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Investments as a Factor Influencing Employment in Bulgaria

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Abstract. In correspondence with the Keynesian concept, that entrepreneurs' expectations define their inclination to invest and to create jobs [6, 13] as well as the goals of the National Employment Action Plan for 2017 to stimulate investments and to increase the number of employed [17] in current article are built some regression models. Through them is studied the relation between coefficient of employment, which is dependent variable and the following factor variables: gross fixed capital formation; interest rate on long-term consumer credits; interest rate on long-term credits for non-financial corporations. On the basis of the specified regression models some conclusions are drawn up.

Keywords: employment, investments, regression model, coefficient of employment

1 Introduction

The average annual employment rate in Bulgaria in 2016 for the age group 20 to 64 years is 67.7% and is below the target level of 75%, that is pointed out in Europe 2020 strategy. The last one is difficult for achievement due to the fact that in 2016 the number of employed aged 15-64 is with 351.9 thousand persons smaller than their number in pre-crisis 2008 year [30]. In order to overcome these negative findings, the purpose of the present study is to investigate the relationship between the employment rate in Bulgaria and factors influencing it. Their identification requires in following lines to be done brief presentation of studies related with regressors influencing employment.

2 Review of Related Literature

O. Kitov and I. Kitov modify the Okun's law[1] and instead of unemployment rate as a variable they use employment rate. The authors find out that there is a high degree of dependence between GDP and employment. On the basis of the created econometric model they predict employment levels in Japan, Australia, France, Canada, United Kingdom and USA [14]. At the same time, A. Loboguerrero and U. Panizza investigate the impact of inflation, but not on the level

[1] Okun's law states that unemployment increases with 1% above its natural level if aggregate production is reduced with two to three percents below the overall economic potential [18].

of unemployment, as in the Phillip's curve,[2] but on the level of employment. They establish that in developed economies with growth of inflation the employment rate is increasing [15].

According to different authors the dynamics of exchange rates has a significant impact on the economy and in particular on the level of employment in the respective country. In particular with devaluation of national currency the export increases and import decreases. As a consequence of the increased exports and reallocation of the costs towards the domestic market the investments in long-term assets are increasing and unemployment is decreasing. At the same time it should be noted that frequent fluctuations in the exchange rate increase the amount of transaction costs and risk. Due to this the export is decreasing as well as the production and employment [1, 3, 10, 26]. J. Döpke establishes similar regularity. He also explores the impact of employers' labour costs on employment in Europe and notes that with their growth the employment is decreasing [5]. In other words, concerning the labour market J. Döpke confirms the neoclassical thesis. The feedback between labour costs and employment is also proven by J. Suedekum and U. Blien [25].

L. Stanila, M. Andreica and A. Cristescu on the basis of panel data specified linear regression model. Dependent variable in the model is the employment rate, and factor variables are some key economic indicator (GDP, Foreign direct investments, average gross earning). The obtained results give grounds to be concluded that the link between remittances and employment rate is reversed [22]. Concerning foreign direct investment (FDI) C. Jude, M. Silaghi [11], M. Mamoon and A. Rahman [16] point out that their importance for increasing the employment is insignificant in comparison with their importance for restructuring the economy. Similar thesis is defended by N. Karim and K. Yin. According to the authors through FDI is secured transfer of technology and know-how, but for increasing the employment and the capacity of production in Malaysia the internal investments from private sector are essential [12]. This point of view is also asserted by B. Bayraktar according to whom FDI can only be additional to domestic, but the last ones are those that contribute for increasing the employment level [2]. The position of D. Psaltopoulos, D. Skuras and K. Thomson is similar to those presented above. The authors analyze the impact of investments on employment in less developed regions of Southern Europe. They find out that the effect of investment on employment in different sectors of regional economies is totally different. In this regard the scientific team has concluded that the competent authorities should take into account the structure of regional economy and to direct investment to those sectors, which are characterized with higher labour productivity [20]. The importance of investment as a factor influencing employment is also studied by V. Escudero, S. Tobin et al. They emphasize that investments are main job generator and means for increasing labour productivity. The authors develop scenarios on the basis of which they estimate the impact of investment on employment in European Union. In the first scenario the investments are allocated proportionally among the member states in correspondence with their GDP and in the second they are allocated in correspondence with the level of unemployment. By means of econometric models the authors prove that the second scenario has a stronger positive impact on employment and as result of the investments 2.0 million workplaces will be generated [8]. The importance of investment to create

[2] The Phillip's curve presents graphically the inverse relationship between unemployment rate and inflation rate [18].

additional workplaces is undeniable. In macroeconomic theory, their size is associated with the interest rate. The changes in its value has impact on key macro indicators such as GDP, price level, employment rate, current account of balance of payment and etc. Regarding the investments it is assumed that the decrease in the interest rate leads to a decrease in the investment costs and this motivates the investment activity [7, 22]. This thesis is shared by A. Cray and others, and E. Okon and O. Osinimu. The researchers point out that the decrease in interest rates stimulates investment and is a prerequisite for hiring additional labour [4, 19]. The relationship between investment and interest rates is not always so trivial. Some empirical studies lead to results, which are in contradiction with theory. For example, in some of them is established positive correlation between investments and interest rate and in others there is not relation between variables [28]. These results are not unexplainable and are possible in different situations.

3 Specification of Regression Models

On the basis of the presented above and in correspondence with Keynesians concept that entrepreneurs 'expectations define their intentions to invest and to create workplaces,[3] R. Kahn's employment multiplier[4] as well as the goals set up in the National Employment Action Plan for 2017 to encourage investment and to increase the number of employed [17] in following lines on the basis of regression models is studied the relation between: employment rate (KE), which is a dependent variable and the following factor variables: gross fixed capital formation (GC); interest rate on long-term loans for households (IRCL); interest rate on long-term loans for non-financial enterprises (IREL). The regression models are based on time series for Bulgaria for the period 2000-2016.The sources of time series are the National Statistical Institute (NSI) and the Bulgarian National Bank (BNB).

Table 1: Factors influencing employment in Bulgaria during the period 2000-2016

Years	Rate of Employment, %	Gross Fixed Capital Formation, billion BGN	Interest Rate on Long-Term Loans for Households, %	Interest Rate on Long-Term Loans for Non-Financial Enterprises, %
2000	49.9	7.4594	17.12	13.33

[3] According to J. Keynes the insufficient effective demand is the main reason for unemployment. When demand is not enough the capital owners are not inclined to invest and to create new workplaces. So in situation of depression and pessimistic expectations of entrepreneurs the changes in interest rates do not affect investment decisions. Due to this opportunities for economic development should be sought in state intervention. The state through the implemented monetary and fiscal policy should stimulate the effective demand. Thus the contemporary employment policy is linked with the Keynesian concept of efficient demand management. By means of macroeconomic stimulation is generated increase in effective demand, which leads to growth in investment, output and employment [6].

[4] Closely related with the concept of J. Keynes for overcoming the economic crisis through state's intervention is R. R. Kahn's theory of employment multiplier, which is developed later by the first one (J. Keynes). According to R. Kahn with increase of domestic investment made by the state, the primary employment is rising. As a consequence the incomes and purchasing power of economic subjects are increasing. They generate secondary, tertiary, and so on employment. In this way through state investment primary employment is created. It is multiplied and leads to growth in total employment. R. Kahn's multiplier can be presented as a ratio between the growth of total employment and the growth of primary employment [18].

2001	49.7	8.9387	17.15	12.92
2002	50.7	9.6660	16.29	12.35
2003	52.5	10.9083	15.68	10.91
2004	54.2	12.4122	13.82	10.87
2005	55.8	15.7304	11.85	10.03
2006	58.6	17.7676	10.18	9.24
2007	61.7	20.0873	9.75	9.19
2008	64.0	24.4997	10.86	10.5
2009	62.6	20.1699	13.45	10.43
2010	59.8	16.6063	12.69	10.01
2011	58.4	15.8707	12.02	9.79
2012	58.8	16.1576	11.38	8.97
2013	59.5	16.2030	10.66	8.04
2014	61.0	16.7573	10.37	6.87
2015	62.9	17.2032	9.49	6.48
2016	63.4	16.0610	8.61	4.82

Source: NSI, BNB

The essence of the variables used in the linear regression models is presented below:

✓ **Rate of Employment**

In this paper the employment rate is dependent variable. It is calculated by the NSI as a ratio between the employed persons and the population on the same age. In this study, the employment rate is determined for the age group from 15 to 64 years [24, 30].

✓ **Gross Fixed Capital Formation**

According to the Keynesian concept of employment and unemployment the investment is one of the main factors contributing for employment growth. In this paper the gross fixed capital formation is used as an indicator for the amount of investments made in the national economy. According to the methodology of the NSI the indicator includes the costs for acquiring the following types of long-term non-financial assets: buildings, equipments, vehicles, productive and working animals, software products etc. In other words these are investments in assets that are used in production for more than one year [30].

✓ **Interest Rate on Long-Term Loans for Households and Interest Rate on Long-Term Loans for Non-Financial Enterprises**

These are annual effective interest rates of consumer loans with a term of more than one year and annual effective interest rates of loans for non-financial enterprises with a term of more than one year. As was mentioned above according to the macroeconomic theory the relationship between interest rates and employment rate should be opposite. The reduction of interest rates stimulates households and firms to conclude contracts for providing loans, to invest and to consume goods and services. This increases aggregate demand, production and labor demand. At the same time the growth of interest rates has the opposite effect – fall in aggregate demand, production and labour demand.

In current study four two-variable regression models with dependent variable employment rate (KE_t) are specified. In the first model the factor variables are gross fixed capital formation

(GC_t) and interest rate on long-term loans for non-financial enterprises ($IREL_t$). In the second model the independent variables are gross fixed capital formation (GC_t) and interest rate on long-term loans for households ($IRLC_t$). In the third model the factor variables are gross fixed capital formation for the previous year (GC_{t-1}) and interest rate on long-term loans for non-financial enterprises ($IREL_t$). In the fourth model independent variables are gross fixed capital formation for the previous year (GC_{t-1}) and interest rate on long-term loans for households ($IRLC_t$). As gross fixed capital formation is independent variable in all four two-variable regression models a single-equation regression model has been specified with it as a regressor (GC_t) and dependent variable is the employment rate (KE_t). Gross fixed capital formation (GC_t) is used not only as a factor variable but also as a dependent variable in two single-equation regression models with factor variables interest rate on long-term loans for households ($IRLC_t$) and interest rate on long-term loans for non-financial enterprises ($IREL_t$).

- **Single-Equation Regression Models Between the Dependent Variable – Employment Rate (KE_t) and Independent Variable – Gross Fixed Capital Formation (GC_t)**

The single equation regression model between the employment rate and gross fixed capital formation is:

$$KE_t = \beta_1 + \beta_2 GC_t + u_t \quad (1)$$

KE_t – the employment rate, empirical values, %;
GC_t – gross fixed capital formation, billion BGN;
u_t – residuals around the regression line.

The parameters of the models are presented in formula (2):

$$\hat{KE}_t = 42.27 + 1.01 GC_t \quad (2)$$

$\hat{KE}_t$ – theoretical values of the employement rate calculated on the basis of the regression model.

Through LM Breusch-Godfrey test from 2nd order is performed verification for autocorrelation in the residuals around the regression line [9]. By means of the test is established that the multiplication between the number of observations and the coefficient of determination (R^2) is 10.23 and is greater than the critical value $\chi^2 = 5.99$ reported from the values for χ^2-distribution at two degrees of freedom and level of significance $\alpha = 0.05$. When χ^2 empirical is bigger than χ^2 critical the zero hypothesis for lack of autocorrelation is rejected and the alternative is accepted [9].

In present study the autocorrelation is removed by means of the most oftenly used approach for this purpose – the method of autoregressive transformation [27]. It is applied in the following order:

- Firstly, if the residuals around the regression line are autocorrelated a first-order autocorrelation coefficient is calculated [23, 27]:

$$r_{u_t u_{t-1}} = \frac{\sum_{t=2}^{N} u_t u_{t-1}}{\sum_{t=1}^{N} u_t^2}, \quad (3)$$

u_t – the residual elements around the regression line.

The relation between autocorrelated residual elements can be expressed through first-order autoregressive model as a Markov process [9, 27]:

$$u_t = \rho u_{t-1} + \varepsilon_t, \quad (4)$$

ρ is a constant coefficient for all values of t;
ε_t – random deviations, independent from each other. They can be expressed as follows:

$$\varepsilon_t = u_t - \rho u_{t-1} \quad (5)$$

On the basis of formula (5) the authors D. Cochrane and G. Orcutt suggest dependent variable (Y) and independent variable (X) from the single-equation regression model to be transformed in the following way [27]:

$$Y_t^{'} = Y_t - \rho Y_{t-1} \; ; \; X_t^{'} = X_t - \rho X_{t-1} \quad (6)$$

This transformation is called autoregressive as it is based on equation (4), which is an autoregressive first-order model. On the basis of formula (6) the transformation of the regression model from formula (1) acquires the type [9, 27]:

$$(KE_t - \rho KE_{t-1}) = \beta_1(1-\rho) + \beta_2(GC_t - \rho GC_{t-1}) + \varepsilon_t \quad (7)$$

$$KE_t^{'} = \beta_1^{'} + \beta_2 GC_t^{'} + \varepsilon_t \quad (8)$$

The determination of the constant coefficient ρ is a significant problem in the application of the autoregressive transformation. D. Cochrane and G. Orcutt suggest ρ to be replaced with the first-order coefficient of autocorrelation calculated by means of formula (3). The authors prove that $\rho \approx r_{u_t u_{t-1}}$ [27].

- Secondly, with the first-order autocorrelation coefficient and through formula (6) is performed the autoregression transformation and the values of the variables $KE_t^{'}$ *and* $GC_t^{'}$ are calculated [27].
- Thirdly, with the transformed values of the two variables and on the basis of equation (8) is built regression model. The residuals around the regression line should not be autocorrelated [27].

On the basis of the presented in equation (2) and through formula (3) is calculated the first-order coefficient autocorrelation ($\rho \approx r_{u_t u_{t-1}}$). Its value is 0.583. It is used in formula (7) in realization of autoregression transformation. With the transformed values of $KE_t^{'}$ *and* $GC_t^{'}$ the following regression model is received:

$$\begin{aligned} &\hat{KE}_t^{'} = 19.553 \; + \; 0.759 GC_t^{'} \\ &se = (1.239390) \;\; (0.170446) \;\; r^2 = 0.586419 \\ &t \; = \; (15.77629) \;\; (4.455407) \;\; df = 14 \\ &p = (0.0000) \;\;\;\; (0.0005) \;\; F_{1,14} = 19.85065 \end{aligned} \quad (9)$$

The model's parameters are statistically significant. From formula (9) is visible that the empirical t-criterion of the regression coefficient is 4.4554. The theoretical value of Student's t-distribution for α = 0.05 and 14 degrees of freedom is 1.753. In other words the theoretical value is smaller than the empirical value. The null hypothesis is rejected and the alternative is assumed, which means that the regression coefficient is statistically significant. The significance of the regression model is checked with F-test. At level of significance α = 0.05 and degrees of freedom (k-1) and (n-k) amounting to 1 and 14 the theoretical value of F_t is 4.60. It is smaller than $F_{emp.}$, which amounts to 19.8506. Due to this the alternative hypothesis is accepted or the regression model is statistically significant. Through LM Breusch-Godfrey test from 2nd order is performed verification for autocorrelation in the residuals around the regression line. It is established that the multiplication of the number of observations and R^2 is 3.9775 and is smaller than the critical value $\chi^2 = 5.99$, which is reported from the χ^2-distribution values at two degrees of freedom and level of significance α = 0.05. As χ^2 empirical is smaller than χ^2 critical the zero hypothesis for lack of autocorrelation is accepted.

It is logical to suppose that the amount of investments from the previous period has an impact on the level of employment in the current one. In this connection is specified regression model with factor variable – gross fixed capital formation for the previous year (GC_{t-1}) and dependent variable – the current level of employment (KE). The parameters of the initial regression model are presented in formula (10):

$$\begin{aligned} &\hat{KE}_t = 44.520 - 0.897GC_{t-1} \\ &se = (1.9906397) \quad (0.119037) \quad r^2 = 0.802523 \\ &t = (23.35325) \quad (7.54283) \quad df = 14 \\ &p = (0.0000) \quad (0.0000) \quad F_{1,14} = 56.89420 \end{aligned} \tag{10}$$

The autocorrelation in the residuals around the regression line is eliminated by means of the method of autoregression transformation in which ρ is 0.53947. With the transformed values of $KE_t^{'}$ and $GC_{t-1}^{'}$ is received the following regression model:

$$\begin{aligned} &\hat{KE}_t^{'} = 23.053 + 0.595GC_{t-1}^{'} \\ &se = (1.408491) \quad (0.175978) \quad r^2 = 0.468178 \\ &t = (16.36748) \quad (3.382939) \quad df = 13 \\ &p = (0.0049) \quad (0.0000) \quad F_{1,13} = 11.44428 \end{aligned} \tag{11}$$

The regression model and its parameters are statistically significant. Through LM Breusch-Godfrey test from 2nd order is performed verification for autocorrelation in the residuals around the regression line. The zero hypothesis for lack of autocorrelation is accepted as χ^2 empirical (3.35) is smaller than χ^2 critical (5.99).

- **Single-Equation Regression Models Between the Dependent Variable Gross Fixed Capital Formation (GC_t) and Independent Variables – Interest Rate on Long-Term Loans for Non-Financial Enterprises ($IREL_t$) and Interest Rate on Long-Term Loans for Households ($IRLC_t$)**

The two linear regression model with dependent variables GC_t and independent variables $IRCL_t$ and $IREL_t$ are presented in table 2. Through LM Breusch-Godfrey test from 2nd order is established that the residuals around the regression line in both models are autocorrelated.

The elimination of autocorrelation is realized through autoregression transformation. For the first model the first-order coefficient of autocorrelation by means of which is realized autoregression transformation is $\rho \approx r_{u_t u_{t-1}} = 0.71174$ and for the second is 0.62301. The results from the regression analysis with the transformed values of the three variabes (GC_t', $IREL_t'$ and $IRCL_t'$) are presented in table 3. The verification for autocorrelation is realized through LM Breusch-Godfrey test. In the first model $\chi^2_{empirical}$ is 3.099 and in the second $\chi^2_{empirical}$ is 3.550.

Table 2: Single-Equation Regression Models with Dependent Variable GC_t and Independent Variable $IREL_t$ and $IRCL_t$

Factors Variables	Results from the Regression Analiz	LM Breusch-Godfrey test from 2nd order for autocorrelation
1. Interest Rate on Long-Term Loans for Non-Financial Enterprises ($IREL_t$)	$\hat{GC_t} = 25.128 - 0.999IREL_t$ $se = (4.307663)\quad (0.433664)\qquad r^2 = 0.26154$ $t = (5.833304)\quad (-2.304896)\qquad df = 15$ $p = (0.0000)\quad (0.0259)\qquad F_{1,15} = 5.312543$	Obs*R^2 = 10.01545 Prob. Chi-Square(2) 0.0067
2. Interest Rate on Long-Term Loans for Households (IRLCt)	$\hat{GC_t} = 30.901 - 1.243IRCL_t$ $se = (3.332107)\quad (0.262091)\qquad r^2 = 0.600087$ $t = (9.273816)\quad (-4.744274)\qquad df = 15$ $p = (0.0000)\quad (0.0003)\qquad F_{1,15} = 22.50814$	Obs*R^2 = 9.049688 Prob. Chi-Square(2) 0.0108

The zero hypothesis for lack of autocorrelation is accepted as the empirical values are smaller than $\chi^2_{critical}$ which is 5.99. By means of F-test, $\alpha = 0.05$ and degrees of freedom (k-1) and (n-k) is established that the two regression models are statistically insignificant (table 3). **In other words the interest rates on long-term loans for non-financial enterprices and interest rates on long-term loans for households do not have influence on gross fixed capital formation.**

Table 3: Single-Equation Regression Models with Dependent Variable GC_t' and Independent Variable $IREL_t'$ and $IRCL_t'$

Factors Variables	Results from the Regression Analiz	LM Breusch-Godfrey test from 2nd order for autocorrelation
1. Interest Rate on Long-Term Loans for Non-Financial Enterprises (IRELt')	$\hat{GC_t'} = 3.956 - 0.435IREL_t'$ $se = (1.421543)\quad (0.565182)\qquad r^2 = 0.040559$ $t = (2.782802)\quad (0.769302)\qquad df = 14$ $p = (0.0147)\quad (0.4545)\qquad F_{1,14} = 0.591825$	Obs*R^2 = 3.099135 Prob. Chi-Square(2) 0.2123
2. Interest Rate on Long-Term Loans for Households ($IRLC_t'$)	$\hat{GC_t'} = 9.09 - 0.647IRCL_t'$ $se = (1.824981)\quad (0.413454)\qquad r^2 = 0.148756$ $t = (4.980680)\quad (-1.564136)\qquad df = 14$ $p = (0.0002)\quad (0.1401)\qquad F_{1,14} = 2.446521$	Obs*R^2 = 3.550068 Prob. Chi-Square(2) 0.1695

- **Two-Variable Regression Models with Dependent Variable – Employment Rate (KE_t) and Factor Variables – Gross Fixed Capital Formation (GC_t), Interest Rate on Long-Term Loans for Non-Financial Enterprises ($IREL_t$) and Interest Rate on Long-Term Loans for Households ($IRLC_t$)**

In the above paragraph has been established that between gross fixed capital formation, interest rate on long-term loans for non-financial enterprises and interest rate on long-term loans for households there are no relation. This gives grounds these variables to be included in two-variable regression models. They are presented in table 4. Through LM Breusch-Godfrey test from

2nd order is established that the residuals in the first two models are not autocorrelated. Both linear regression models as well as their parameters are statistically significant.

Table 4: Two-Varable Regression Models

Factors Variables	Results from the Regression Analiz	LM Breusch-Godfrey test from 2nd order for autocorrelation
1. Gross Fixed Capital Formation (GC_t) and Interest rate on Long-Term Loans for Non-Financial Enterprices ($IREL_t$)	$\hat{KE}_t = 54.480 + 0.776GC_t - 0.889IREL_t$ $se = (2.104320)\ (0.069767)\ (0.136360)\ r^2 = 0.958791$ $t = (25.88978)\ (11.12795)\ (-6.519447)\ df = 14$ $p = (0.0000)\ (0.0000)\ (0.0000)\ F_{2,14} = 162.8646$	Obs*R^2 = 3.641462 Prob. Chi-Square(2) 0.1619
2. Gross Fixed Capital Formation for the Previous Year (GC_{t-1}) and Interet Rate on Long-Term Loans for Non-Financial Enterprices ($IREL_t$)	$\hat{KE}_t = 55.629 + 0.719GC_{t-1} - 0.883IREL_t$ $se = (2.339342)\ (0.076342)\ (0.164092)\ r^2 = 0.938828$ $t = (23.77984)\ (9.421968)\ (-5.382074)\ df = 13$ $p = (0.0000)\ (0.0000)\ (0.0001)\ F_{2,13} = 99.75704$	Obs*R^2 = 2.918798 Prob. Chi-Square(2) 0.2324
3. Gross Fixed Capital Formation (GC_t) and Interest rate on Long-Term Loans for Households ($IRCL_t$)	$\hat{KE}_t = 59.974 + 0.596GC_t - 0.890IRCL_t$ $se = (2.378031)\ (0.070885)\ (0.126727)\ r^2 = 0.958826$ $t = (25.22001)\ (8.412119)\ (-7.025008)\ df = 14$ $p = (0.0000)\ (0.0000)\ (0.0000)\ F_{2,14} = 151.3681$	Obs*R^2 = 7.125667 Prob. Chi-Square(2) 0.0284
4. Gross Fixed Capital Formation for the Previous Year (GC_{t-1}) and Interet Rate on Long-Term Loans for Households ($IRCL_t$)	$\hat{KE}_t = 57.822 + 0.631GC_{t-1} - 0.7824IRCL_t$ $se = (4.655286)\ (0.139014)\ (0.223138)\ r^2 = 0.911397$ $t = (12.42076)\ (4.543530)\ (-3.504214)\ df = 13$ $p = (0.0005)\ (0.0035)\ (0.0000)\ F_{2,13} = 72.00367$	Obs*R^2 = 7.319766 Prob. Chi-Square(2) 0.0257

In the third and the fourth model there is autocorrelation. For the third model the first-order coefficient of autocorrelation ($\rho \approx r_{u_t u_{t-1}}$) is 0.36102 and for the fourth is 0.54859. Through formula (7) the autoregression transformation is realized. With the transformed values of $KE_t^{'}, GC_t^{'}, GC_{t-1}^{'}$ *and* $IRCL_t^{'}$. the following models are received:

$$\begin{aligned} &\hat{KE}_t^{'} = 38.532 + 0.614GC_t^{'} - 0.9467IRCL_t^{'} \\ &se = (1.747285)\ (0.091628)\ (0.170173)\ r^2 = 0.889722 \\ &t = (22.05255)\ (6.698027)\ (-5.558091)\ df = 13 \\ &p = (0.0000)\ (0.0000)\ (0.0001)\ F_{2,13} = 48{,}40788 \end{aligned} \tag{12}$$

$$\begin{aligned} \hat{KE}_t^{'} &= 25.623 \;+\; 0.609GC_{t-1}^{'} \;-\; 0.653IRCL_t^{'} \\ se &= (2.253746) \quad (0.164257) \quad (0.267869) \quad r^2 = 0.728151 \\ t &= (11.36922) \quad (3.710203) \quad (-2.436182) \quad df = 12 \\ p &= (0.0005) \quad (0.0300) \quad (0.0026) \quad F_{2,12} = 17.41035 \end{aligned} \tag{13}$$

Both models and their parameters are statistically significant. In residuals around the regression line there are not autocorrelation as χ^2_{critical} is 5.99 and is bigger than $\chi^2_{\text{empirical}}$,which is 5.127136 for the third model and 2.215709 for the fourth.

4 Conclusion

The analysis of factors influencing employment rate in Bulgaria give grounds for the following conclusions:

- On the basis of single-equation regression models is established: firstly, an increase in gross fixed capital formation with BGN 1 billion causes an increase in the employment rate on average with 0.76 percent points; secondly, an increase in gross fixed capital formation for the previous year with BGN 1 billion causes an increase in the employment rate on average with 0.595 percent points.
- On the basis of two-variable regression model with dependent variable –rate of employement and factor variables – gross fixed capital formation and interest rate on long-term loans for non-financial enterprises is established: firstly, an increase in gross fixed capital formation with BGN 1 billion and elimination the impact of interest rate on long-term loans for non-financial enterprises cause an increase in the employment rate on average with 0.77 percent points; secondly, an increase of interest rate on long-term loans for non-financial enterprises with 1 percent point and elimination the impact of gross fixed capital formation cause a decrease in the employment rate on average with 0.889 percent points.
- On the basis of two-variable regression model with dependent variable –rate of employement and factor variables – gross fixed capital formation for the previous year and interest rate on long-term loans for non-financial enterprises is established: firstly, an increase in gross fixed capital formation for the previous year with BGN 1 billion and elimination the impact of interest rate on long-term loans for non-financial enterprises cause an increase in the employment rate on average with 0.72 percent points; secondly, an increase of interest rate on long-term loans for non-financial enterprises with 1 percent point and elimination the impact of gross fixed capital formation for the previous year cause a decrease in the employment rate on average with 0.883 percent points.
- On the basis of two-variable regression model with dependent variable –rate of employement and factor variables – gross fixed capital formation and interest rate on long-term loans for households is established: firstly, an increase in gross fixed capital formation with BGN 1 billion and elimination the impact of interest rate on long-term loans for household cause an increase in the employment rate on average with 0.614 percent points; secondly, an increase of

interest rate on long-term loans for households with 1 percent point and elimination the impact of gross fixed capital formation cause a decrease in the employment rate on average with 0.945 percent points.

- On the basis of two-variable regression model with dependent variable –rate of employement and factor variables – gross fixed capital formation for the previous year and interest rate on long-term loans for households is established: firstly, an increase in gross fixed capital formation for the previous year with BGN 1 billion and elimination the impact of interest rate on long-term loans for household cause an increase in the employment rate on average with 0.609 percent points; secondly, an increase of interest rate on long-term loans for households with 1 percent point and elimination the impact of gross fixed capital formation for the previous year cause a decrease in the employment rate on average with 0.653 percent points.

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