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EVALUATING THE RELATIONSHIP BETWEEN OFFICIAL ECONOMY AND SHADOW ECONOMY IN ROMANIA. A STRUCTURAL VECTOR AUTOREGRESSIVE APPROACH

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Abstract

Official economic situation plays a crucial role in people's decision to work or not in the informal sector. In a booming official economy, people have a lot of opportunities to earn a good salary and even extra money. This is not the case of an economy in recession, when people try to compensate the loss of income from formal economy through involvement in the informal economy.

The paper aims to evaluate the relationship between official economy and shadow economy for the case of Romania using quarterly data covering the period 20000Q1-2013Q4.In order to do that, a structural vector autoregressive approach(SVAR) was used.

The relationship between the two variables is tested by imposing a long-run restriction in the Structural VAR model to analyze the effect in the size of Romanian shadow economy to a temporary shock in real GDP. The impulse response function generated by the Structural VAR confirms that in the short-run, a rise in the official economy will lead to a decrease in the size of the shadow economy.

Keywords: shadow economy, real GDP index, MIMIC model, Structural VAR, Romania.

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1. Introduction

Official economic situation plays a crucial role in people's decision to work or not in the informal sector. Schneider (2005) considers that the degree of economic development determines the relationship between official and unofficial sectors, revealing the existence of negative relationship for developing countries and a positive relationship for industrialized and transition countries. The explanation was that in high-income countries citizens are overburdened by taxes and regulation so that an increasing SE stimulated the official economy as the additional income earned in the SE was spent in the official sector. On the contrary, for low-income countries, an increasing SE "erodes the tax base, with the consequence of a lower provision of public infrastructure and basic public services with the final consequence of lower official economy" (Schneider, 2005, p. 613).

The shadow economy manifests both positive and negative effects on official economy. The studies of Frey and Weck-Hannemann (1984), Loayza (1996), Kaufmann si Kaliberda (1996), Eilat and Zinnes (2000), Schneider and Enste (2000), Ott (2002), Dell'Anno (2003), Dell'Anno, Gomez and Alañón (2007) and Dell'Anno (2007) argue the existence of a negative effect of shadow economy on GDP growth, while the positive relationship between shadow economy and official one was revealed in studies such as: Adam and Ginsburgh (1985), Giles (1999), Giles and Tedds (2002), Tedds (2005), Schneider and Hametner (2007), Chatterjee, Chaudhuri and Schneider (2003), Dell'Anno (2008), Bovi and Dell'Anno (2007), Dell'Anno and Halicioglu (2010), Schneider and Klinglmair (2004) and Brambilla (2008).

The paper aims to evaluate the relationship between official economy and Romanian shadow economy using a structural VAR approach (SVAR).The paper is divided two sections presenting the data, the methodology, main econometrical results and major conclusions.

2. Data and Methodology

The size of the Romanian shadow economy (SE) has been estimated using a structural equation approach using quarterly data covering the period 2000Q1-2013Q4.The shadow economy is modelled like a latent variable using a special case of the structural equation models-the MIMIC model. It allows to consider the SE as a "latent" variable linked, on the one hand, to a number of observable indicators (reflecting changes in the size of the SE) and on the other, to a set of observed causal variables, which are regarded as some of the most important determinants of the unreported economic activity(Dell'Anno, 2003). The multi-equation model was estimated by restricted Maximum Likelihood estimation testing if the data follow a multivariate Normal distribution. A detailed presentation of the estimation

process is presented in the paper "Estimating the size of the Romanian shadow economy using the MIMIC approach" presented into the Conference of European Statistics Stakeholders, Sapienza-University of Rome, Rome, 24-25 November 2014.

The best model for the estimation of the size of Romanian shadow economy was a MIMIC 4-1-2 model with four causal variables (unemployment rate, self-employment, government employment and 12 months real interest rate) and two indicators (index of real GDP and currency ratio M1/M2). The shadow economy measured as percentage of official GDP records the value of 40% in the first quarter of 2000 and follows a descendent trend reaching the value of 27% in the third quarter of 2008. The size of the shadow economy begins to slowly increase, reaching the value of 32.8% of official GDP in the third quarter of 2010. For the last years, the size of the unreported economy oscillates around the value of 28%-29% of official GDP. The results are in line with the studies of Schneider et al.(2010) and Albu(2010).

The official economy was quantified using real official gross domestic product index (2005=100) expressed % seasonally adjusted using tramo seats. The data source was the Quarterly National Accounts database of Eurostat.

Using the series of shadow economy, the existence of a structural relationship between shadow economy and official economy is analyzed in order to isolate aggregate supply and aggregate demand disturbances using the Structural Vector Autoregression Approach (SVAR) of Blanchard and Quah(1989). A detailed description of SVAR technique is provided in Davidescu and Dobre(2013, 2014).

The objective is to decompose the size of the shadow economy into its temporary and permanent components. Economic theory is used to associate aggregate demand shocks as being the temporary shocks and aggregate supply shocks as having permanent effects.

The classical VAR can be writing in a matrix form:

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}\begin{bmatrix} \Delta SE_t \\ \Delta REAL\_GDP\_INDEX_t \end{bmatrix}=\begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix}+\begin{bmatrix} \gamma_{11}^1 & \gamma_{12}^1 \\ \gamma_{21}^1 & \gamma_{22}^1 \end{bmatrix}\begin{bmatrix} \Delta SE_{t-1} \\ \Delta REAL\_GDP\_INDEX_{t-1} \end{bmatrix}+\ldots$$
$$+\begin{bmatrix} \gamma_{11}^p & \gamma_{12}^p \\ \gamma_{21}^p & \gamma_{22}^p \end{bmatrix}\begin{bmatrix} \Delta SE_{t-p} \\ \Delta REAL\_GDP\_INDEX_{t-p} \end{bmatrix}+\begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \quad (1)$$

Since the demand-side and supply-side shocks are not observed, the problem is to recover them from a VAR estimation. The critical insight is that VAR residuals are composites of pure innovations ε_{dt} and ε_{st}.

So, using the structural shocks, the VAR can be written:

$$\begin{bmatrix} \Delta SE_t \\ \Delta REAL\_GDP\_INDEX_t \end{bmatrix}=\sum_{i=0}^{\infty} L^i \begin{bmatrix} b_{11i} & b_{12i} \\ b_{21i} & b_{22i} \end{bmatrix}\begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \quad (2)$$

The vector $\varepsilon_t = \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix}$ contains the two structural shocks, the demand one and the supply one.

The elements b_{11i} and b_{21i} are the impulse responses of an aggregate demand shock on the time path of the shadow economy and unemployment rate. The coefficients b_{12i} and b_{22i} are the impulse responses of an aggregate supply shock on the time path of shadow economy and official economy respectively.

The main assumption of According to Blanchard and Quah technique is to assume that an aggregate supply (real GDP index*) shock has no long-run effect on shadow economy. In other words, we impose a long-run restriction stating that the second structural shock (aggregate supply- ε_{st}) has no long-run effect on shadow economy($\sum_{i=0}^{\infty} b_{12i} = 0$) (3)

3. Empirical results

Analyzing the graphical evolution of the both variables, it can be point out that we have a strong inverse relationship between shadow economy measured as % of official GDP and the official economy represented by real GDP index quantified by a correlation coefficient of -0.98.

The first step in applying the SVAR analysis is to determine the level of integration of the variables and the optimal number of lags in order to estimate a bivariate VAR model and to identify the supply and demand shocks.

The unit root analysis realized using ADF and PP test point out the variables are non-stationary at their levels but stationary at their first differences, being integrated of order one, I(1), and I will difference the variables in order to estimate de model. According to SBC, AIC, HQ, LR an FPE criterions the optimal number of lags is found to be 1. The estimated VAR model verifies the stability condition and the non-autocorrelation homoskedasticity and normality hypothesis of the residuals were verified by estimated VAR.

The statistical significance of coefficients supports only the impact of official economy on the size of the shadow economy. The empirical results of VAR model does not highlight a possible influence of shadow economy on official one.

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* Aggregate supply is the total production of gross domestic product. Aggregate supply is the supply of REAL production. The standard measure of real production is real gross domestic product or real GDP, which is the total market value, measured in constant prices, of all goods and services produced within the boundaries of an economy during a given period of time, usually one year. Real GDP measures the physical production in the economy after it is adjusted for inflation or price changes.

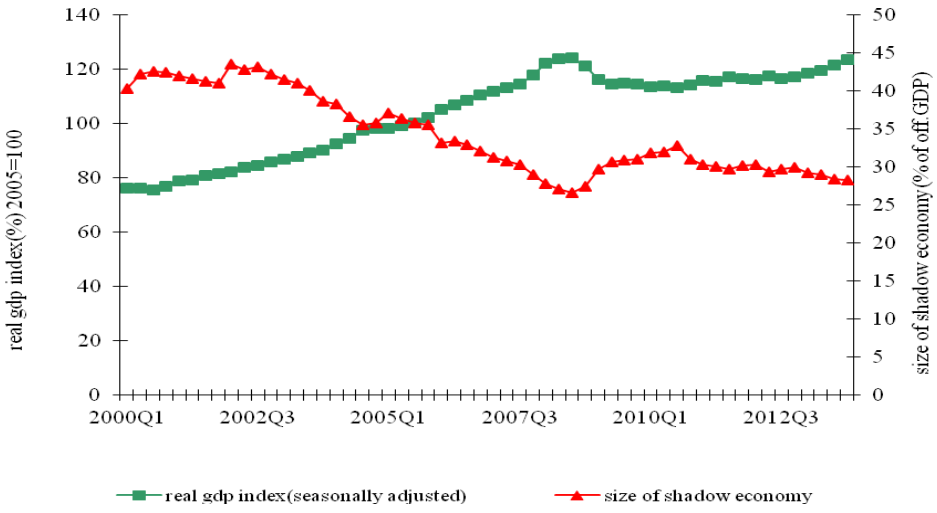

Fig.1. The evolution of official and unofficial economy in Romania during the period 2000-2013

Furthermore, we impose on this VAR a long-run restriction which specifies that the long run effect of the supply shocks on the shadow economy is null. The restriction in (3) implies that the ***cumulative effect*** of ε_{st} on ΔSE_t is zero and consequently the long-run effect[†] of ε_{st} on the level of SE_t itself is zero. The supply shock (ε_{st}) has only short-run effects on the shadow economy.

Table 1. Empirical results of SVAR model

Structural VAR Estimates
Sample (adjusted): 2000Q3 2013Q4
Included observations: 54 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 9 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: long-run text form
Long-run response pattern:

C(1)	0		
C(2)	C(3)		

[†] In Eviews, I have specified the restriction such as: @lr1(@u2)=0 "zero LR response of 1st variable to 2nd shock"

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	1.311346	0.126184	10.39230	0.0000
C(2)	-2.568278	0.297109	-8.644239	0.0000
C(3)	1.211918	0.116617	10.39230	0.0000
Log likelihood	-141.9828			

Starting from this model, we analyze the impulse response function for the structural version of the model.

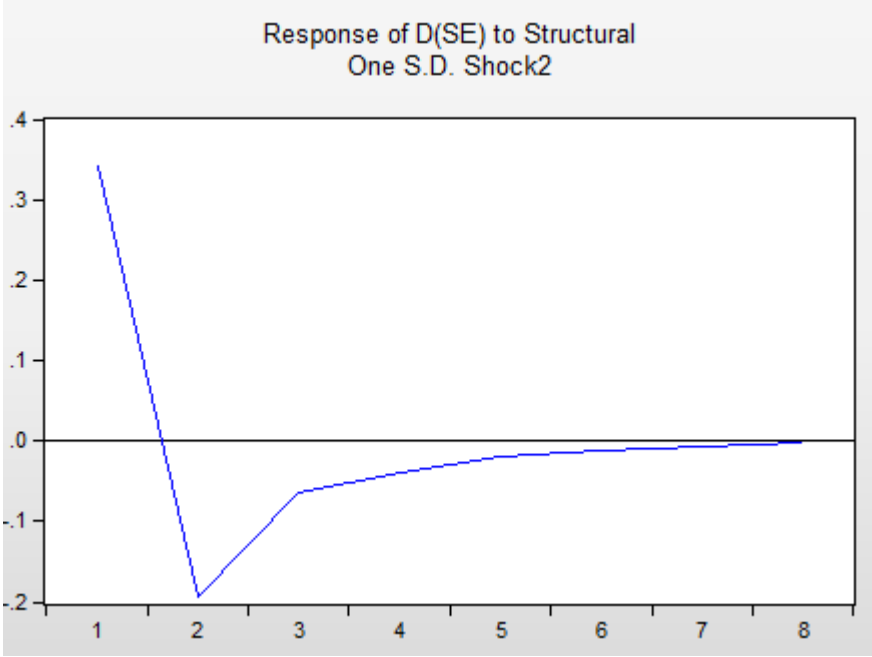

Fig 2. Effect of an aggregate Supply Shock on the size of the Shadow Economy

In the short-run, the positive aggregate supply shock causes a decrease in the size of shadow economy by about 0.2% above the baseline. This occurs in the second quarter following the initial shock. In the third quarter, shadow economy changes trend following an upward path, and from fourth quarter until the eighth quarter it increases very slowly, the supply shock losing power since the third quarter.

The interpretation of these results is conformed to the studies of Eilat and Zinnes (2000) for 24 transition countries and Kaufmann and Kaliberda (1996) who estimate a negative *impact of official GDP on the size of the shadow economy, mentioning that a decline in* official GDP, will lead to an increase in the size of the shadow economy.

The variance decomposition using the actual ε_{st} and ε_{dt} sequence allow assessing the relative contributions of demand and supply shocks to forecast error variance of the shadow economy.

Table 2. Variance decomposition of D(SE) due to supply-side shock(real GDP index)

Period	Percent of Forecast Error Variance due to: Shock1(demand-side shock)	Shock2(supply-side shock)
1	82.91	17.09
4	80.35	19.64
Factorization: Structural		

The demand-side shocks explain almost all the forecast error variance of the shadow economy at any forecast horizon. Hence, the demand shocks are responsible for movements in shadow economy. The supply shocks explain maximum 20% of forecast error variance of the shadow economy.

4. Conclusions

The paper has investigated the relationship between official and unofficial economies for te case of Romania using structural VAR methodology of Blanchard and Quah.

The size of the shadow economy as % of official GDP was estimated previously using a special case of the structural equation models-the MIMIC model, recording the value of 40% at the beginning of 2000 and following a descendent trend over the analyzed period.

The relationship between the two variables is further tested by imposing a long-run restriction in the Structural VAR model to analyze the effect in the size of Romanian shadow economy to a temporary shock in real GDP. The impulse response function generated by the Structural VAR confirms that in the short-run, a rise in the official economy will lead to a decrease in the size of the shadow economy.

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