervening variables to the most important macroeconomic indicators taken based on the analysis of graphs of impulse-response functions, which trace out the effect of a standard deviation shock to one variable on the behaviour of the other endogenous variables, and statistical quality criteria equations of vector autoregression model. During of the research were able to identify a statistically significant impact of the monetary transmission on change in real output (gap of real GDP) by wealth-consumption channel. Granger test results for the estimated vector autoregression model, in particular confidence level of joint significance of endogenous variable real output with all other lagged endogenous

variables, indicate the presence of causation between endogenous variables of the model.

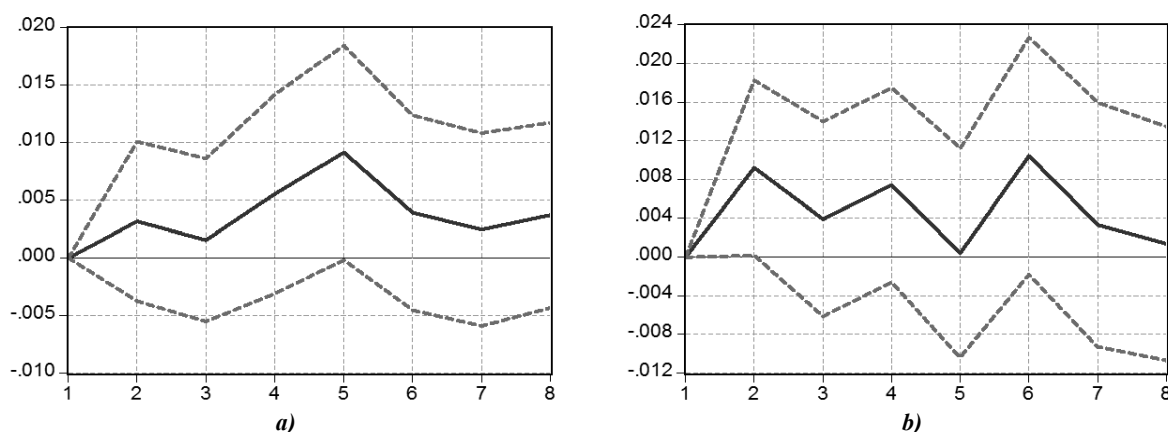
Graphs 1 and 2 present the graphs of impulse response functions for estimated VAR-models with a time horizon of 8 quarters and associated confidence intervals ( $\pm 2$  standard errors, which corresponds to a 95 % confidence interval). The provided graphs confirm the hypothesis of statistically significant relationship between the gap of real GDP and the share of national currency deposits in liabilities of the banking system, which indicates the presence in the Ukrainian economy the wealth-consumption (household) channel. One standard deviation shock of DHD has short-term effects in the dynamics of real output gap: a statistically significant impact observed within 1–3 months (Graph 1a).

Graph of the response function of real output in Graph 1b demonstrates a statistically significant response to the innovation of the exchange rate, which further allowed, despite the Granger test results, to consider variant of VAR-model with M2 and M3 as a monetary aggregates. Statistical characteristics of the VAR-model, which included the M3, confirmed its adequacy, allowing further use the results of the analysis of the response function of real output to a shock of the monetary aggregate, obtained for this model.



Graph 1. The graphs of impulse response function of real output gap: a) to share of national currency deposits in liabilities of the banking system; b) to the exchange rate shock

Graph 2a shows a plot impulse response function of real output on shock of M0. Graph 2b shows a plot impulse response function of real output to a shock in the monetary aggregate, obtained based on variant of the VAR-model with lagged endogenous variables of the fourth order, in which considered M3 as the monetary aggregate. The graphs demonstrate the existence of significant positive reaction of real output to shock of aggregate M3 and statistically insignificant response to change of M0 (the impact of the monetary aggregate in the considered model turned out indirectly).



**Graph 2.** The graphs of impulse response function of real output gap:  
a) to monetary aggregate M0 shock; b) to monetary aggregate M3 shock

The Graph 2b) indicates the presence of a long-term positive reaction of real output to growth of monetary aggregate M3. The Response of real output to monetary shock can be considered statistically significant at the 5 % level from the first to the second time periods, in the sixth period, and weakly statistically significant at the 10 % level for the third and fourth periods, and at the end of the second year the reaction becoming statistically insignificant. The Output response to M0 shock is weakly statistically significant from the first to the second period, in the fourth and sixth periods. Maximum positive response of real GDP to a shock M0 observed in the fifth period from the moment of change in this monetary aggregate.

Relationships established during the Granger causality testing and analysis of impulse response functions themselves can not answer the question of how much effect of one factor to another, unlike variance decomposition method, which confirms the endogeneity of the real output gap: total share of innovations the other variables in explaining the variance of the forecast of the output

gap in the first period of up to 13 %, in the fourth period – up to 59 %. For comparison, the share of total innovations of the other variables are 7 % for DHD in the fourth period. Decomposition variances also confirms the assumption that the variable DHD is the most exogenous variable. For most exogenous variable is characteristic that in the first period to nearly 100 % the variance is determined by its own shock.

The revealed relationships indicate the confirmation of the banking system's role in forming of consumer demand. Shown that the dynamics of

share of national currency deposits in the liabilities of the banking system causes real GDP growth in the short term. Whereby the direction of influence and the relations strength are unstable: real output demonstrates a positive response during the growth of liquidity of households in some periods and negative response in others. As a particular conclusion can be noted that in the long term there is a positive effect, which confirms the existence of demand for domestic producer's goods. The analysis also confirmed a statistically significant influence of the dynamics of M0 and M3 on real output through household wealth channel of monetary transmission. Is of interest the presence of significant bilateral relationships between real GDP gap, share of national currency deposits in liabilities of the banking system and the exchange rate change.

Overall, the analysis demonstrates the possibility of using econometric methods, in particular vector autoregression models to research monetary transmission in the Ukrainian economy and complements the previous studies of bank lending channel of other authors.

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## ЗАСТОСУВАННЯ VAR-МОДЕЛІ В ДОСЛІДЖЕННІ ВПЛИВУ ЛІКВІДНОСТІ ДОМОГОСПОДАРСТВ НА МОНЕТАРНУ ТРАНСМІСІЮ

*Детальне дослідження механізму монетарної трансмісії в сучасних умовах економіки України є актуальним питанням при аналізі короткострокового впливу грошово-кредитної політики на реальний сектор економіки. Мета цього дослідження полягала у визначенні каналів монетарної трансмісії, пов'язаних з ефектом ліквідності домогосподарств. Динаміка частки депозитів у національній валюті в пасивах банківської системи викликає реальне зростання виробництва в короткостроковій перспективі. Виявлені взаємозв'язки вказують на роль банківської системи у формуванні споживчого попиту.*

**Ключові слова:** трансмісійний механізм монетарної політики, ефект ліквідності домашніх господарств, вектор авторегресії (VAR) моделі.

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## CORPORATE SOCIAL RESPONSIBILITY PRACTICES IN DEVELOPED AND DEVELOPING COUNTRIES

*Corporate social responsibility practical implementation experience in different countries is investigated. The main drivers for corporate social responsibility activities within in developed and developing countries are distinguished and reviewed. The corporate social responsibility concept development in Ukraine is explored, the main obstacles for socially responsible activities of Ukrainian companies are underlined.*

**Keywords:** corporate social responsibility, sustainable development, environmental sustainability, climate crisis, human rights protection, responsible business.

Stock market downturns, corporate scandals, threat of terrorism, uncertain economy and a number of other economic factors have brought down trust in the corporate sector and its leaders. Companies have to address this both collectively intro-

ducing a set of indicators to measure their impact on society as well as reporting about this and individually by positioning themselves as those that make a positive impact on society. Stakeholders are becoming more critical, and the standards for