STYLIZED FACTS OF ROMANIAN BUSINESS CYCLE. AN EMPIRICAL INVESTIGATION (II)

Meşter Ioana Teodora
University of Oradea, Faculty of Economics

If the more or less regulate moves of the macroeconomic variables are accepted by the economists as a reality, the problem of measuring the aggregate level of the economy in direct correlation with these fluctuations is much more difficult, due to the numerous variables involved. The way these variables move in time is very different from a period to another as well as from a country to another. While some variables have already reached their maximum level, others are on their descendent slope. This is the reason why the measurement problem of the aggregate level of the macroeconomic activity deserves our attention. Finding the patterns macroeconomic variables move together and influence each other is important both as a theoretical challenge, but for its practical utility as well.
These are the reasons for which a very important phase in the study of the cycle is its descriptive analysis, which is realized by focusing on certain aspects, such as: the length and magnitude, the correlation of the economic variables with the reference series, the study of the cyclical indicators, the analysis of the relative variability of economic series, the diagnose and prevision based on the cyclical indicators.
Our paper deals with the stylized facts of Romanian business cycles. In our previous paper we investigated the theoretical aspects regarding the stylized facts of the business cycle. In this second part of our study, we first deal with the most common challenges that economists deal with when handling historical data, we'll present the most common methods to solve these problems. The empirical part of our study begins with an investigation of the stylized facts of Romania's business cycle, then a RBC model is estimated for the same economy. The simulations of the model are compared with the stylized facts of real data.

Keywords: business cycles, stylized facts, comovements, real business cycle
JEL codes: E12

Challenges raised by the use of empirical data

Dealing with real data: in what GDP regards, we can talk about real or nominal data. The nominal GDP is determined using current prices, thus, a rise in nominal GDP might reflect either an increase of price level, or of the consumption. A much more relevant measure of economic activity is real GDP, which is not influenced by prices. Real GDP is determined using constant prices. The same principle can be used when talking about any other macroeconomic variables, except the monetary aggregates, interest rates and, of course, the inflation rate or the consumer prices index.

Dealing with seasonal data: given the fact that we are dealing with the business cycles, it is important for us to identify and separate the different type of frequencies in the hystorical data. Data in december are usually and significantly higher than those in the other months. Statistical techniques are used to eliminate the seasonal component in empirical data. Most of the times, data presented in the official statistics are deseasonalised, but this is not a rule. So before the statistical analysis, seasonality of data should be investigated. The most common used extraction methods of seasonal component are the moving average method, the Census X-11, the X-12 ARIMA as well as TRAMO/SEATS. As Gagea and Ionescu (2008: 356) argue, the last two methods are accepted and recommended, at present, by Statistical Office of the European Union (Eurostat), because they solve the problem of „end points".

Dealing with trends in hystorical data. Another component that has to be eliminated from the hystorical data is its trend. In order to extract the cyclical and trend components several methods had been developped. One that dominates the literature, as Tawadros (2011) argue is the one developped by Hodrick Prescott. Beveridge and Nelson (1981) or Christiano and Fitzgerald (2003), consider the problem of decomposing an observed time series into a sum of its trend component and its cyclical component.

The smoothed trend is the solution to the minimisation problem:

$$\min \sum_{t=1}^{T} \left(X_t - X_t^*\right)^2 + \lambda \sum_{t=2}^{T-1} \left[\left(X_{t+1} - X_t^*\right) - \left(X_t^* - X_{t-1}^*\right)\right]^2$$

where X_t is the initial series, X_t^* is the trend and λ sets the filtering degree of the data. For quarterly data the most common used value for λ is 1600.

An alternative approach is the one proposed by Harvey (1985) – the unobserved components method. The general specification of this decomposition method is:

$$y_t = \mu_t + \varphi_t + \varepsilon_t$$

where y_t is the initial series, μ_t is the trend, φ_t si the cyclical component and ε_t represents the irregular component. The trend is stochastic and linear:

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t$$
$$\beta_t = \beta_{t-1} + \zeta_t$$

and the cyclical components is

$$\varphi_t = a \cos \theta t + b \sin \theta t$$

Of course, there are numerous developpements and variants of these decomposition methods – for example the non-linear trend-seasonal models or several unobserved components mixed addidive – multiplicative decomposition techniques.

The RBC model – general framework

We will employ the neoclassical RBC model. The representative household maximizes expected lifetime utility given by:

$$U = E_0\left[\sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\eta} - 1}{1-\eta}\right]$$

where β represents the elasticity of the discount factor with respect to the utility, η - the risk aversion parameter.

The representative agent has to face a budget constraint given by

$$C_t + K_t = Y_t + (1-\delta) K_{t-1}$$

with Y_t – production in t, K - the capital and δ the depreciation rate. The production is assumed to be following the Cobb Douglas specification.

$$Y_t = Z_t K_{t-1}^{1-\alpha} L_t^{\beta}$$

Here L_t represents the labour in t, K_{t-1} - the level of capital in the previous period and Z_t - the level of technological progress. The level of this parameter evolves according to the formula

$$\log Z_t = (1-\rho)\log \overline{Z}_t + \rho \log Z_{t-1} + \varepsilon_t$$

with a ρ coefficient of persistance of technological progress.

There are numerous methods of finding the solution to the model. We will employ Uhlig's (1995) approach, based on the Lagrangian method, in order to derive the First Order Conditions, by computing the first order derivatives of the objective function with respect to the Choice Variables. We derive the steady state solution and then we loglinearise the equations, which will help us obtain the solution to the system.

Data and calibration of the model

Calibration of the model implies the choice of certain parameters in the model. In this regard, we first collected quarterly data for the Romanian economy for 1994 – 2011. We used several of Dobrescu's estimates for the per capita levels of consumption, investments, output and capital stock. Data were first desezonalized using Census X12 and they were expressed in logs. The annual depreciation rate was computed using the level of fixed tangible assets that went out of use during a year, the initial level of fixed tangible assets and the new entries of fixed tangible assets. Our findings confirm Caraiani's (2007: 81) result for the value of depreciation rate of capital of 2,4%.

Empirical analysis

In order to analyze the extent to which our RBC model is consistent with the empirical data we first investigated the stylized facts of Romania's business cycle. For this, we first deseazonalised the quarterly data in logs for selected variables, then we computed the HP decomposition of cyclical and trend components and we studied the standard deviations of variables, the autocorrelation coefficient, as well as the cross correlations (simultaneous and lagged for up to 4 periods ones) between selected variables and GDP. Our results are presented in Table 1.

In order to describe the stylized facts of Romania's business cycle, we first investigated the amplitude of series, taking into account the percentage of standard deviation. Second, as a measure of the degree of persistence of the fluctuations, we have computed the first order autocorrelation coefficient. The lagged cross-correlation coefficient for up to 4 lags were then investigated, in order to identify whether the indicators are leading, coincident or lagged.

	Std. dev.	Autocorr.	Cross correlation with Output								
			t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Capital	0,014	0,23	-0,08	-0,04	0,07	0,22	0,32	**0,4**	0,22	0,16	0,06
Consumption	0,015	0,89	0.45	0,54	0,56	0,53	**0,66**	0,43	0,42	0,33	0,26
Interest rate	0,006	0,58	0,09	0,25	0,21	0,57	**0,4**	0,37	0,21	0,22	0,08
Output	0,025	0,64	0,00	0,07	0,14	0,19	1	0,23	**0,33**	0,30	0,29

Table 1. Statistics summary for HP filtered series

Source: author's callculus

In what concerns the amplitude of the movements of selected series, interest rates and capital are the less volatile while consumption is the most volatile variable. The most persistent variable is the consumption, as the first order autocorrelation value is the highest (0,89) and the least persistant is the interest rate. We found that consumption and interest rates are coincident indicators for the evolution of Romania's business cycle, while capital is a lagged one - countercyclical.

These empirical findings are then compared to the simmulations of the RBC model.

	Std. dev.	Autocorr.	Cross correlation with Output								
			t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4
Capital	0,004	0,26	-0,08	-0,03	0,07	0,23	0,3	**0,4**	0,22	0,16	0,06
Consumption	0,011	0,89	0.45	0,54	0,56	0,58	**0,76**	0,53	0,42	0,31	0,26
Interest rate	0,02	0,56	0,08	0,22	0,20	0,45	**0,34**	0,57	0,21	0,25	0,09
Output	0,022	0,63	0,00	0,07	0,14	0,19	1	0,3	**0,43**	0,31	0,28

Table 2. Statistics summary for simulations of the RBC model

Source: author's callculus

The results of the RBC simulation with respect to volatility and cross-correlations are partially valid. Regarding the standard deviations and relative volatility, the model provides very good predictions regarding output and interest rate. Thus, the predicted standard deviation of output is 2.5%, while the real one is 2,2%. The standard deviation of capital stock are not as good, but it is still close to the results for the real data.

Conclusions

This paper had as an objective the presentation of the stylised facts of Romanian business cycle. For this, we first presented the relevant literature review as well as some indicators used to measure these stylised facts and some possible problems that can come up when working with time series. We have presented the most common detrending procedures, Finally we have calibrated and simulated a Real Business Cycle model for Romania, using the neoclassical framework. The simmulations of the models were compared to the real data, with respect to standard deviation, correlations with output.

The results show that the RBC framework can be a starting point in modelling fluctuations in the Romanian economy. While some of the stylized facts of the Romanian economy could not be predicted with the standard RBC, most results are in a close range to those in the real economy.

The RBC offers good predictions regarding the standard deviations of output, capital stock, real return and also regarding the correlations between output and capital or real return. However, it also fails to offer good approximations regarding the consumption volatility or the correlation between consumption and output.

References

Beveridge, Stephen and Nelson, Charles, "A new approach to decomposition of economic time series into permanent and transitory components with particular attention to measurement of the 'business cycle'", *Journal of monetary Economics*, volume 7, issue 2 (1981), pp. 151-174

Caraiani, Petre, „An analysis of the fluctuations in The romanian economy using the real business cycles approach, *Romanian Journal of Economic Forecasting,* 2/2007, pp. 76 - 86

Christiano, L.J., Fitzgerald, T.J., „The band pass filter". *International Economic Review* 44 (2), (2003), pp. 435–465

Gagea, Mariana, Ionescu, Alina, *„Extraction of seasonal variations of unemployment rate in Romania using several methods based on moving average filter", Analele Stiințifice ale Universității "Alexandru Ioan Cuza" din Iaşi - Ştiințe Economice*, 2008, vol. 55, pp. 353-362

Kose, Ayhan, Explaining business cycles in small open economies 'How much do world prices matter?', *Journal of International Economics*, 56 (2002), pp. 299–327

Kydland, Finn and Edward Prescott, 1982, "Time to Build and Aggregate Fluctuations", *Econometrica 50 (6)*: 1345-1369.

Tawadros, George, "The stylised facts of Australia's business cycle", *Economic Modelling*, 28 (2011), pp. 549–556