IDENTIFYING THE INDUSTRY BUSINESS CYCLE USING THE MARKOV SWITCHING APPROACH IN CENTRAL AND EASTERN EUROPE

Professor PhD Cristi SPULBĂR
University of Craiova
Email: cristi_spulbar@yahoo.com
Assist. PhD Mihai NIȚOI
University of Craiova
Email: nitzoimihai@yahoo.com
Lecturer PhD Cristian STANCIU
University of Craiova
Email: valeriu.stanciu@gmail.com

Abstract:
In this article we use a Markov Switching model with two lags to identify and to compare the business cycle in Romania, Czech Republic, Hungary and Poland using data on industrial production for the 1991-2011 period. We use a model with two regimes that reflect the economic expansions and contractions. The Markov Switching models have been widely used in order to detect and to date the business cycle turning points. However, it should be pointed out that the industrial production may have a little bit different dynamics than the quarterly gross domestic product which is the main measure of economic activity. Based on the smoothed regime probabilities the model track three recessionary periods of the Romanian economy in 1991, 1997 and 2009 and two recessionary periods for the other countries in 1991 and 2009. Mean yoy growth of IPI is 5.01% during expansion periods, while it switches to -18.6% during contraction periods for the Romanian economy. In comparison, mean yoy growth of IPI is 7.25% during expansion periods, while it switches to -13.4% during contraction periods for the Poland economy. Furthermore, in Romania, the duration of the three recessions in months was 25, 25 and 9 months. In Poland, the duration of the two recessions was 16 and 10 months. The results of the study may be used in order to compare the business cycle in Central and Eastern European countries with the Euro Area business cycle.

Keywords: business cycle, Markov Switching model, Romanian economy, transition economies

1. Introduction

One of the market economies characteristics is the economic cycles' recurrence. The recessions are often periods of reorganization and reformation of the already existing structures created after the incorrect allocation during the boom periods. The appearance of these is imminent and the adoption of some sustainable recovery measures constitutes a precondition of the economic growth. The identification of economic cycles always represented a challenge for the specialized economic literature. The analysis used by NBER for identifying the evolution of the economic cycle in the United States of America is based on the variation of some indicators such

as personal incomes, industrial production, commercial sales value, unemployment rate, etc. The analytical models which formalize a probabilistic structure through which the evolution of the economic cycle can be identified were developed by virtue of Hamilton's paper (1989).

Within this paper we intend to identify the periods of recession in Romania through a Markov-switching model, using as a basic indicator the industrial production. Having also in mind the possibility of adopting the European unique currency by some countries from Central and Eastern Europe, the analysis will be also extended to Czech Republic, Hungary and Poland. Thus, we would be able to compare the data about the evolution of the economic cycle in those four countries. The integration in a monetary and economic union supposes a correlation and a similarity of the economic cycle between the countries from the union. That is why it is important to identify the way in which the economy of these countries answers to some economic shocks. The lack of synchronization between the economic cycles complicates the implementation of some monetary policies and represents a negative indicator for the monetary union.

The paper is structured as it follows: the second section comprises some literature references, in the third section the methodology used in this paper is detailed; in the fourth section the estimation results are presented and a comparison between the four countries included in the study is realized, and in the last section the conclusions of the article are emphasized.

2. Literature review

The studies on identifying the economic cycles in Romania are limited. Albu (2001) and Purica and Caraiani (2009) utilized the non-linear approaches for dating the economic cycles in Romania. Caraiani (2010) also used a model based on a Markov Switching AR approach, using the industrial production as a relevant indicator, for determining the duration of the recessions, the medium growth rate and the medium rate of decrease of the industrial production in Romania between 1990-2008.

Senyuz, Yoldas, Baycan model Turkish business cycle using Markov-switching models, identifying five recessionary periods in 1989, 1994, 1999, 2001 and 2008. Chkili, Nguyen (2011) use the Markov regime-switching model to investigate the volatility behavior of six stock markets (France, Spain, Greece, Egypt, Tunisia, and Turkey) over the 1995-2010 period. Their results show that the developed stock markets are less affected by international market events such as Asian and Russian financial crisis than emerging markets. Krolzig (2001) identifies and dates the Euro-zone business cycle by using a Markov-switching approach, tracking two recessionary periods between 1980Q1-1981Q1 and between 1992Q3-1993Q2. Mladenovic and Nojkovic (2011) estimate inflation persistence in Central and Eastern Europe countries using a Markov switching approach. They show that inflation persistence is moderate and high in Hungary, Poland, Romania and Serbia and in Slovakia and Czech Republic is low.

3. Methodology

The main idea behind regime switching models of the business cycle is that the parameters of a time series model of some macroeconomic variables depend upon a stochastic, unobservable regime variable which represents the state of business cycle. Most of the models use two regimes that reflect the economic expansions and contractions. The Markov-switching models have been widely used in order to detect and to date the business cycle turning points.

The Markov switching approach follows the specification proposed by Hamilton (1989) which is naturally a benchmark in this class of models. The Markov switching model of Hamilton (1989) is specified as:

$$y_t - \mu(s_t) = \sum_{i=1}^{p} \phi_i (y_{t-i} - \mu(s_{t-i})) + \varepsilon_t$$

$$\varepsilon_t \sim N(0, \sigma^2)$$

Where s_t and s_{t-i} are the unobserved regime variables that take the values of 1 or 2, ϕ_i are the model's coefficients, ε_t are the residuals that follows a Normal distribution with zero mean and variance given by σ^2, μ and σ are the mean and the standard deviation of the return distribution respectively. In our model y_t indicates the yoy growth rate of monthly industrial production. As we can see from previous equation, the independent variables are conditional on the states, an unobserved process. That means that the regressors, $\sum_{i=1}^{p} \phi_i (y_{t-i} - \mu(s_{t-i}))$, are also unobserved prior to estimation. Our approach will follow a two step estimation process as suggested by Perlin (2010). Consider the following notation for Hamilton's Model:

$$z_t = y_t - \mu(s_t)$$

This is equivalent to:

$$z_t = \sum_{i=1}^{p} \phi z_{t-i} + \varepsilon_t$$

By rearranging the first equation we get:

$$y_t = \mu(s_t) + z_t$$

where z_t are the residuals from this reduced model. Following a two steps approximation (Perlin, 2010), firstly we will estimate the model:

$$y_t = \mu(s_t) + \varepsilon_t$$

$$\varepsilon_t \sim N(0, \sigma^2)$$

$$S_t = 1, 2$$

Secondly we retrieve the ε_t vector and regress it on a specified number of lags:

$$\hat{\varepsilon}_t = \sum_{i=1}^{p} \beta_i \hat{\varepsilon}_{t-i} + \nu_t$$

$$\nu_t \sim N(0, \sigma_{vt}^2)$$

In order to model phases of Romania, Hungary, Poland and Czech Republic industry business cycle, we consider a Markov Switching model with two lags.

4. Results and discussions

The identification and the determination of the medium duration of the recession periods in the four countries reveal all the aspects worthy to be emphasized. As we notice the first period of recession estimated for all those four countries is identified at the beginning of 1990. The main cause of this economic evolution is represented by the fact that the transition process from a planned economy to a market economy demands the reformation and the reorganization of the economies from Central and Eastern Europe. Thus, the adoption of some measures specific to the market economies for ensuring the competitiveness within the economic agents on a market where the economic constraints were limited imposed. The duration of this negative cycle is of 16 months in Poland and Czech Republic, of 21 months in

Hungary and of 25 months in Romania as we can observe from appendices.

On the other hand, unlike the other three countries included in the study, Romania got through a period of recession in 1997. The recession started in the seventh month and it lasted 25 months. The gradual liberalization of the prices and the high inflation, the lack of some steady measures of reformation and reorganization of the public sector, the delay of the process of privatization and the lack of an adequate governed financial market constitute one of the main reasons of recession in Romania in the period 1997.07-1999.07. As a matter of fact, even in what concerns the prices stabilization, Romania passed through episodes of disinflation which had significant negative influences on the economic activities. Two approaches allow the identification of a period of disinflation: the episodic approach proposed by Calvo and Végh (1994) and the mechanic approach proposed by Ball (1994), Easterly (1996) and Hamann (2001).

The inflation stabilization became the main concern of the monetary authorities from Central and Eastern Europe in 1990. For this reason, programs of stabilization for combating the spectacular growth of inflation were implemented. Some countries preferred the adoption of stronger strategies, shock therapies, applying rapidly some drastic programs from the beginning of the period of transition. Other countries preferred a gradual step.

Table 1

Disinflation periods in Central and Eastern Europe

Country	Episodic approach - Calvo and Végh (1994)	Mechanic approach - Ball (1994)
Poland	1990	1990
Hungary	1990	-
Czech Republic	1991	1991
Romania 1	1993	1993
Romania 2	1998	1997

Source: Fischer, Sahay şi Végh (1998)

The table no. 1 presents episodes of disinflation which are identified starting from the episodic method and from the mechanic method. The first approach allows the identification of five periods of disinflation, between which the one from Hungary is rather a moderate one. Ball's method (1994) identifies four periods of disinflation in the mentioned countries, excluding the Hungarian episode.

The results from the table show that the countries from the Central Europe were the first who engaged in the fight against high inflation, followed by the Balkan states. Poland and Hungary implemented the reforms from 1990. The help program of the International Monetary Fund for Poland was officially started on first January 1990, but the stages of preparation were launched from the last trimester of 1989. The Czech Republic and Bulgaria started the programs of stabilization and of liberalization starting with 1991. To be noticed the fact that Bulgaria and Romania repeated the attempts of stabilization.

The stabilization policies were implemented much more quickly in the countries from Central Europe. Thus, in the first phase of disinflation the inflation rates decreased towards a rate proximate to 40% in 1994 and 1995 and under the level of 10% in 1997. In the Czech Republic the inflation stabilized around a rate of 10% starting from 1994, while in Hungary and Poland the movement was more gradual.

A third period of recession is identified by the model at the end of 2008 in all four countries. In this case, we can state the fact that the beginning, the intensity and the duration of the period of recession are almost similar in the case of Romania, Czech Republic, Poland and Hungary. This fact is owed to the international financial and economic crisis which represents the main cause of the evolution surprised in the industrial production indexes and which affected symmetrically the industrial production indexes in the four countries.

Unlike Caraiani (2010) who looks up the logarithm of the industrial production index and applies the differentiation operator, within our estimation we shall use a different approach of treating the data. Thus, after looking up the logarithm of the industrial production index we shall determine the annual index growth rate (yoy). Although in this way we shall lose the first 12 observations from the set of data, we consider that this approach offers a more exact perspective on industrial production evolution on medium and long term. That is why, dating the periods of recession is different from the one obtained by Caraiani (2010). Thus, in our model the first recession ends in May 1993, and in Caraiani's model in September 1992. The second period of recession starts in February 1997 and ends in January 1999, according to Caraiani's estimation.

From the intensity analysis of the economic cycles in the four countries some important observations can be emphasised. The most positive results are identified in the case of Poland, where the annual rate of the medium growth of the industrial production is of 7.25% in the periods of economic growth, and in the periods of recession the industrial production index decreases with -13.43%. The obtained results in the case of Romania and in the case of Hungary are similar, the industrial production growth rate being of 5.01% and, respectively, of 7.38%, while in the periods of recession the industrial production index decreases on average with -18.69% and, respectively, with -18.77%. In the case of Czech Republic, the effects of the recession on the industrial production are more emphasized, the index decreasing with 22.41%, while in the periods of economic boom the industrial production grows with 3.96%. This asymmetry is determined by the structural, institutional and behavioural heterogeneousness within the countries. As we observe, generally in the periods of economic growth the industrial production index registers a high growth, but in the periods of recession the collapse is drastic.

On the other hand we must mention the fact that the industrial production index can have a dynamics different from the gross domestic product, representing the main indicator of measurement of the economic activity. Thus, if we study the data from the next table, we will observe the fact that the share of industry in gross domestic product diminished in the last 20 years especially in Poland, in Czech Republic and in Romania, the services having a higher contribution.

Table 2

Share of industry in gross domestic product

	1991	1998	2004	2010
Hungary	27,3	27,7	25,7	27,03
Poland	31,8	24,9	25,2	24,5
Czech Republic	34,4	30,0	30,6	29,4
Romania	37,9	25,1	27,3	26,1

Source: Eurostat database

The diminish of the share of industry in the total GDP is normal, taking into consideration the trend of the developed economies to reorient towards services (table 2). In what concerns the evolution of the industry contribution to GDP in Romania, it knew an important growth until 1998, after which it limited. It is important to mention that this final decrease produced due to some important entries of foreign investments. From here it results that, in the future, even if Romania will still know important investments in industry, the rhythm of growth of the entire industrial sector won't lead to a growth of this one as a share in GDP.

If we also refer to the data concerning the gross domestic product evolution from Romania the entrance in recession (two consecutive trimesters of gross domestic product decrease) was realised in the first trimester of 2009, and the exit from the recession (two consecutive trimesters of gross domestic product growth) was realised in the first trimester of 2011. In our opinion, the difference between different evolutions of the industrial production and of the gross domestic product in the case of Romania is caused by the high correlation between the industrial production-exports-gross domestic product from the euro area, the majority of exports from Romania being allocated for the developed markets in the euro area, such as Germany and France.

5. Conclusions

The objective of this study was represented by identifying and dating the economic cycles in the countries from Central and Eastern Europe. For this reason we estimated a Markov switching model used largely in the specialised literature for identifying the economic cycles. The results of the estimation show that all four countries confronted with a period of recession at the beginning of 1990 after passing from a planned economy to a market one. The duration and the intensity of this period were different for the four countries. Another period in which the four countries confronted with a period of recession was at the end of 2008. The main cause of this evolution was an international economic and financial crisis which led to the global demand decrease. Romania is the only country which crossed a negative economic cycle in 1997.

Future studies which establish the correlations between the industrial production in the emergent markets from Central and Eastern Europe, the gross domestic product of these countries and the gross domestic product in the countries from euro area represent a future direction of research.

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REFERENCES

Albu, Liviu (2001), Evolution of Inflation-Unemployment Relationship in the Perspective of Romania's Accession to EU, *Romanian Journal of Economic Forecasting,* no. 2, p. 5-23.

Ball, Laurence (1994), What determines the sacrifice ratio?, *National Bureau of Economic Research Studies in Business Cycles*, Volume 29, University of Chicago, p. 155-193.

Calvo, Guillermo and Vegh, Gramont (1994), Inflation Stabilization and Nominal Anchors, *Contemporary Economic Policy*, Volume 12, p. 35-45.

Caraiani, Petre (2010), Modeling Business Cycles In The Romanian Economy Using The Markov Switching Approach, *Romanian Journal of Economic Forecasting,* no. 1, p. 130-136.

Chkili, Walid and Nguyen, Duc Khuong (2011), Modeling The Volatility Of Mediterranean Stock Markets: A Regime-Switching Approach, *Economic Bulletin*, 31(2), p. 1-9.

Easterly, William (1996), When Is Stabilization Expansionary? Evidence from High Inflation, *Economic Policy*, Volume 11, no. 22, p. 67-107.

Fischer, Stanley, Ratna Sahay, Gramont Vegh (1998), From Transition to Market: Evidence and Growth Prospects, *International Monetary Fund Working Paper*, WP/98/52.

Hamann, Javier (2001), Exchange-rate-based-stabilization: A Critical Look at the Stylized Facts, *IMF Staff Papers*, Volume 48, no. 1, p. 111-138.

Hamilton, James (1989), A New Approach To The Economic Analysis Of Nonstationary Time Series And The Business Cycle, *Econometrica*, 57, p. 357–384.

Krolzig, Hans-Martin (2001), Markov-Switching Procedures for Dating the Euro-Zone Business Cycle, *Vierteljahrshefte zur Wirtschaftsforschung*, No. 3, p. 339-351.

Mladenovic, Zorica and Nojkovic, Aleksandra (2011), Inflation persistence in Central and Southeastern Europe: Evidence from time series approach, *Annual International Conference On Macroeconomic Analysis And International Finance*.

Perlin, Marcelo (2010), MS Regress - The MATLAB Package for Markov Regime Switching Models, *Available at SSRN*: http://ssrn.com/abstract=1714016.

Purica, Ionuț and Petre Caraiani, (2009), Second Order Dynamics Of Economic Cycles, *Romanian Journal of Economic Forecasting,* Volume 10, no. 1, p. 36-47.

Senyuz, Zeynep, Emre Yoldas and Onur Baycan (2010), Regime-Switching Analysis of Turkish Business and Stock Market Cycles, 6TH Colloquium On Modern Tools For Business Cycle Analysis: “The Lessons From Global Economic Crisis”, *6th Eurostat Colloquium*.

APPENDICES

Dating business cycles in Romania

Peak	End	Recession duration
1991.05	1993.05	25 months
1997.07	1999.07	25 months
2009.01	2009.09	9 months

Maximum Likelihood Estimates (Romania)

		P. value	Std Error
μ_1	0.05	0.00	0.005
μ_1	-0.18	0.00	0.010
$p_{1,1}$	0.99	0.00	0.07
$p_{2,2}$	0.94	0.00	0.14
σ^2			
ϕ_1	0.57		

Dating business cycles in Czech Republic

Peak	End	Recession duration
1991.04	1992.07	16 months
2008.12	2009.11	12 months

Maximum Likelihood Estimates (Czech R.)

		P. value	Std Error
μ_1	0.03	0.00	0.004
μ_1	-0.22	0.00	0.014
$p_{1,1}$	0.99	0.00	0.07
$p_{2,2}$	0.92	0.00	0.20
σ^2			
ϕ_1	0.71		

Dating business cycles in Hungary

Peak	End	Recession duration
1991.01	1992.09	21 months
2009.01	2009.12	12 months

Maximum Likelihood Estimates (Hungary)

		P. value	Std Error
μ_1	0.07	0.00	0.003
μ_1	-0.18	0.00	0.010
$p_{1,1}$	0.99	0.00	0.07
$p_{2,2}$	0.94	0.00	0.17
σ^2			
ϕ_1	0.68		

Dating business cycles in Poland

Peak	End	Recession duration
1991.01	1992.04	16 months
2008.12	2009.09	10 months

Maximum Likelihood Estimates (Poland)

		P. value	Std Error
μ_1	0.07	0.00	0.003
μ_1	-0.13	0.00	0.013
$p_{1,1}$	0.99	0.00	0.07
$p_{2,2}$	0.91	0.00	0.21
σ^2			
ϕ_1	0.57		