
A Time Series Analysis of Macroeconomic Determinants of Corporate Births in Romania in the period 2008-2013

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ABSTRACT

In this article, we studied the relationship between macroeconomic factors and the observed corporate births for the Romanian economy through the Autoregressive Distributed Lags Model (ADL). We performed a time series analysis that uses monthly data for the period January 2008 – December 2013 in order to establish the impact of the fiscal and monetary policy adopted by the Romanian government in times of economic crisis on the firms' demography. The corporate birth rate is an endogenous variable in a linear function model with five exogenous macroeconomic variables such as the CPI, the loans ratio to GDP, the FDI, the long term interest rate, tax rate to GDP and the lags of the dependent variable. The main finding is that the variance of the corporate birth rate variable is negatively correlated with the variances of CPI in the current month and the interest rate two months lagged. We also determined that the variance of the dependent variable was positively correlated with the variances of the loans rate two months lagged, tax rate four months ago and FDI two months lagged and FDI in the current period.

Keywords: corporate births, macroeconomics, fiscal policy, monetary policy, Autoregressive Distributed Lags Model, Romania

JEL Classification: G33, E31, E32, E42, E52, E62

INTRODUCTION

Firm births create a competitive environment where production costs are minimized. New firms enhance the possibility of product and process innovation (Love, 1996). Corporate births are one means of reallocating resources to their most productive use as economic conditions vary over time. A healthy rate of firm births is usually regarded as a positive indicator of growth in the spatial economy (Love, 1996).

The creation of new companies is very important to a healthy economy because they provide new jobs, they are involved in innovations and they bring economic growth. In some countries, governments make laws and enforcement policies to protect enterprises and, in other countries, the priority is to protect employees and labor organizations. Policies that inhibit large firm competitiveness also shelter more new corporate births and the ones that give large firms an advantage seem to hinder

companies births. High accounting standards encourage the specialization ability of large firms and decrease new companies startups.

The goal of this paper is to establish the relationship between macroeconomic variables such as the interest rate, tax rate, credits granted to the private sector, inflation rate and foreign direct investment on one side and the number of corporate births rate on the other side through time series analysis. An Autoregressive Distributed Lags Model (ADL) is used in our research in order to achieve our purpose.

The article is structured as follows: the second part presents the main literature concerning corporate births at macroeconomic level, the third part the methodology and data used, the research design, the fourth part the econometric model design; the fifth section analyzes the empirical results and the last one presents the main conclusions.

LITERATURE REVIEW

The number of new firms is positively related to the growth of GDP, openness, and inflation and is negatively related to unemployment. Expenditure on R&D has an important positive effect on the birth of new firms. (Salman, 2013)

”Small and Medium Enterprises should be levied lower amounts of taxes so that they will have enough funds for other activities that will lead to business growth. In addition, it will help SMEs get better equipped to survive in a competitive market. The government should consider increasing tax incentives and exemptions as this will not only attract investors who are potential tax payers, it will also encourage voluntary compliance”.(Atawodi & Ojeka, 2012)

Djankov et. al. (2010) demonstrates that high tax rates determine lower business activity. The highest marginal tax rates are usually relevant to the largest firms that could create an opportunity for small companies operating at lower tax rates, which would give them a reduced after-tax cost of capital. (Djankov, Ganser, McLish, Ramalho, & Shleifer, 2010)

Aghion, Fally and Scarpetta (2007) conclude that private credit (proxy for the degree of financial development) is important for promoting entry of new enterprises. Following Aghion et al., 2007, we included a credit rate variable from the National Bank of Romania database which represents the credits granted by the financial institutions to the private sector and measures the importance of the banking sector in financing it. Deposit money banks and other financial institutions are smaller in poorer countries than in richer ones. (Aghion, Fally, & Scarpetta, 2007)

”Nations should make efforts to formulate regulations that encourage individuals to move into the formal economy. Examples of such efforts that promote private sector development include availability of capital, favorable interest rates, and attraction of foreign investments”. (Friedman & Hall, 2014)

Rraci finds that SMEs are more prone to report higher financing obstacles than large firms, regardless of bank ownership and that large firms benefit more than do SME firms in access to financing and cost of financing.(Rraci, 2010)

The growth accounting results indicate that the FDI contribution was relatively low for both developed and developing countries. A positive and significant

effect was also found for FDI in the entire panel of states, as well as in the group of developed countries. However, the significance of the FDI growth effect could not be established in the group of developing countries. (Dimelis & Papaioannou, 2010)

METHODOLOGY AND DATA

Data collection and description

For our analysis, we have used the monthly time series of the Romanian corporate birth number from January 2008 till December 2013. The database was created with the help of the data posted on the official sites of the NIS (National Institute of Statistics), NBR (National Bank of Romania), NTOR (National Trade Office Register) and the MPF (Ministry of Public Finance) of Romania. The macroeconomic variables were selected based on recent studies in the field and taking into consideration the global economic environment and the characteristics of Romania's economy.

We have identified transformations to perform on the raw data on the basis of plots, legislation, and model specification. The quarterly data for the Gross Domestic Product (GDP) were transformed into monthly data by dividing by three. The FDI was measured in million euros, and we transformed them in million RON by multiplying with the monthly exchange rate.

The fiscal policy was assessed through the tax rate and the monetary policy was quantified by the long term interest rate, CPI, and loans rate as a percentage of GDP.

The endogenous variable selected for the analysis is the birth rate of new enterprises is expressed as a percentage of the number of active Romanian firms with data from the NTOR (Firm_New) (National Trade Office Register)

The exogenous variables employed in our analysis are the following:

- the long term interest rate for the new loans granted in RON by the banks and financial institutions which measures the cost of borrowing for businesses (National Bank of Romania) (Interest_rate)
- the tax rate represents the percentage of tax revenues in GDP that estimates the fiscal burden borne by the firms (Ministry of Public Finance) (Tax_Rate)
- the CPI (Consumer Price Index) with the current period December 2013 measures the price dynamics in Romania's economy (National Institute of Statistics)
- the foreign direct investments rate as a percentage of GDP which represent the injection into the Romanian economy of foreign capital flows; We selected the data from the NBR site – Balance of payments - Net - Capital and Financial Account - Financial Account - Direct investments in Romania. (National Bank of Romania)
- the loans rate as a percentage of GDP; The credits granted by the financial institutions to the private sector measure the importance of the banking sector in financing it. (National Bank of Romania) (Loans)

Methodology

In this article we performed a time series analysis built on a monthly data from the period January 2008 – December 2013, i.e. 72 instances, in order to establish

the relationship between macroeconomic factors and the corporate births. For our research, we have analyzed the descriptive statistics of the data, and we have computed the correlation matrix in order to establish the degree of correlation that exists between the dependent variable and the explanatory ones.

A view of the raw data header

Firm_New	Loans	Interest_rate	CPI	Tax_Rate	FDI
1	0.98	2.45	12.14 131.0	2.2	0.60
2	1.40	2.50	12.52 130.1	1.3	4.10
3	1.32	2.60	13.09 129.2	1.7	8.21
4	1.14	2.13	13.62 128.6	2.1	22.77
5	1.07	2.16	13.78 127.9	1.7	3.07
6	1.08	2.22	13.94 127.6	1.5	6.61

Table 1

Source: Own calculations in R

The dependent variable corporate births rate becomes stationary after taking the first difference, and the same is valid for the explanatory variables. Only the coefficients of the first difference of the variables PCI and FDI in the current period were statistically significant and for the other explanatory variables certain lags of them were statistically significant. We have created the econometric model by using all the independent variables or their lags and the lags of the dependent variable corporate births.

Descriptive statistics and exploratory data analysis

The following descriptive statistics are calculated for the six raw variables that we decided to employ in our analysis: the firms' birth rate, Loans rate, Interest rate, CPI, Tax rate and FDI. We observe that the mean of the dependent variable corporate birth rate (Firm_New) is 0.77% of total active firms in the period January 2008 – December 2013.

Descriptive statistics for the raw data

Firm_New	Loans	Interest_rate	CPI
Min. :0.070	Min. :1.73	Min. : 7.55	Min. : 99.5
1st Qu.:0.627	1st Qu.:2.04	1st Qu.:10.26	1st Qu.:104.7
Median :0.740	Median :2.22	Median :10.87	Median :109.5
Mean :0.778	Mean :2.34	Mean :12.45	Mean :112.2
3rd Qu.:0.938	3rd Qu.:2.56	3rd Qu.:14.15	3rd Qu.:120.6
Max. :1.400	Max. :3.21	Max. :20.91	Max. :131.0
Tax_Rate	FDI		
Min. :0.60	Min. :-3.810		
1st Qu.:1.40	1st Qu.: 0.442		
Median :1.50	Median : 2.535		
Mean :1.55	Mean : 2.811		
3rd Qu.:1.70	3rd Qu.: 4.105		
Max. :2.30	Max. :22.770		

Table 2

Source: Own calculations in R

We also performed an exploratory analysis of the raw data examining tables, plots and correlograms of the observed data in order to determine if the variables have a trend and a seasonal pattern or outliers. We have decided to take the first difference of the variables in order to transform the data into stationary time series. The variables selected have the same degree of integration $I(0)$.

Correlation matrix for the differenced variables

Table 3

	df_Firm_New_ts	df_Loans_ts	df_Interest_rate_ts
df_Firm_New_ts	1.00	0.12	0.24
df_Loans_ts	0.12	1.00	0.12
df_Interest_rate_ts	0.24	0.12	1.00
df_CPI_ts	-0.26	-0.28	-0.29
df_Tax_Rate_ts	-0.10	-0.21	0.07
df_FDI_ts	0.05	0.09	0.13

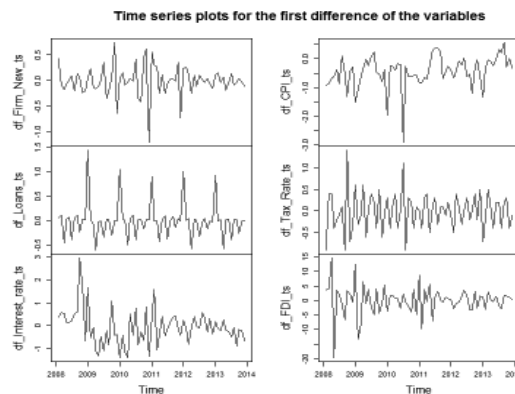
	df_CPI_ts	df_Tax_Rate_ts	df_FDI_ts
df_Firm_New_ts	-0.26	-0.10	0.05
df_Loans_ts	-0.28	-0.21	0.09
df_Interest_rate_ts	-0.29	0.07	0.13
df_CPI_ts	1.00	-0.23	-0.05
df_Tax_Rate_ts	-0.23	1.00	0.25
df_FDI_ts	-0.05	0.25	1.00

Source: Own calculations in R

From the picture above we notice that the first difference of the dependent variable Firm_New is negatively correlated with the first difference of CPI and Tax_Rate and positively correlated with the first difference of the Interest rate, Loans rate, and FDI variables.

Time series plots for the first difference of the variables

Figure 1



Source: Own computation in R

For our analysis we have performed unit root tests (Augmented Dickey-Fuller test), cointegration tests (Engle-Granger test), autocorrelation tests on the variables selected in order to build the Autoregressive Distributed Lags Model (ADL) that captures the short term effects of the monetary and fiscal policy.

ECONOMETRIC MODEL

In order to relate the corporate births rate to specific macroeconomic variables we performed an Autoregressive Distributed Lags Model (ADL) on the database that we had created with the NIS, NBR, MFP and NTOR data. Coefficients were estimated with ordinary least squares method, and standard errors were computed using standard asymptotic approximations. All variables are expressed as ratios and the GDP, FDI and the credits granted to the private sector were measured in million RON. The data transformations, the tests, and the econometric model were performed in the R programming language.

After performing the Engle-Granger test for cointegration, we concluded that the exogenous variables aren't cointegrated with the dependent variable. We found the lag length for each of the variables that are used in the model through the PACF & ACF correlogram and then we have selected lag 2 of the independent variables loans rate and interest rate to introduce into the model, lag 2 of the FDI, lag 4 for the tax rate variable and the first two lags of the dependent variable Firm_New in order to get the minimum Akaike Information Criterion (AIC) i.e. -24.29.

We have designed an Autoregressive Distributed Lags Model (ADL) in order to analyze the short-term effects of macroeconomic variables on corporate births in Romania. We took the first difference of all variables. The ADL has the following design:

$$\Delta(\text{Firm_New}_t) = a_0 + a_1\Delta(\text{CPI}_t) + a_2\Delta(\text{Loans}_{t-2}) + a_3\Delta(\text{Interest_Rate}_{t-2}) + a_4\Delta(\text{Tax_Rate}_{t-4}) + a_5\Delta(\text{FDI}_t) + a_6\Delta(\text{FDI}_{t-2}) + \Theta_1\Delta(\text{Firm_New}_{t-1}) + \Theta_2\Delta(\text{Firm_New}_{t-2}) + \varepsilon_t$$

where:

- ✓ Δ = the first difference of the variables selected
- ✓ Firm_New = the rate of corporate births in Romania
- ✓ Loans = the new loans rate as a percentage of GDP
- ✓ CPI = consumer price index
- ✓ Interest_Rate = long term interest rate
- ✓ Tax_Rate = the percentage of tax revenues in GDP
- ✓ FDI = foreign direct investments in Romania as a percentage of GDP
- ✓ Firm_New_{t-i} = the lagged rate of corporate births in Romania
- ✓ a_i = parameters of the independent variables
- ✓ Θ_i = parameters of the lagged dependent variable
- ✓ ε_t = error terms ($u_t \sim N(0, \sigma^2)$)
- ✓ t = the current period, the current month

The econometric model

Table 4

```

Call:
lm(formula = df_Firm_New_ts ~ df_CPI_ts + df_Loans_ts_2 + df_Loans_ts_2 +
    df_Interest_rate_ts_2 + df_Tax_rate_ts_4 + df_FDI_ts + df_FDI_ts_2 +
    +df_Firm_New_ts_1 + df_Firm_New_ts_2, data = db, na.action = na.omit)

Residuals:
    Min       1Q   Median       3Q      Max
-0.3853 -0.1110 -0.0281  0.0705  0.4497

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   -0.07407    0.02937   -2.52  0.01444 *
df_CPI_ts     -0.14096    0.04312   -3.27  0.00182 **
df_Loans_ts_2  0.22428    0.06753    3.32  0.00156 **
df_Interest_rate_ts_2 -0.08184    0.03186   -2.57  0.01281 *
df_Tax_rate_ts_4  0.23512    0.05687    4.13  0.00012 ***
df_FDI_ts      0.01286    0.00614    2.10  0.04045 *
df_FDI_ts_2    0.01169    0.00483    2.42  0.01864 *
df_Firm_New_ts_1 -0.52774    0.09072   -5.82  2.7e-07 ***
df_Firm_New_ts_2 -0.44994    0.09200   -4.89  8.3e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.187 on 58 degrees of freedom

Multiple R-squared:  0.647, Adjusted R-squared:  0.598
F-statistic: 13.3 on 8 and 58 DF, p-value: 1.12e-10

AIC -24.29

```

Source: Own calculations in R

Based on the requirement to obtain the minimum AIC, the final form of the econometric model, with all the coefficients being statistically significant at 5%, 1% or below, is the following:

$$\Delta(\text{Firm_New}_t) = -0.07 - 0.14 \Delta(\text{CPI}_t) + 0.22 \Delta(\text{Loans}_{t-2}) - 0.08 \Delta(\text{Interest_Rate}_{t-2}) + 0.235 \Delta(\text{Tax_Rate}_{t-4}) + 0.01 \Delta(\text{FDI}_t) + 0.01 \Delta(\text{FDI}_{t-2}) - 0.528 \Delta(\text{Firm_New}_{t-1}) - 0.45 \Delta(\text{Firm_New}_{t-2}) + \varepsilon_t$$

From the model above, we notice that the variance of corporate births in the current month (t) is negatively correlated with the last two months variance of the same variable. The variance of the dependent variable is also negatively correlated with the variances of CPI in the current month and the interest rate two months lagged.

The variance of the dependent variable was positively correlated with the variances of the loans rate two months lagged, tax rate four months ago and FDI two months lagged and FDI in the current period.

We observe that the most statistically significant coefficient is the one of

the first differenced explanatory variable tax rate four months lagged. An increase of 0.235% of the variance in the percentage of tax revenues in GDP four months ago determines an increase with 1% of corporate birth rate.

This model explains 59.80% of the variation in the dependent variable corporate birth rate (Firm_New). All coefficients are statistically significant at a p-value of 5%, 1% or below.

Tests for verifying the assumptions of the linear model

Table 5

```
studentized Breusch-Pagan test
data: ls4
BP = 12.31, df = 8, p-value = 0.1377
lag Autocorrelation D-W Statistic p-value
1 -0.1424 2.283 0.214
Alternative hypothesis: rho != 0
Shapiro-Wilk normality test
data: db
W = 0.579, p-value < 2.2e-16
```

Source: Own calculations in R

We have performed Breusch-Pagan test for heteroskedasticity, the Shapiro-Wilk test for normality of residuals and the Durbin-Watson test for autocorrelation in order to verify the assumptions of the linear model and we can state that all of them were met.

EMPIRICAL RESULTS

After we performed the Engle-Granger test of cointegration we concluded that the explanatory variables aren't cointegrated with the dependent variable and the VECM model can't be used so we employed the Autoregressive Distributed Lags Model (ADL).

Our results suggest that the variance of the dependent variable is negatively correlated with the variances of CPI in the current month and the interest rate two months lagged and is positively correlated with the variances of the loans rate two months lagged, tax rate four months ago and FDI two months lagged and FDI in the current period.

The Foreign Direct Investments have a positive impact on the corporate births but its influence on the birth of new enterprises is quite weak, only 0.01%, and the p-value is statistically significant at 5%.

The most statistically significant coefficient is the one of the first differenced explanatory variable tax rate four months lagged. An increase of 0.235% of the variance in the percentage of tax revenues in GDP four months ago determines an increase with 1% of corporate birth rate.

CONCLUSIONS AND RECOMMENDATION

Our analysis suggests that the first difference of the dependent variable corporate birth rate is negatively correlated with the variances of CPI in the current month and the interest rate two months lagged and is positively correlated with the variances of the loans rate two months lagged, tax rate four months ago and FDI two months lagged and FDI in the current period.

Our findings might be of interest to policy makers in Romania in order to prepare a better economic, monetary and fiscal policy for the public sector, as well as to the private sector and to the banking sector.

Our analysis is consistent with the main literature results as concerns the foreign direct investments, loans rate and interest rate and it contradicts the Djankov et. al. (2010) results and Salman 2013 findings regarding the tax rate and inflation impact on the corporate births rate.

For further research, the explanatory variable, the birth of new enterprises, could be used as a dependent variable in a Vector Autoregression Model in order to explain the impact of the fiscal and monetary policy on the activity of the Romanian firms from a demographic perspective. We also think that the non-linear relationship between the variables analyzed should be taken into consideration for future research.

On the other hand, it could also be employed the government expenditure and/or the consumption rate as a percentage of Romania's GDP in a quarterly time series analysis in the same period in order to measure the result of the Romania's government and National Bank decisions during and after the economic crisis on the firms' activity.

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