The relationship between shadow economy and unemployment rate. A ARDL causality analysis for the case of Romania

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Abstract

The paper aims to investigate the nature of the relationship between the shadow economy (SE) and unemployment rates (both registered and ILO) for the case of Romania using Pesaran et al.(2001) bounds tests approach for cointegration. The study uses quarterly data covering the period 2000-2010. The size of Romanian shadow economy is estimated using the currency demand approach based on VECM models, stating that its size is decreasing over the analyzed period, from 36.5% at the end of 2000 to about 31.5% of real GDP at the middle of 2010.

The ARDL cointegration approach results show that in short-run both ILO and registered unemployment rate has a negative and statistically significant effect on the size of the shadow economy, while in the long-run the unemployment rates has a positive effect on shadow economy. The ARDL causality results revealed the existence of a long-run unidirectional causality that runs from unemployment rates to shadow economy.

Keywords: currency demand approach, ARDL cointegration approach, unemployment rates

1. Introduction

The paper aims to estimate the size of the Romanian shadow economy (SE) using the currency demand approach for quarterly data covering the period 2000-2010 and to investigate the relationship between the size of the shadow economy(SE) and the registered and ILO unemployment rates for the case of Romanian data using ARDL causality analysis.

This dual structure divides the paper into two main sections. The first part briefly presents the estimation of the size of Romanian shadow economy as % of official GDP using the currency demand approach.

The second part presents an overview of the empirical research analyzing the relationship between shadow economy and unemployment rates and investigates the
causality between them providing the data and methodology and finally the main econometrical outputs.

The main empirical results regarding the Romanian shadow economy estimates are obtained by both national and international studies using different estimation methods and are presented in table 1.

Table 1. The size of Romanian shadow economy (% of official GDP)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Approach</th>
<th>Period</th>
<th>Size of SE (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutul Național de Statistică</td>
<td>Labour input method</td>
<td>1998-2009</td>
<td>14.5%-23.5%</td>
</tr>
<tr>
<td>Schneider et al.(2010)</td>
<td>MIMIC model</td>
<td>1999-2006</td>
<td>34.4%-36.7%</td>
</tr>
</tbody>
</table>

As Schneider and Enste (2000) stated, no approach is exempt from criticism, the empirical results being different. So, if according to National Institute of Statistics, the informal activity represents between 14.5% and 23.5% of official GDP, Schneider et al.(2010) estimates the size of shadow economy in Romania to overcome the threshold of 35% of official GDP.

2. Estimating the size of Romanian shadow economy

2.1. Methodology and data

The size of Romanian shadow economy was estimated using one of the most commonly used indirect methods proposed by Caganda and Tanzi’s that assumes that shadow (or hidden) transactions are undertaken in the form of cash payments, so as to leave no observable traces for the authorities. An increase in the size of the shadow economy will therefore increase the demand for currency.

The size of the Romanian shadow economy based on the currency demand approach was estimated using multivariate cointegration and vector error correction models (VECM) in order to investigate whether a long-run equilibrium relationship exists between currency demand and its determinants.

Several empirical models were estimated:

M1: \[ C_t = \alpha_0 + \alpha_1 \cdot Y_t + \alpha_2 \cdot Tax_t + \alpha_3 \cdot R_{12t} + \alpha_4 \cdot WS_t + \epsilon_t \] (1)

M2: \[ C_t = \alpha_0 + \alpha_1 \cdot Y_t + \alpha_2 \cdot Tax_t + \alpha_3 \cdot R_{12t} + \alpha_4 \cdot WS_t + \epsilon_2t \] (2)

M3: \[ C_t = \beta_0 + \beta_1 \cdot Y_t + \beta_2 \cdot Tax_t + \beta_3 \cdot R_{12t} + \beta_4 \cdot Gov_t + \epsilon_3t \] (3)

M4: \[ C_t = \theta_0 + \theta_1 \cdot Y'_{at} + \theta_2 \cdot Tax_t + \theta_3 \cdot R_{12t} + \theta_4 \cdot E_t + \epsilon_4t \] (4)

M5: \[ C_t = \vartheta_0 + \vartheta_1 \cdot Y'_{at} + \vartheta_2 \cdot Tax_t + \vartheta_3 \cdot R_{12t} + \epsilon_5t \] (5)
M6: \( \frac{C}{M_2} = \gamma_0 + \gamma_1 \cdot Tax_t + \gamma_2 \cdot WS_t + \gamma_3 \cdot R_{r12t} + \gamma_4 \cdot Y_{pc} + \epsilon_{it} \) (6)

where:
- \( C \) is the currency in circulation outside the banks (at the end of the period in millions RON) normalized by the GDP deflator;
- \( \frac{C}{M_2} \) is of currency outside the banks and M2 (broad money);
- \( Y \) is real gross domestic product in millions RON, base year (2000=100);
- \( Y_{pc} \) is real GDP per capita;
- \( Y_d \) is real disposable income (GDP at current prices-taxes) normalized by GDP deflator;
- \( Y''_d \) is real disposable income (GDP at current prices-taxes+social benefits) normalized by GDP deflator;
- \( Tax \) is total tax revenues normalized by GDP;
- \( R_{r12} \) is 12-month Real Romanian inter-bank offered rate (ROBOR);
- \( R_{r3} \) is 3-month Real Romanian inter-bank offered rate (ROBOR);
- \( WS \) is the ratio of gross wages and salaries in national income;
- \( Gov \) is the ratio of final government consumption expenditure in GDP;
- \( E \) is the ratio of private consumption expenditure in GDP;
- \( \epsilon_i \), \( i = 1,\ldots,6 \) are the error terms.

Regarding the sign of the variables in the models, we expect a positive impact on currency demand for income, taxes, wages, government consumption, private consumption and a negative effect from the part of interest rates.

The time span covered by the series is from 2000:Q1 to 2010:Q2, the number of observation is 42. Apart from the real interest rates and the real currency outside banks, the data were seasonally adjusted by means of tramo seats method. All series were expressed in logarithmic form. The main sources used to collect the data are: Eurostat, National Bank of Romania and National Institute of Statistics. A description of the variables and their sources is summarized in the table 1 of Appendix.

### 2.2. Empirical results

#### 2.2.1. Estimating the currency demand approach

As a preliminary step, we carried out tests of non-stationarity for each series. Furthermore, Augmented Dickey-Fuller (ADF) and Philips-Perron (PP)) tests were employed in order to identify each variable’s integration level. Both tests were consistent with the hypothesis that the variables are level-unstationary but first difference stationary.

Since it has been determined that the variables under examination are integrated of order 1 then the Pantula principle and the Johansen and Juselius cointegration test were be performed. The tests suggest at least one cointegrating vector exists for each model considered, meaning that there is a long-run equilibrium relationship between the variables of the model.

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1 The expected positive impact of taxes on currency demand can be interpreted, following Tanzi: if the level of taxation increase, economic agents will be encourage engaging tax-evading activities, using currency, due to the intractability of cash, and than the currency rises (Brambilla Macias and Cazzavillan, 2009).

2 If the interest rate increases, the economic agents get ride to their currency holdings. The negative expected coefficient on the inflation variable reflects the fact that rising rates on inflation erode the value of money and encourage smaller volumes of currency holdings.
Given the non-stationarity of our series, traditional estimation methods are ruled out and we must then estimate a VAR model in which we shall include a mechanism of error correction model (ECM). The results of the VECM models are presented in table 2.

Table 2. Empirical results of VECM models

<table>
<thead>
<tr>
<th>Model</th>
<th>$M_1$</th>
<th>$M_2$</th>
<th>$M_3$</th>
<th>$M_4$</th>
<th>$M_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace Statistic</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Max. eigenvalue p-value</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

$C_{t-1}$

$Y_{t-1}$

$X_{t-1}$

$TAX_{t-1}$

$R_{t-1}$

$W_{t-1}$

$GOV_{t-1}$

$E_{t-1}$

Const.

$R^2$ | 0.47 |
| H. G. | 0.65 |
| Lag intercept | 88.62 |
| F-test | 32.78 |
| Autocorrelation Ljung-Box | 12.67 |
| Normality test | 0.97 |
| White test | 0.97 |
| AIC | -2.52 |
| BIC | -2.20 |

Note: All series used in the models are I(1). The numbers of lags in the models were determined using Schwarz's information criterion (SBC) and HQ. All models estimated assume one contemporaneous equation. $R^2$ is the coefficient of determination adjusted for the degrees of freedom (d.f.). LM test is the Lagrange multiplier test of residual serial correlation at lag order 8 following $x^2$ distribution with n-1 d.f. and White test is a heteroscedasticity test, following $x^2$ distribution. Standard errors are in parentheses, e.g., 0.05 is the standard error of the equation. [ ] denotes the prob. level. * indicates significance at the 5% level.

Analyzing the empirical results for all the six models, the best model was considered the model $M_1$ in which the coefficients for output, tax burden and wages have a positive long-run effect, while interest rate take the pressure off on currency demand.

This implies that an increase in the tax rate is likely to motivate individuals to participate in the underground economy in an attempt to increase their income. The coefficient on interest rates is negative as expected reflecting the increasing opportunity cost in holding currency balances when interest rates are rising. All coefficients are strongly statistically significant.

The significance of the error correction term (ECT) shows causality in at least one direction. The lagged error term ($EC_{t-1}$) in our results is negative and highly significant.
The error correction term for model $M_1$ as $-1.22 (0.20)$ indicates a high rate of convergence to equilibrium, which implies that deviation from the long-term equilibrium is corrected by 122% over each quarter. The coefficient of the error correction term is significant at 1% level and greater than unity implying a high speed of adjustment towards equilibrium.

2.2.2. Obtaining the size of Romanian shadow economy

After estimating the vector error correction model (VECM)\(^3\) and obtaining the coefficients for the long-run relationship of model $M_1$, we compute $\hat{C}$ using all the coefficients in equation (7). Then, we set the tax variable\(^4\) equal to zero and re-estimate the equation, keeping all the other coefficients unchanged to obtain $\hat{\hat{C}}$:

$$\hat{\hat{C}}_t = -16.40 + 1.80 \cdot Y_t + 4.42 \cdot \text{Tax}_t - 0.15 \cdot R_t + 1.85 \cdot \text{WS}_t$$  \hspace{1cm} (7)

The difference between these two variables, $\hat{C}$ and $\hat{\hat{C}}$, gives the amount of extra currency (EC) or illegal money in the economy. Following Tanzi (1983), we assume equal velocity in both the formal and informal and estimate it as follows:

$$\frac{Y_t}{M_1 - EC} = \nu$$  \hspace{1cm} (8)

Equation (8) yields the velocity of money in the Romanian economy. $Y$ is the gross domestic product, $M_1$ corresponds to total currency and deposits in circulation and extra currency (EC) for extra currency or illegal currency. The difference between $M_1$ and EC can be interpreted as the amount of legal money used in economy.

Once we estimate the velocity from equation (8), the dimension of shadow economy using the currency demand approach can be obtained multiplying EC by the velocity of money:

$$EC \ast \nu = Y_{\text{shadow}}$$  \hspace{1cm} (9)

The main idea behind the model is that a rise in the underground economy will cause an increase in demand for money. Following the Ahumada et al. (2007), we proceed to correct our estimates using their suggested method\(^5\):

$$\frac{Y_{\text{shadow}}}{Y_{\text{official}}} = \left( \frac{C_{\text{shadow}}}{C_{\text{official}}} \right)^{1 / \beta} = \left( \frac{Y_{\text{shadow}}}{Y_{\text{official}}} \right)^{1 / \beta}$$  \hspace{1cm} (10)

where: $Y$ is the GDP, $C$ is the currency, while $\beta$ is the income elasticity. The correction basically deflates the wrong ratio ($\frac{Y_{\text{shadow}}}{Y_{\text{official}}}$) that we obtained using inappropriately the assumption $\beta = 1$. Equation (12) corrects the estimation when $\beta = 1$.

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3 The long-run relationship between our variables was derived normalizing C.

4 The only reason tax rates would affect the use of cash is that cash is used as a means of evading taxes in the underground economy (Spiro, 1994).

5 Ahumada et al. (2007) show that it is wrong to assume the same velocity of money when the hypothesis $\beta = 1$ is rejected by the econometric estimation of the currency demand model. This is our case, since our model gives us a coefficient $\beta \approx 1.80$.
The empirical results of currency demand approach based on VECM models emphasizes that there is a general downward trend in the size of the shadow economy as % of official GDP for the period 2000-2010 with an highlight on two low periods, 2003Q1 and 2008Q4. Thus, the size of the shadow economy as % of official GDP measures approximately 36.6% in 2000Q1 and follows a downward trend after registering the value of 31% by 2008. For the past few quarters, there is a slightly upward trend in the size of Romanian shadow economy. The results are consistent with studies by Schneider (2007) and Albu (2007, 2010, 2011) which show a mainly downward trend of informal economy in Romania.

3. The relationship between unemployment rate and shadow economy in Romania. A ARDL causality analysis

The aim of this second part of the paper is to investigate the nature of the relationship between unemployment rates and the size of the Romanian shadow economy and to identify the direction of causality between them using ARDL cointegration and causality approach.

According to Giles and Tedds (2002), two opposing forces determine the relationship between unemployment and the informal economy. On the one hand, an increase in the

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6 It is important to note that because of its undetectable nature and character, it is nearly impossible to measure precisely the size of economic activities taking place in the informal economy of any country in the world, whether developed or less developed. Given this, any theoretical or empirical inference derived from these results should always be regarded as an approximation. In the face of these difficulties, the results drawn from these estimates should be interpreted with due reserve, given the limitations of the methods.

7 Regarding the Romanian unemployment data, there are two measures available for unemployed persons: the first is the registered unemployment rate, who is calculated by National Agency for Employment (NAE) and based on statements of people who pass by employment agencies and said that they are unemployed and the ILO unemployment rate, who is published quarterly by the National Institute of Statistics and is based on labour force survey (LFS).
unemployment rate may involve a decrease in the informal economy because it is positively related to the growth rate of GDP and eventually negatively correlated with unemployment (Okun's law). On the other hand, increase in unemployment leads to an increase in people working in the informal economy because they have more time for such activities.

Dell’Anno and Solomon (2007) stated that there is a positive relationship in the short-run between unemployment rate and U.S. shadow economy for the period 1970-2004. Using SVAR analysis, they investigate the response of the shadow economy to an aggregate supply shock (impact of the shadow economy to a temporary shock in unemployment). The empirical results show that in the short-run, a positive aggregate supply shock causes the shadow economy to rise by about 8% above the baseline.

3.1. Methodology and data

The data used in the research covers the period 2000:Q1-2010Q2. The variables used are as follows: the size of the Romanian shadow economy expressed as % of official GDP (SE) obtained by currency demand approach; ILO unemployment rate (ILO_U) and registered unemployment rate (R_U). The unemployment rates were seasonally by means of tramo seats method. The main source of the data for unemployment rates is the National Institute of Statistics (Tempo database) and the National Bank of Romania.

In order to investigate the relationship between shadow economy and unemployment rate, we estimate the models:

\[ SE_t = \alpha_1 + \beta_1 \cdot R_{UR_t} + \varepsilon_{t1} \]  
\[ SE_t = \alpha_2 + \beta_2 \cdot ILO_{UR_t} + \varepsilon_{t2} \]

where:
- \( SE_t \) is the size of Romanian shadow economy as % of official GDP obtained through ARDL models;
- \( R_{UR_t} \) is the registered unemployment rate;
- \( ILO_{UR_t} \) is the ILO unemployment rate;
- \( \alpha_1, \alpha_2 \) are constants;
- \( \varepsilon_{t1}, \varepsilon_{t2} \) is the disturbance terms.

According to Pesaran et al. (2001) approach, in the first step we have verified the cointegration using the bounds test approach. In the second phase, once the cointegration confirmed, we estimate the long-run coefficients of the level equations (11)-(12) and the short-run dynamic coefficients using the ARDL error correction models. To ascertain the goodness of fit of the ARDL models, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, functional form, normality, and heteroscedasticity associated with the model. The parameter stability was tested using the CUSUM and CUSUMSQ tests. Finally, we tested the direction of causality within the conditional Granger causality tests using the ARDL mechanism as a long-run context. The F-statistics for the short-run causations and the t statistics of ECTs (error correction term) for the long-run causations must be statistically significant to achieve Granger causality between the shadow economy and the unemployment rates.
3.2. Empirical results

Investigating the possibility of cointegration between the shadow economy and the unemployment rates using the bounds tests within the ARDL modeling approach, the empirical results show that in short-run both ILO unemployment rate and registered unemployment rate has negative and statistically significant effect on shadow economy; however in the long-run both unemployment rates have a positive effect on shadow economy.

The long-run estimated R\textsubscript{UR} and ILO-UR coefficients state that 1% increase in registered unemployment rate yields an average 0.40% increase in the size of the shadow economy, while a 1% increase in ILO unemployment rate yields an average 2.17% increase in the size of the shadow economy.

Finally, we tested the direction of causality within the conditional Granger causality tests using the ARDL mechanism.

<table>
<thead>
<tr>
<th>Table 3. Results of Granger Causality for SE and R\textsubscript{UR} and SE and ILO\textsubscript{UR}</th>
</tr>
</thead>
</table>

\begin{tabular}{lcc}
\hline
F-statistics & SE & R\textsubscript{UR} & SE \hspace{1cm} $t$-stat (prob) \hspace{1cm} for EC\textsubscript{1,2} \\
\hline
SE & 3.176* & -2.573* & [0.034] [0.0166] \\
R\textsubscript{UR} & - & 0.244 & -1.453 & [0.9393] [0.1590] \\
\hline
\end{tabular}

The empirical results revealed the existence of a long-run uni-directional causality that runs from the registered unemployment rate to the shadow economy. In table 3, the significance of F-statistic value confirms the short-run causality from registered unemployment rate to shadow economy. The negatively and significance of error correction term provide evidence of long-run causality. The error correction term is significant with the expected sign that confirm long-run unidirectional causality from unemployment rates to shadow economy as we concluded through bound test. Therefore, in the long-run we have proved that there is a unidirectional causality that runs from unemployment rate (registered or ILO) to shadow economy.

4. Conclusions

In this paper, we used the currency demand approach in order to obtain a measure of the Romanian shadow economy expressed as % of official GDP and we investigate the relationship between unemployment rate and the size of the shadow economy using ARDL causality analysis. The Romanian shadow economy as % of official GDP is estimated using vector error correction models, and its size is decreasing over the analyzed period, from 36.5% at the end of 2000 to about 31.5% of real GDP at the middle of 2010.
The dynamic relationship between shadow economy as % of official GDP obtained through VECM models and unemployment rate for the case of Romania has been investigated using quarterly time series data from 2000-2010.

To investigate long-run causal linkages and short-run dynamics, ARDL causality tests are applied. Cointegration test results shows that in short-run both ILO unemployment rate and registered unemployment rate has negative and statistically significant effect on shadow economy; however in the long-run both unemployment rates have a positive effect on shadow economy.

The ARDL causality results revealed the existence of a long-run uni-directional causality that runs from the both unemployment rates to the shadow economy.

One possible explanation of the negative impact in the short run can be the the inability of the labor market to provide more jobs whether they are official or 'hidden'/unregistered (clandestine in some extent of course) in the event of rising unemployment, underlining a limitation of opportunities to work in the informal economy. But on the long run, an increase in unemployment leads to an expansion of the activities in the shadow economy, underlining a positive impact on the size of the shadow economy.

References


*** Quarterly National Accounts database, Eurostat.
*** Quarterly Labor Force Survey database, Eurostat.
*** Quarterly Interest Rates database, Eurostat.
*** Quarterly Monetary and Financial Statistics database, Eurostat.
*** Employment and Unemployment database, Eurostat.
### APPENDIX

#### Table 1. The description and source of the data

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td>Natural logarithm of real currency holdings measured as nominal currency in circulation normalised by GDP deflator (2000=100). 2000Q1-2010Q2 in national currency (mil. RON). The values of currency, bills and coins outside the banking system are those at the end of the quarter.</td>
<td>The series of nominal currency is available in National Bank of Romania Monthly Bulletins 2000-2010. The series of GDP deflator (2000=100) is available in Eurostat, Quarterly National Accounts database.</td>
</tr>
<tr>
<td>$C'/M_s$</td>
<td>Natural logarithm of the ratio of currency holdings to money supply. 2000Q1-2010Q2.</td>
<td>The series are available in National Bank of Romania Monthly Bulletins 2000-2010.</td>
</tr>
<tr>
<td>$M_1$</td>
<td>Natural logarithm of monetary aggregate $M_1$, 2000Q1-2010Q2 in national currency (mil. RON).</td>
<td>The series are based on the methodology of European Central Bank beginning with 2007 produce some changes in monetary aggregates $M_1$ which includes from 2007 in addition to the structure employed until December 2006, the demand deposits of household savings expressed in RON and sight foreign currency deposits of residents previously included in money supply, being considered as having the same degree of liquidity as the demand deposits of economic agents. The series has been recalculated for the period 2009-2008 using data from National Bank of Romania, Monthly Bulletins 2000-2010.</td>
</tr>
<tr>
<td>$Y$</td>
<td>Natural logarithm of real GDP (2000=100), 2000Q1-2010Q2 in national currency (mil. RON).</td>
<td>The series is available in Eurostat, Quarterly National Accounts database.</td>
</tr>
<tr>
<td>$Y_{pc}$</td>
<td>Natural logarithm of real GDP per capita, 2000Q1-2010Q2 in national currency (mil. RON).</td>
<td>All per capita values are calculated using population data for persons aged 15 and older, from Eurostat Quarterly Labor Force Survey database and Quarterly National Accounts database.</td>
</tr>
<tr>
<td>$Y'd$</td>
<td>Natural logarithm of real disposable income (GDP at current prices - taxes) normalised by GDP deflator, 2000Q1-2010Q2 in national currency (mil. RON).</td>
<td>The series is computed based on official data from Eurostat Quarterly Government Finance Statistics and Quarterly National Accounts databases.</td>
</tr>
<tr>
<td>$Y'd'$</td>
<td>Natural logarithm of real disposable income (GDP at current prices - taxes + social benefits) normalised by GDP deflator, 2000Q1-2010Q2 in national currency (mil. RON).</td>
<td>The series is computed based on official data from Eurostat Quarterly Government Finance Statistics and Quarterly National Accounts databases.</td>
</tr>
<tr>
<td>Tax</td>
<td>Natural logarithm of total tax revenues (taxes on production and imports, current taxes on income, wealth, social contributions) over GDP, 2000Q1-2010Q2 in %.</td>
<td>The series is available in Eurostat, Quarterly Government Finance Statistics database.</td>
</tr>
<tr>
<td>$R_{s1}$</td>
<td>Natural logarithm of 1-month Real Romanian inter-bank offered rate (ROBOR), 2000Q1-2010Q2 in %.</td>
<td>The series is calculated using nominal interest rate from Eurostat, Quarterly Interest Rates database, National Bank of Romania.</td>
</tr>
<tr>
<td>$R_{s3}$</td>
<td>Natural logarithm of 3-month Real Romanian inter-bank interest rate, 2000Q1-2010Q2 in %.</td>
<td>The series is calculated using nominal interest rate and average inflation rate from Eurostat, Quarterly Interest Rates database, National Bank of Romania, respectively National Statistics Institute TEMPO database.</td>
</tr>
<tr>
<td>Gov</td>
<td>Natural logarithm of the rate of final government consumption expenditure in GDP, 2000Q1-2010Q2 in %.</td>
<td>The series is available in Eurostat, Quarterly Government Finance Statistics database.</td>
</tr>
<tr>
<td>$E$</td>
<td>Natural logarithm of the rate of private consumption expenditure in GDP, 2000Q1-2010Q2 in %.</td>
<td>Private consumption expenditure includes the consumption expenditures of households and non-profit institutions serving households (NPISHs). The series is available in Eurostat, Quarterly National Accounts database.</td>
</tr>
<tr>
<td>$R_{UR}$</td>
<td>Registered unemployment rate, 2000Q1-2010Q2 in %.</td>
<td>The series is available in Monthly Bulletins 2000-2010, National Bank of Romania.</td>
</tr>
<tr>
<td>$HLO_{UR}$</td>
<td>HLO unemployment rate, 2000Q1-2010Q2 in %.</td>
<td>The series is available on Tempo database, National Institute of Statistics.</td>
</tr>
</tbody>
</table>