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MACROECONOMIC DETERMINANTS OF HOUSEHOLD INDEBTEDNESS IN ROMANIA: AN ECONOMETRIC APPROACH[*]

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Abstract

This paper examines the reaction of the household indebtedness to various shocks in the economy between 2011Q1 and 2021Q4, using a Structural Vector Autoregressive model. The results of the econometric model indicate that average net wage was the driver of the loans granted by credit institutions to individuals' variation after their own innovations at all time horizons. This result was achieved in the conditions that households' resilience to shocks has improved significantly in the period 2011-2020 from lei 243 billion to lei 480 billion. The evolution of the economy starting from March 2020 was influenced by the emergence of the COVID-19 pandemic and the imposition of restrictions to prevent the spread of the disease. In this situation, between March 2020 and September 2021, the new standard mortgage loans recorded an average growth rate of 2.2 percent in nominal terms and 1.91 percent in real terms, standing above the pre-pandemic level (1.34 percent, respectively 1.17 percent). The low interest rates and general household income growth (the minimum wage in the economy increased 14 times between 2011 and 2021) were responsible for high household debt. The rise in household indebtedness growths its vulnerability to shocks in the economy, potentially having a negative impact mainly on the creditors' balance sheet.

Keywords: Household debt, Interest rate, Vector autoregressive model, Sims-Bernanke decomposition, variance decomposition
JEL Classification: C58, G51, E24

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1. Introduction

The household sector, like the corporate sector, is part of the real sector in the economy, in which it plays an important role for many reasons (Santoso and Sukada, 2009). Households can have a negative impact on financial stability, especially from the adverse evolution of 2 factors: the dynamics and volatility of balance sheet and disposable income and the level of indebtedness (Neagu and Mărgărit, 2005). According to Mendelsonas (2014), excessive and improperly controlled borrowing can create important financial stability problems. Individuals can become more sensitive to interest rate and income changes. They can lose flexibility during change of economic cycle. Household debts can have direct effect on financial system when banks record losses due to customers' insolvency and indirect impact by reducing consumption.

In Romania, according to the statistical data published by the National Bank of Romania, the balance sheet developments for households remained overall favourable during the period 2011-2021. Thus, households' real estate assets were lei 1,119 billion in 2011 and lei 1,249 billion in 2012, followed by an upward trend during the interval 2013 – 2021 from lei 1,196 billion to lei 1,969 billion. On the other hand, households' net financial assets increased from lei 155 billion in 2011 to lei 420 billion in 2017 and then shrank to lei 384 billion in 2018. Further on, this indicator followed an upward path, reaching lei 634 billion in 2021. Instead, the share of households' total debt in GDP decreased from 18.7 percent in 2011 to 13.5 percent in 2019. Subsequent, this share went up to 14.2 percent in 2020, due to the declining of GDP as a consequence of the healthcare crisis. In 2021, the households' total debt stood at 13.9 percent of GDP amid the relaxation measures to limit the spread of coronavirus and favourable financial conditions, mainly in the 2nd and 3rd quarters of the year.

In the period 2011-2021, the structure of the total loans to households is indicative of a drop in the share of consumer loans from 59.5 percent to 37.5 percent, along with the increase in the share of housing loans from 32.0 percent to 61.3 percent. In should be noted that in 2021, the share of loans for other purposes in the total loans to households stood at 1.2 percent, down 7.3 percentage points from 2011. Between March 2020 and September 2021, the new standard mortgage loans recorded an average growth rate of 2.2 percent in nominal terms and 1.91 percent in real terms, standing above the pre-pandemic level (1.34 percent, respectively 1.17 percent). Instead, the new consumer loans posted an average growth of 4.8 percent in nominal terms and 4.3 percent in real terms from March to September 2021, after the significant decrease seen in the period from March 2020 to February 2021 (- 2.3 percent, respectively -2.5 percent).

Households' non-performing loan ratio for September 2021 dropped by 5.84 percentage points against December 2015, standing at 3.29 percent. By loan type, the NPL ratio for real estate loans decreased from 5.32 percent to 1.52 percent, while the NPL ratio for secured consumer loans declined from 19.88 percent to 11.89 percent between December 2015 and

September 2021. On the other hand, the NPL ratio for unsecured consumer loans diminished from 9.2 percent in December 2015 to 4.75 percent in December 2019 and then went up to 5.48 percent in December 2020 and 5.53 percent in September 2021, amid the high uncertainty on future revenues and the emergence of the Delta variant of the virus. In September 2021, the NPL ratio for consumer loans more than 90 days past due was 5.4 percent (4.5 percentage points higher than the mortgage loans in the same category).

In this context, the question I want to examine is the manner in which interest rates of credit institutions on loans and monthly net average wage would impact the loans granted by credit institutions to individuals in the period 2011Q1-2021Q4. The methodology I will apply is the Vector Autoregressive (VAR). According to Boțel (2002) the principal goal of the VAR model is to measure the effects of diverse shocks on variables in the system. Each variable is influenced by its own innovations, as well as by innovations in the other variables. It should be noted that the VAR model was developed and popularized by Sims (1980). Forwards, Hamilton (1994) and Lutkepohl (2005) updated the VAR techniques.

The study has the following structure. After the introduction, section 2 provides a brief overview of the related literature. Section 3 presents the VAR methodology and section 4 the data and the modelling stages. Section 5 discusses the results of the econometric model and the last section is dedicated to conclusions.

2. Literature review

The analysis of the relationship between household debt and its determinants is a widely examined subject in the specialized literature. According to Devine (2022), debt represents money borrowed by individuals in the form of loans for later repayment, being measured at a household level. Loans are generally granted by banks or other financial institutions and include mortgages, personal loans, car loans, student loans, the balance on credit cards, and overdrafts on bank accounts. When it comes to macroeconomic determinants of household indebtedness for both developing countries and developed countries, there are many indicators taken into account, even if some are more present than others (Dumiterscu et al., 2022).

For instance, Rubaszek and Serwa (2012), using a life-cycle model with individual income uncertainty, demonstrated that household credit to gross domestic product (GDP) ratio is influenced by the lending-deposit interest rate spread, individual income uncertainty, individual productivity persistence, and the generosity of the pension system. In addition, the authors showed that the implications of the theoretical model are to some degree supported by the data for OECD and EU countries in the period 1995-2009.

Meniago et al. (2013) examined the main drivers of household debt growth in South Africa between 1985Q1 and 2012Q1 with the aid of the Vector Error Correction (VEC) model. The results indicate that the rise in household debt was significantly affected by positive variations

in the consumer price index, GDP and household consumption. On the other hand, household debt was significantly and insignificantly affected by negative variations in income and prime rate, respectively.

In another study, Coletta et al. (2014), using the Ordinary least-squares (OLS) method for a sample of 32 countries (26 members of the European Union plus Japan, South Korea, Canada, Australia, New Zealand and the United States) in the period 1995-2011, found that GDP per capita and life expectancy have a positive effect on household debt. In this respect, the authors argue that in rich countries households are more likely to go into debt, on the one hand, and individuals are more inclined to incur debt if they expect to live longer, in line with the life-cycle model, on the other hand.

Instead, Zimunya and Raboloko (2015) investigated the determinants of household debt in Botswana over the period 1994Q1-2012Q2, using the VEC model. The findings show that GDP per capita, interest rates and money supply boost household debt in the long-run. In addition, analysis reveals that lagged household debt, interest rates and money supply cause variations in household debt in the short-run.

In the case of the Romanian economy, Manole et al. (2016) concluded that the unemployment rate and the consumer price index exerted a robust influence on household loans between 2008M01 and 2015M12. To achieve this outcome, the authors applied a model with an ARMA component, in which the impact of the unemployment rate and the consumer price index acts with a delay (lag) and is described by a linear relationship.

Later, Moore and Stockhammer (2018), applying the co-integration and error-correction technique on a set of 13 OECD countries for the period 1993–2011, revealed that the most important macroeconomic determinant of household debt is real residential house prices, and that debt accumulates especially in the expansion phase of house price.

Additionally, Jestl (2019) found a positive link between income inequality and consumption-related household indebtedness in continental European countries for the period 2005-2010 by means of the multilevel regression model. The author considers that individuals take into account both their own balance sheet and their relative position in the society when making financial decisions. Moreover, the low levels of consumer indebtedness in the euro area indicate a low risk of financial stress and macroeconomic instability.

Nur et al. (2019), using the OLS method with the multiple regression for the period 2012M01-2016M12, noted that inflation has a positive yet insignificant relationship with household debt in Malaysia. The authors also observed that the interest rate, unemployment rate and consumption are positive and significantly linked with household debt.

In contrast, by resorting to the autoregressive distributed lag (ARDL) model in the Indonesian context for the period 2010Q1-2020Q4, Werdaningtyas et al. (2022) found that in the long term, savings growth and inflation significantly influence household debt growth. In the short term, household credits are influenced by savings growth and inflation with a 2-

quarter lag, commercial interest rates for household credits, and the exchange rate with a 1-quarter lag.

In completing the picture, Dumitrescu et al. (2022) examined the macroeconomic determinants of household debt in developed economies, using the unconditional quantile regression for a sample of 26 OECD countries for the period of 2002Q1–2020Q4. The results indicate that economic growth, unemployment rate and higher public expenditures are associated with lower household debt, while higher house prices and investments boost household debt. At the same time, mortgage credit interest rates are positively related to household debt, starting with the 50th quantile, while inflation reduces household borrowing only if the level of debt is high.

The findings of the analyses provide an involvement to the policy for both developing and developed countries to further their awareness of actively-increasing household debt, particularly when history has revealed the nature of the debt cycle that can determine financial shocks that destabilize the economic environment (Samad et al., 2020).

3. The VAR model: a brief review

The model I cover here is similar to that presented by Enache (2016), Enache and Merino (2017). The general form of a Vector Autoregressive (VAR) model with k variables and p lags is written matricially:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + e_t \quad (1)$$

where:

$$Y_t = \begin{bmatrix} y_{1,t} \\ y_{2,t} \\ \vdots \\ y_{k,t} \end{bmatrix}; \ \beta_p = \begin{bmatrix} \beta_{1p}^1 & \beta_{1p}^2 & \cdots & \beta_{1p}^k \\ \beta_{2p}^1 & \beta_{2p}^2 & \cdots & \beta_{2p}^k \\ \vdots & \vdots & \vdots & \vdots \\ \beta_{kp}^1 & \beta_{kp}^2 & \cdots & \beta_{kp}^k \end{bmatrix}; \ e_t = \begin{bmatrix} e_{1,t} \\ e_{2,t} \\ \vdots \\ e_{k,t} \end{bmatrix}$$

The error covariance matrix, E(etetT)=∑e, is not known.

The equation (1) can be written, using the lag operator, in the reduced form:

$$\beta(L)Y_t = e_t \quad (2)$$

where:

$\beta(L) = I_k - \beta_1 L - \beta_2 L^2 - \ldots - \beta_p L^p$, I_k is the unit matrix.

The VAR (p) process is a non-integrated process - I(0), if $\det(\beta(z))=\det(I_k - \beta_1 Z - \ldots - \beta_p Z^p)\neq 0$ for any $|z|\leq 1$ does not have roots inside the unit circle.

A restricted VAR model represents the structural form of the VAR(p) model, being defined as:

$$\beta Y_t = \beta_1^* Y_{t-1} + \beta_2^* Y_{t-2} + \ldots + \beta_p^* Y_{t-p} + \acute{U} u_t \quad (3)$$

According to Pfaff (2008) "it is assumed that the structural errors, ut, are white noise and the coefficient matrices βi*, for i = 1,…,p, are structural coefficients that differ in general from their reduced form counterparts". Ű is the diagonal matrix.

Multiplying equation (3) by β-1 gives:

$$Y_t = \beta^{-1} (\beta_1^* Y_{t-1} + \beta_2^* Y_{t-2} + \ldots + \beta_p^* Y_{t-p} + \acute{U} u_t) \quad (4)$$

or:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \varepsilon_t \quad (5)$$

where:

$\varepsilon_t = \beta^{-1}\acute{U}u_t$ realizes the link between the 2 forms.

$\sum_\varepsilon = \beta^{-1}\acute{U}\acute{U}^T \beta^{-1T}$ → the variance-covariance matrix.

Next, at least k(k-1)/2 zero restrictions are necessary to be fixed to the coefficients of matrix β in equation (4) in order to detect structural innovations → matrix β highlights the causal links present between the analysed variables. The Sims-Bernanke method (1986) for short-term innovations, which assumes that zero restrictions are freely distributed in the case of matrix β, is useful for this purpose.

In this paper I will use the following results of the VAR model: impulse response function; variance decomposition. The impulse response function (IRF) highlights the impact of a shock in the variable of interest on the variable itself and on the other variables in the system over a specified time horizon. The variance decomposition (VD) quantifies as a percentage the proportions of the oscillation of a variable that are attributed to its own shocks and shocks that occur from the other variables in the model over a specified time horizon.

4. Data description and model estimation

I have considered the following variables in my study:



The series of data were collected from the websites of the National Bank of Romania and the National Institute of Statistics. The data series have a quarterly frequency and cover the period 2011-2021. The values of loans granted by credit institutions to individuals and those of monthly net average wage were deflated by the Consumer Price Index (CPI), 2015 base year.

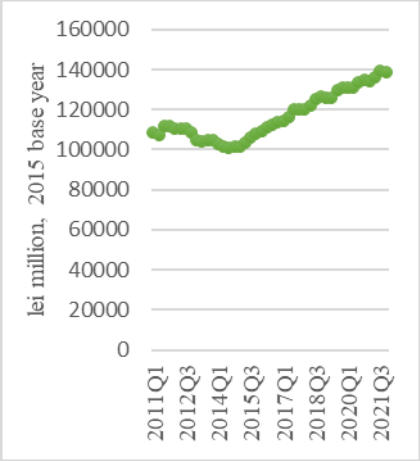


Figure no.1: Loans granted by credit institutions on loans

Source: NBR; own calculations

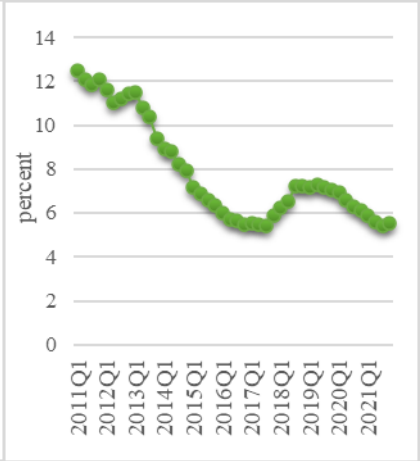


Figure no.2: Interest rate of credit institutions to individuals

Source: NBR

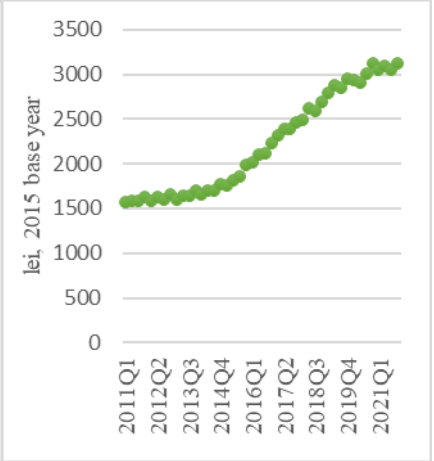


Figure no.3: Monthly net average wage

Source: NIS; own calculations

The three series were expressed in natural logarithms and seasonally adjusted applying the X-12 procedure, used by the United States Census Bureau. The traditional Augmented Dickey-Fuller test (see Dickey and Fuller, 1979) and Phillips-Perron test (see Phillips and Perron,1988) indicated that the all variables are integrated of order one – I(1) (table no. 1).

Table no. 1: Results of unit root tests without structural breaks

Variables	Augmented Dickey-Fuller test		Phillips-Perron test	
	Level	First difference	Level	First difference
LGI	-0.922	-3.579**	0.548	-3.659*
IRC	-1.687	-3.333**	-1.445	-3.374**
ME	0.584	-4.244*	0.209	-4.353*

Note: The null hypothesis of unit root existence is rejected at the 1 percent level (*) or at the 5 percent level (**).

Source: Author's own research.

The Augmented Dickey-Fuller test and Phillips-Perron test do not consider the possibility of structural breaks. Consequently, they can generate incorrect result when accepting the null hypothesis of a unit root. In this context, I will further apply the Zivot-Andrews (1992) and Perron (1997) unit root tests, that allow to detect the break point 'endogenously' from the data (Glynn et al., 2007). Thus, the results presented in tables no. 2 and 3 indicate that LGI and ME are non-stationary in levels. Instead, Zivot-Andrew test rejected the null hypothesis of a unit root for IRC at level, this finding evidently contradicting the results attained from the other tests performed.

Table no. 2: Zivot-Andrews unit root test results

Variables	Levels	Break date	First differences	Break date
LGI	-4.882(1)	2014Q1	-6.500 (0)*	2014Q4
IRC	-4.086(2)*	2017Q4	-4.793(0)**	2017Q4
ME	-2.445(3)	2020Q1	-4.833(2)***	2015Q3

,,*** denote significance at 1%, 5% and 10% levels, respectively.*

The number of lag order is presented in parenthesis.

Source: Author' own research

Table no. 3. Perron unit root test results

Variables	Levels	Break date	First differences	Break date
LGI	-4.788(1)	2014Q1	-5.809 (0)**	2014Q3
IRC	-3.753(1)	2017Q3	-4.793(0)*	2017Q3
ME	-2.793(3)	2020Q2	-4.767(2)*	2015Q2

,,*** denote significance at 1%, 5% and 10% levels, respectively.*

The number of lag order is presented in parenthesis.

Source: Author' own research

The structural breaks for LGI were detected amid the attractiveness of the "First Home" government program that supported about 60 percent of the new real estate bank loans in 2014. Instead, the structural breaks for IRC were detected in the context in which the indicator stood at 5.86 percent in 2017Q4, up 0.44 percentage points from 2017Q3 and 0.39 percentage points from 2017Q2, mainly as a result of higher interest rates on new housing loans. Moreover, the structural breaks for ME were detected due to the increase of the gross minimum wage, its share in the average gross wage reaching 41 percent in 2015, at the level of the national economy and due to lockdown restrictions amid the uncertainties associated with the evolution of the COVID-19 pandemic in spring and summer 2020.

Table no. 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	205.8786	NA	7.89e-09	-10.14393	-10.01727	-10.09813
1	424.8139	394.0836	2.18e-13	-20.64070	-20.13403	-20.45750
2	441.6461	27.77314*	1.49e-13	-21.03231	-20.14565*	-20.71172*
3	452.0133	15.55070	1.42e-13*	-21.10066*	-19.83400	-20.64268
4	460.8225	11.89247	1.50e-13	-21.09113	-19.44447	-20.49575

** indicates lag order selected by the criterion*

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author' own research

The selection of the appropriate number of lags in estimating the VAR model was based on the Schwarz (see Schwarz, 1978) and Hannan-Quinn (see Hannan and Quinn, 1979) information criteria that suggested the adequate lag was two (table no. 4). The structure of matrix β is presented in table no. 5.

Table no. 5. β matrix structure

	LGI	IRC	ME
LGI	1	1	1
IRC	0	1	0
ME	1	0	1

Source: Author' own research

The set restrictions show that, within a quarter time horizon, LGI is influenced by IRC and ME. Also, LGI influences ME. Moreover, each variable is influenced by itself.

The imposed restrictions are in line with previous literature.

Thus, a series of authors studied the relationship between interest rate and household debt. The sign of interest rate varies from one country to another. For example, Anderson et al. (2014) and Samad et al. (2020) found that interest rate significantly positively affects household debt growth. According to Mian and Sufi (2009), households with a good credit profile can borrow at a standard interest rate, while households with a poor credit profile can access subprime mortgage loans, which comes with higher interest rates and increased debt service. As a result, household debt growths with the increase in the interest rate on loans (Samad et al., 2020). In contrast, Turenetti and Zhuang (2011), Meng et al. (2013), Soo and Chong (2022) found that interest rate has a significant and negative impact on household debt growth, this result being in line with the Keynesian theory (Nomatye and Phiri, 2018). According to Emiris and Koulischer (2021), while first time borrowers are more sensitive to variations in interest rates, the debt growth of non-first-time borrowers is higher at the overall level when interest rates decrease.

In another study, Neagu and Mărgărit (2005) reached the conclusion that household debt is positively and significantly influenced by real wages. This result conforms to the theory, as the beneficiaries must show the ability to comply with the terms of the loan. Credit scores are used to determine eligibility for almost all types of credit, such as home mortgages, credit cards and even hospital billing plans (Shawn and Traub, 2011).

Moving forward, according to Wood (2020), household debt growths the share of income held at the top of the income distribution, whereas raising inequality between the top and middle of the income scale. Thus, the decision of households to go into debt has important distributive effects, widening the gap between rich and less rich households. Moreover, household debt lowers the wage share, possibly by augmenting financial vulnerability that has

a negative impact on the will of workers to participate in collective action (Anderloni et al., 2012; Barba and Pivetti, 2009; Kohler et al., 2015, as cited in Guschanski and Onaran, 2016).

The VAR stability is satisfied for the estimated model. The results of the error tests indicate that they are normally distributed, homoscedastic and not autocorrelated. The results of the CUSUM test and CUSUM of squares test (see Brown et al., 1975) indicate that the parameters of the regression equation of LGI are stable, at a significance level of 5 percent (figure no. 4).

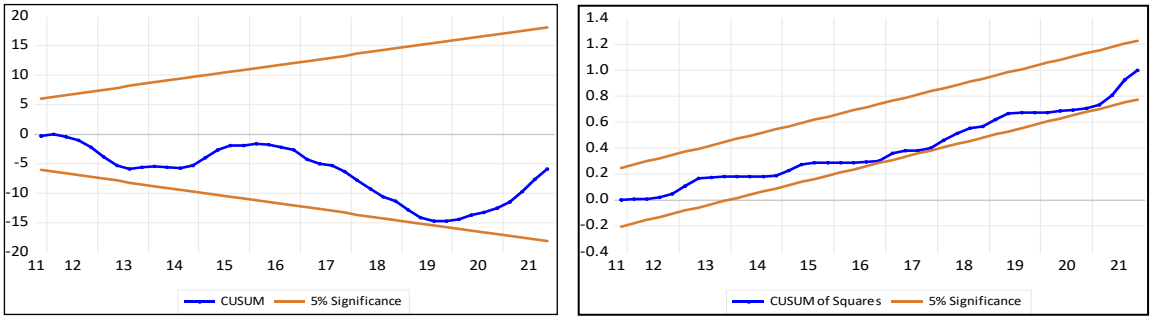


Figure no. 4. Coefficients stability test

Source: Author' own research

5. Results and interpretation

According to the estimated model, it could be simulated as IRF, the LGI reactions to the shocks coming from all variables (figure no. 5).

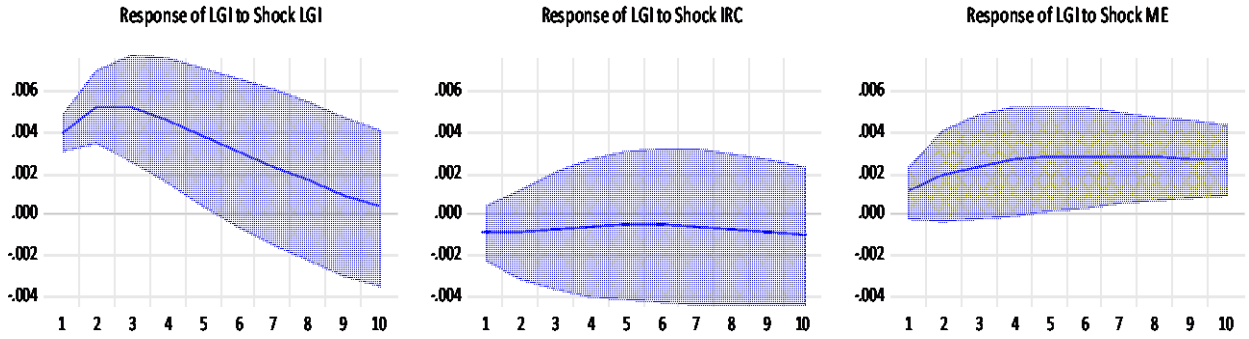


Figure no. 5. Response to Structural VAR Innovations
(95 percent CI using analytic asymptotic S.E.s)

Source: Author' own research

As can be seen, LGI reacts positively to the shocks coming from ME, in line with the findings of Neagu and Mărgărit (2005), their effects being statistically significant starting from

the 6th quarters. This result was obtained in the context in which loans target mainly earners with above average incomes since 2015.

LGI responds negatively to IRC shocks, their effects not being significantly different from zero (the confidence interval includes the zero value). This result can be supported by Mutezo (2014), who suggested that the interest rate has an insignificant relationship with household debt, but is partially contradicted by Ma'ina et al. (2016) who found that the interest rate has a negative and significant influence on household debt. According to Azwani et al. (2019), the increase in interest rate will growth the cost of borrowing. As a result, households will borrow a smaller amount of money or may choose to postpone obtaining a loan.

In addition, LGI reacts positively to its own shocks, their effects being statistically significant in the first 4 quarters.

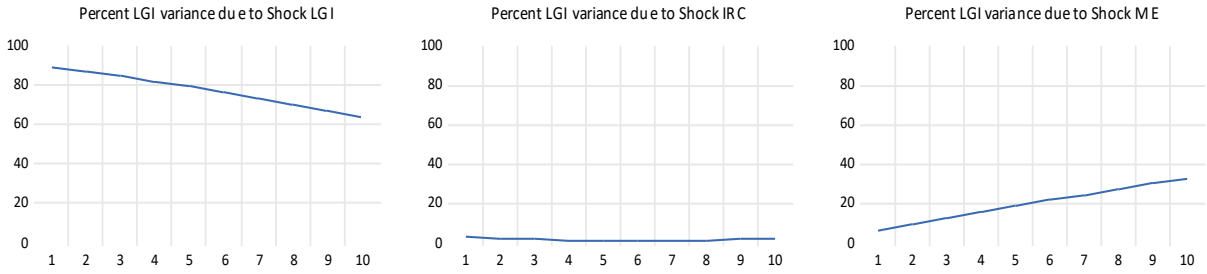


Figure no. 6. Variance decomposition using Structural VAR Factors

Source: Author' own research

The variance decomposition reflects that ME was the driver of the LGI variation, after its own innovations at all time horizons (figure no. 6).

It should be mentioned that, in real terms, ME recorded a higher average growth rate than LGI in the pre-pandemic period (1.75 percent, compared to 1.36 percent). Instead, during the COVID-19 pandemic, ME posted an average growth of 1.18 percent, compared to 1.2 percent in the case of LGI.

These results were achieved in the conditions that, in the period 2011-2020, households' resilience to shocks has improved significantly from lei 243 billion to lei 480 billion, while debt service to income decreased from 8.5 percent to 4.5 percent (figure no. 7). Besides, households consolidated their assets between 2011 and 2021, with both fixed and financial assets recording an average growth rate of 6.5 percent and 15.0 percent, respectively.

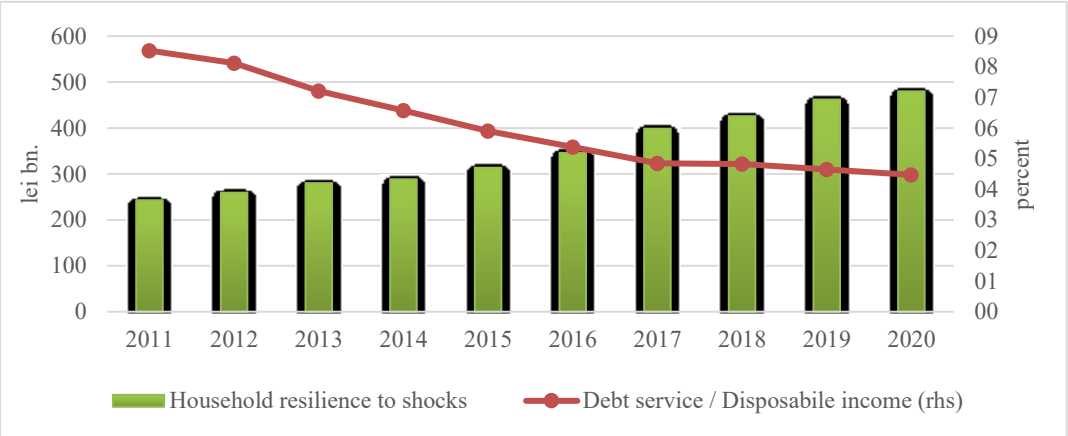


Figure no. 7. Household resilience to shocks

Source: NBR

According to the Financial Stability Report of the National Bank of Romania (December 2021), the evolution of the economy starting from March 2020 was influenced by the emergence of the COVID-19 pandemic and the imposition of restrictions to prevent the spread of the disease. Starting in May 2020, these restrictions began to be phased out steadily, some of them being reintroduced during the second and third waves of diseases, but the measures no longer had the same intensity as those imposed in the state of emergency, which was reflected in the recovery of the economy from the second part of 2020. In addition, the start of the vaccination campaign in December 2020 it created the conditions for boosting the recovery of economic activity. It should be mentioned that based on GEO no. 37/2020, debtors who had temporary financial difficulties had the possibility of suspending their loan payment obligations for up to nine months. Moreover, companies that suspended their activity received technical unemployment benefits for employees. In this context, the recommendation of the NCMO from October 2021 was to set the countercyclical capital buffer rate (CCyB) at 0.5 percent, with application since October 2022 as a result of the continued acceleration of lending activity.

6. Conclusions

In the present study, the relationship between loans granted by credit institutions to individuals, interest rates of credit institutions on loans and monthly net average wage was investigated through a Structural Vector Autoregressive model.

Departing from quarterly data for 2011–2021, it was found that LGI reacts positively to its own shocks and those coming from ME. In addition, the variation of LGI is explained in a proportion of only 2 percent by the shocks of IRC at a horizon of four quarters. It should be mentioned that, in real terms, ME recorded a higher average growth rate than LGI in the pre-pandemic period (1.75 percent, compared to 1.36 percent). Instead, during the COVID-19

pandemic, ME posted an average growth of 1.18 percent, compared to 1.2 percent in the case of LGI. The structure of the total loans to households reflected a decrease of the share of consumer loans from 59.5 percent in 2011 to 37.5 percent in 2021, although consumer loans are guaranteed to a lesser extent or are unsecured, and this risk profile is found in a higher bank profitability obtained by applying a higher active interest rate. It should be pointed out that the increase in household indebtedness growths its vulnerability to shocks in the economy, potentially having a negative impact mainly on the creditors' balance sheet.

The implication of the study is that low interest rates and general household income growth (the minimum wage in the economy increased 14 times between 2011 and 2021) have fostered high household debt.

In my opinion, the extension of this study will contribute to a better understanding of the factors influencing the evolution of households' indebtedness.

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