INTERNATIONAL JOURNAL OF INTERDISCIPLINARITY IN THEORY AND PRACTICE
ITPB - NR.: 6, YEAR: 2015 – (ISSN 2344 - 2409)

MONITORING AND PREDICTION OF BUSINESS CYCLE

Andrea Tkáčová [1] - Barbora Gontkovičová [2] - Emília Duľová Spišáková [3]

Abstract: *Monitoring of business cycle has a long tradition in the world. The most popular part of analysing of business cycle is their prediction to the future. Nowadays we can find many methods how to predict business cycles. The most useful methods are based on construction of Composite leading Indicator (CLI) which can help to us predict business cycle about few months or quarters. Many countries use their own methodology for construction of CLI but they also can use methodology of world organization as Eurostat, OECD and Conference Board. Objective of this article is to analyse these methodologies and on the base their comparison to find differences between them.*

Keywords: Business cycle, economic fluctuation, composite indicator, leading indicator.

1 INTRODUCTION

The economic cycle was at the forefront of the economic research's interest in the 20s and 40s of the 20th century. The main reason was the unstable economy and subsequently the Great Depression in the 30s. It seemed like in the 50s and 60s the economic cycle was "dead", however the 70s and the oil crisis revived it and at the same time new economic theories attempted to explain the causes of the economic cycle [1]. The studies from the Harvard Institute had a lot of the important benefits for monitoring of the business cycle. These studies constructed Harvard Index (barometer) of business conditions in the period after World War II. There were three composite parts [2], [3]: "Speculative" index of A (reflecting the development of average prices of shares and related to the period of expansion when optimism about the future development and investment income dominated), B index (reflects the movements of sales volume and price levels, development of which was caused by the movement of supply), C index (reflects the development of money market loans through level of loans).

Another important methodological approach to the analysis of the business cycles were studies of A. Burns and W. Mitchell [4] from National Bureau of Economics Research (NBER). Benefits of their publication Measuring Business Cycles was extending of the definitions, the characteristic features and ways of monitoring of the business cycle using cyclical indicators. The use of cyclical indicators for signalling and confirming in the business cycle has a long tradition.

The essence of this approach is the creation of groups of cyclical indicators which are able to assist in the detection of position in the development of business cycle. Indicators of the business cycle thus are used to monitor and analyse the position of the economy in the business cycle and the current phase and possible future course of business cycle can be determined with them.

In terms of relationship time-trajectory of selected indicators to the reference range can distinguish three groups of indicators of the business cycle. These indicators give sufficient information about the course of this cycle. Cyclical indicators are published separately, but more often in the form of some kind of composite indicators [5].

2 DEFINITION OF BUSINESS CYCLE

The term business cycle (or economic cycle) is associated with economic fluctuations in the manufacturing industry, or in business activity, lasting for several months or years. These fluctuations include periods of relatively quick economic growth and periods of relative stagnation or decline [6]. They are most often measured through the real Gross Domestic Product growth rate [7]. Despite the fact that they are referred to as cycles, most of these fluctuations in economic activity do not occur mechanically or predictably [8].

In 1819, Sismondi, the French economist, introduced the first systematic explanation of periodic behaviour of the economy and the inception of economic crises. At the time, he was against the economic equilibrium theory. At that time, the inception of negative economic fluctuations was associated exclusively with external factors, mainly war periods [9]. The works of Simondi later served as the basis for the analysis of periodic behaviour of the economy, mainly in the theory of alternating cycles by Charles Dunoyer [10] and later by Johann Karl Rodbertus.

The American economist W.C. Mitchell also dealt with the analysis of business cycle and in 1913, in his work "Business cycle" he talks about the economic cycle as a problem of the economy. In his work "A definition of business cycle" from 1927 Mitchell laid out the fundamentals of the economic cycle definition. Then he elaborated and rewrote this definition in cooperation with A. F Burns and they concluded that "*Business cycles are a type of fluctuation found in the aggregate economic activity*

of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle". [4]

At present it is thought that the economic cycle is a cyclical component of time series lasting for more than 18 months and less than 96 months. In case of GDP, where there are mostly quarterly data available (quarters), frequencies between 6 to 32 quarters are being analogically studied. Fluctuations at higher frequency (less than 18 months) are mostly referred to as seasonal fluctuations or insignificant short-term shocks. Lower fluctuation frequencies (of a length exceeding 8 years) are no longer referred to as a business cycle but as a trend movement [11], [12].

Lucas also presented his own view of the business cycle; in his work "Understanding business cycles" he defined the business cycle as a fluctuation from real GDP, or a fluctuation of aggregate real output from trend [14]. Lucas' view of the business cycle was followed by Kydland and Prescott who claimed that in order to analyse a business cycle, it is necessary to focus on a detailed observation of economic indicators' time series, which can have a different relation to a business cycle development itself, as represented by real GDP or by aggregate output [1]. The methodology of Kydland and Prescott based on researching the relationship between GDP and key macroeconomic indicators served as the basis for the studies of Wolf (1991), Serletis and Kraus (1996) in the case of the United States of America, of Backus a Kehoe (1992) regarding a group of nine countries (Australia, Canada, Germany, Italy, Japan, Norway, Sweden, Great Britain and USA), for the studies of Kim, Bucklehp and Hall (1994) regarding New Zealand and for the works of Crossby, Otto, Fisher (1996) and Voss (1996) regarding Australia. Brandner and Neuser (1992) examined the facts about the economic cycle for Australia and Germany using an analysis similar to that presented by Kydland and Prescott.

2 THE DEFINITION OF COMPOSITE INDICATOR

The American economist Moore, of the Economic Cycle Research Institute, was the first to elaborate detailed studies aimed at analysing the relation of selected economic indicators to the development of a business cycle represented by GDP. He constructed a composite leading indicator enabling a short-term prediction of the US business cycle. This original composite leading indicator he then transformed, back in 1960, into an index of leading economic indicators (LEI). Since then, many economists and international organizations have used leading cyclical indicators in their analyses and predictions of a business cycle [16]. Among the international organizations which deal with the construction of composite leading indicators (CLI) are Eurostat, OECD, and American Conference Board, there are also national institutions which are interested in the construction of a CLI with regard to the specificities of their countries. The composite indicator is an indicator composed of sub-indicators of the business cycle. This composite indicator reflects the evolution of the economy better than individual indicators separately. Selection of cyclical indicators into composite indicators is not random, but depends on their economic significance, explanatory value and predictive power and on the degree of correlation with GDP. Composition of composite indicators is different in each country, mainly because of the different significance of individual indicators for the economy [17].

In general, we distinguish three groups of indicators [18]. These groups of indicators are created by their relationship to economic development, which is usually monitored through the development of gross domestic product and represents the reference range.

Coincident indicators are indicators whose time course refers to development of GDP. These indicators confirm or refute the position of the economy and thereby contribute to characterize the stability and sustainability in the economy. Comparison of different indicators showed that the values of certain indicators have different time-trajectory as an indicator designed to monitor the development of the economy (GDP). Some indicators have the ability to predict the development of economy and to identify the turning points. In this case we are talking about *leading indicators*. Their main task is to predict the turnover points of economic activity and to inform the likely extent and amplitude fluctuations of data in the reference series at any stage of the business cycle. These indicators are given their predictive capability and are the most important from whole group of cyclic indicators.

Table 1 Overview of selected indicators of cyclical development in relation to GDP. Source:[20].

Category	Indicator
leading indicators	stock market index
	new orders and orders of industry
	prices of consumer services
	money supply
	stock movement
	profit margins
	building permits
	average hours worked and overtime
	sensitive commodity price index
	interest rates
	exchange rates
	prices or yields of bonds
coincident indicators	sales of manufacturing industry and trade
	industrial production or production of manufacturing industry
	Employment and unemployment rate
	disposable income of the population
	wages and salaries
lagging indicators	income of population
	retail turn-over
	credit interest rates
	profit in consumer goods industries

A third group of indicators *(lagging indicators*) are those indicators of business cycles, whose development is delayed for the reality of economic activity. They serve to verify the course of the last cycle (turning points) [19].

It should be noted that interpretation of the composite indicator is not always simple and straightforward, and it is therefore necessary to relate the development of a composite indicator of development of its individual components and take notice of their explanatory power and relevance of input data. Among the timeliness of information by the composite indicator and its coverage of the economy there is a relationship that says that the more complex indicator (better describing of the economy), it loses more of its availability and speed of publication [21]. Composite indicators have their advantages, but also disadvantages. It is important to know them, if we want to use them for analysis of the business cycle. A list of these properties of indicators shows the following Table 2.

Table 2 Advantages and disadvantages of composite indicator. Source: [19].

Advantages	Disadvantages
Current information about present, past and future economic activity.	It is necessary to determine weights of each individual ingredient.
It provides the first signal about turning point in economic activity (in the case of leading indicators).	Composite indicator may produce incomplete findings because of poor construction or interpretation without the aid indicators entering
It includes a bigger set of variables, thus reducing the risk of false signals.	
It provides greater stability than the separate solo-indicators, so it has better predictive ability.	It can be used as a tool only for short-term macro-economic analysis (for leading indicators).
Easier interpretation as a set of individual indicators.	
It can be used to summaries of complex economic phenomena (business cycles)	

3 APPROACHES TO THE FORMATION OF A COMPOSITE INDICATOR

Composite cyclical indicators are used for the monitoring and analysis of business cycles in the various international institutions. In the world, institutions like the Organization for Economic Cooperation and Development (OECD), Eurostat and the U.S. Conference Board (CB) are dealing with composite cyclical indicators. But approaches to creation of indicators are different. They differ in the choice of the reference series, selection of sub-indicators, using various filters, in determining whether or not to define weights for the sub-indicators. For comparison, here is a brief overview of these methodologies.

3.1 Eurostat methodology

Eurostat works in the analysis of cyclical developments with access to the growth cycle and for estimation of the trend uses the Christiano-Fitzgerald filter. The time series of quarterly GDP is selected for the reference time series. Eurostat defines for the economies of all member states a one leading composite indicator made up of the following components [22].

Industrial confidence indicator (average of responses to questions regarding production, orders and stocks of finished production),

Consumer confidence indicator (average of responses to questions about the financial situation of households, overall economic situation (past and future, suitability and purchase of durable goods),

Stock price index.

In selecting of the cyclical indicators, Eurostat uses the OECD criteria, supplemented by the following [17]:

- Accuracy (concerning the reliability of data).
- Comparability (applies to international commensurability data).
- Completeness (data should cover the whole period and the entire economic area for which the user choose them).
- Coherence (data should be continuous, logically connected and mutually consistent).
- Accessibility and clarity.

A construction of composite indicator is constructed according to Eurostat methodology more or less on soft data. Eurostat uses a simple system of weighting the individual components which are divided into two groups. The second group (construction confidence indicator and the stock price index) is half the weight compared to the first group (confidence indicator in industry and consumers). The advantage of the Eurostat is that all components are always available.

Questionnaire to assess the present situation of economy contains questions formulated for the current and expected tendencies. The questions are asked in the form of assessment scales, usually with three possible variants of answers in the style of improvement, constant, worse. Evaluation of the results is through a summary of responses in different variations, a clear expression of the tendencies is balance, which is the difference between improvement and worsening responses, expressed as a percentage. The higher the positive balance of answers is, the more optimistic it is to evaluate the response.

Performance of evaluation by using of composite indicators of the OECD and Eurostast showed that forecasting potential could be increased [17] [23].

- Selection of indicators with the best explanatory ability in individual countries.
- Using the same weights for the best performing indicators.
- Settlement of time series.
- Introduction of more financial components.

3.2 Conference board methodology

Conference Board (CB) took over from National Bureau of Economic Research (NBER) function to monitor the evolution of the U.S. economy and establish the cyclical indicators. Procedure for construction of leading composite indicator is simpler - month indices sub-indicators are constructed and these are also statistically adjusted. Conference Board compiles the reference time series as a comprehensive economic indicator, which includes the index of industrial production, the sales volume of the processing industry and trade, number of employees of non-agricultural sectors, personal income without transfers. This file also serves as a coincident indicator. Leading indicator for the U.S. economy has ten components, which include for example:

- Average weekly hours worked in manufacturing.
- New orders in manufacturing industry.
- New building permits.
- Stock prices.
- The money supply.

Cyclical indicators of the U.S. economy are based solely on quantitative data. Leading indicator for the U.S. economy is constructed also by Centre for International Business Cycle Research (CIBCR). This composite indicator is made up of twelve sub-indicators and uses only hard data [24].

3.3 OECD methodology

One of the main problems of analysing the business cycle is the trend, which is necessary for further estimates of the economy's position in the business cycle. OECD uses to estimate the trend of the modified method of phase-average trend (PAT) of the U.S. National Bureau of Economic Research (NBER). This method is mathematically and statistically quite difficult. Simply speaking, the trend calculation is based on counting the moving averages of time series. PAT uses the access method called growth cycle. This means to pursue absolute decreases or increases in the cyclical component of selected variables and determine their percentage deviation from trend [25]. OECD used time series index of industrial production as a reference because of its faster and more frequent access time compared to GDP. Turning points are defined on the modified methodology NBER follows [19]:

- Length of the cycle phase must be at least 5 months.
- Length of the cycle at least 15 months.
- Unless there is a turning point, so there is flat zone, or conversely two turnover points occur close to each other, the last value is considered a turning point.
- Extreme values are not considered relevant, if their effect is short or insignificant.

OECD takes the view that it is impossible to create the same composite indicators for the various economies and therefore uses different configurations of leading indicators. Among the most widely used belong [20]:

- Business surveys.
- Monetary and financial indicators.
- Inventories and orders.
- Retail sale.
- Prices and indicator of foreign trade.

In the selection of cyclical indicators OECD uses the following criteria [13], [20]:

- Relevance (economic significance is important, i.e. whether the indicator is correlated with the selected reference series and the length of time series of the indicator, which indicators with longer time series are preferred).
- Cyclical behaviour (such as the length of time and robustness of the lead-time of variable to reference series in turning points, lack of turning points that are not contained in the reference series).
- Quality of data (how often and how quickly the time series of the indicator is available. The aim is to avoid frequent revisions. Time series with a higher frequency of reporting are preferred to lower series, monitoring mainly the availability and long-term data).

OECD as the only institution uses indicators related to the external economy as foreign trade, especially development of export and exchange rates. In this approach soft and hard data is combined. Individual indicators have the same weight. The reason why this is so is fact that when using different weights mineralization of the effects of indicators could occur, which does not show the necessary concurrence with other indicators. The consequence would be to reduce the reliability of composite indicators, given the fact that some indicators have greater explanatory capacity in one cycle and the other again in another. Scoring and ranking systems built according to the degree of concurrence of individual indicators are valuable tools for the selection of indicators to integrate into a composite index. Time series of indicators included in the composite indices are not usually revised, because in case of a review inconsistent and larger errors in the predictions could arise. In their analysis, OECD lays emphasis on the development of so-called prime movers - indicators that as first signal the change in the business cycle and as first reflects the effects of economic policy measures. According to various studies [25] indicators used by OECD have better explanatory value than indicators used by European Union.

3.4 Comparison of methodologies for cli construction

Basic methods for construction of Composite leading indicators have many differences:

- Type of business cycle.
- Groups of countries which are monitoring.
- Trend determination techniques.
- Reference series for monitoring of business cycles.
- Relationships between reference series and indicators witch are analyses in business cycles.
- Type of using data.
- Period of using data.
- Wages of components in CLI.
- Components of CLI.

Table 3 Comparison of CLI methodologies

Criteria	Eurostat	OECD	Conference Board
Type of business cycle	Grow cycle	Grow cycle	Grow cycle
Countries	Chosen countries of European Union, Eurozone	Members of OECD, a few non-member countries	Chosen countries of the world (USA, Canada, Brazil, Mexico…)
Trend determi-nation	Hodrick-Prescott Filter	Christiano-Fitzgerald Filter	Phase-Average Trend (PAT)
Reference series	GDP	Index of industrial production	Complex indicator for every country
Relationship between reference series and indicators	Cross correlation	Method don't use this relationship	Method doesn't use this relationship
Type of data	Quantitative and qualitative data	Quantitative and qualitative data	Quantitative data
Period of data	Monthly data	Quarterly data	Monthly data
Wages of components	Different wages for two groups of components	Same wages for all components	Method doesn't use wages for components
Components of CLI	Same components CLI for every country	Different components CLI for every country	Different components CLI for every country

Source: authors

4 CONCLUSION

Nowadays we can find a few methodologies for prediction of business cycle. The most useful method is the monitoring and prediction of business cycle by composite leading indicator. This indicator is constructed in many countries by their own methodology. There are also methodologies which constructed world organization as Eurostat, OECD and Conference Board. These organizations have different methodology for construction of CLI. The biggest differences are in reference series which are used for monitoring of business cycles, analysing countries, trend determination, type and period of using data, wages and type of components CLI. Construction of CLI on the base of these methods can help us to predict business cycle about few months or quarters.

REFERENCES

[1] KYDLAND, F., PRESCOTT, E. 1990. Business Cycles: Real Factsanda Monetary Myth. Quarterly Rewiev, Federel Reserve Bank of Minneapolis, 1990. pp. 3-18, from: http://ideas.repec.org/a/fip/fedmqr/y1990isprp3-18nv.14no.2.html

[2] JAROLÍMEK, P. 2005. Vnitřní a vnejší (ne)rovnováha ekonomiky. ČSÚ, Soudobé informace, sekce a analýzy, 2005.

[3] NILSSON, R., GYOMAI, G. 2007. Cycle extraction: A comparison of the PAT method, the Hodrick-Prescott and Christiano-Fitzgerald filters, OECD, 2007, from: www.oecd.org/dataoecd/26/39/41629509.pdf

[4] BURNS, A. F., MITCHELL, W. C. 1946. Measuring Business Cycles, Cambridge: NBER, 1946. ISBN: 0-870-14085-X

[5] CZESANÝ, S. 2005. Specifika hospodářskeho cyklu ve vybraných tranzitívnych ekonomikách, In: Statistika, 2009. č. 6, s. 489 – 505, from: czso.cz/csu/2004edicniplan.nsf/p/1517-04

[6] O'SULLIVAN, A., SHEFFRIN, S. M. 2003. Economics: Principles in action. New Jersey: Pearson Prentice Hall, 2003. ISBN 0-13-0630853, from: http://www.pearsonschool.com/index.cfm?locator=PSZ3R9&PMDbSiteId=2781&PMDbSolutionId=6724&PMDbCategoryId=&PMDbProgramId=12881&level=4.

[7] SAWA, CH. S., KYRIAKOS, C. N., OSBORN, N. R. 2010. Business cycle synchronization of the euro area with the new and negotiating member countries. In: International Journal of Finance & Economics. 15: 288–306. ISSN 1099-1158.

[8] ŠULÍKOVÁ, V. Increasing macroeconomic imbalances in the world and in the Euro area. In: National and Regional Economics 9: zborník z medzinárodnej konferencie: 26th-27th September, 2012, Herľany, Slovakia. Košice: TU, 2012, s. 490-500. ISBN 978-80-553-1215-6.

[9] BARTA, R. 2002. Economics in Crisis: Severe and Logical Contradictions of Classical, Keynesian, and Popular Trade Models. In: Review of International Economics, 2002. Volume 10, Issue 2, pp. 623-644. ISSN 1467-9396.

[10] BENKEMOUNE, R. 2009. Charles Dunoyer and the Emergence of the Idea of an Economic Cycle, In: History of Political Economy, 2009. Volume 41, Num. 2. pp. 271–295

[11] BAXTER, M., KING, R.G. 1999. Measuring Business Cycles: Approximate Band-Pass Filters For Economic Time Series, Review of Economics and Statistics 81

[12] MASSMANN, M., Mitchell, J. 2003. Reconsidering the Evidence: Are Eurozone Business Cycles Converging? Bonn, Center for European Integration Studies

[13] OECD. 1998. OECD Composite Leading Indicators: A tool for short-term analysis. OECD Statistics - Leading Indicators. 2008, from: http://www.oecd.org/dataoecd/4/33/15994428.pdf

[14] LUCAS, R. E. JR. 1977. Understanding business cycle. In: Carnegie-Rochester Conference series on Public Policy, Volume 5, Reprinted in: Lucas (1981), pp. 215-239

[15] ECONOMIC CYCLE RESEARCH INSTITUTE, 2011. Turning Points & Leading Indicators, from: http://www.businesscycle.com/business_cycles/turning_points_leading_indicators

[16] CZESANÝ, S., JEŽÁBKOVÁ, Z. 2009(b). Kompozitní indikátory hospodářského cyklu české ekonomiky, In: Statistika, 2009. č. 3, s. 257-274, from: panda.hyperlink.cz/cestapdf/pdf09c3/czesany.pdf

[17] OECD. 1993. Cyklical Indicators and Business Tendency Survey. Paris: OECD, 1993, from: www.oecd.org/dataoecd/20/18/1844842.pdf

[18] OECD. 2011. Composite leading indicator, from: http://www.oecd.org/document/0,3746,en_2649_201185_46462759_1_1_1_1,00.html

[19] CZESANÝ, S., JEŽÁBKOVÁ, Z. 2009. Metóda konstrukce kompozitních indikatorú hospodářského cyklu pro českou ekonomiku. In: Statistika, 2009. č.1, s. 21-31, from: http://panda.hyperlink.cz/cestapdf/pdf09c1/czesany.pdf

[20] OECD. 2008. Handbook on Constructing Composite Indicators: Methodology and User Guide, OECD Publishing, 2008. ISBN 978-92-64-04345-9

[21] CZESANÝ, S., MACHÁČKOVÁ, L., SEDLÁČEK P. 2007. Monitorování a analýza hospodárského cyklu. Praha: Ceský statistický úrad, 2007. ISBN 978-80-250-1401-1.

[22] CZESANÝ, S. 2006. Hospodářsky cyklus. Praha: Linde, 2006. ISBN 80-7201-576-1.

[23] CZESANÝ, S. 2005. Specifika hospodářskeho cyklu ve vybraných tranzitívnych ekonomikách, In: Statistika, 2009. č. 6, s. 489 – 505, from: czso.cz/csu/2004edicniplan.nsf/p/1517-04

[24] CONFERENCE BOARD. 2001. Business Cycle Indicator Handbook. Economic Research, from: http://www.conference-board.org/pdf_free/economics/bci/BCI-Handbook.pdf

[25] NILSSON, R. 2000. Confidence indicators and composite indicators. Paris: OECD, 2000, from: http://www.oecd.org/dataoecd/16/14/2389378.pdf

AUTHORS ADDRESSES

[1] Ing. Andrea Tkáčová, PhD.

Technical university of Košice,
Faculty of economics,
B. Němcovej 32, 041 01 Košice, Slovakia

E-mail: andrea.tkacova@tuke.sk

[2] Ing. Barbora Gontkovičová, PhD.

University of Economics in Bratislava
Faculty of Business Economy with seat in Košice
Tajovského 13, 041 30 Košice

E-mail: barbora.gontkovicova@euke.sk

[3] Ing. Emília Duľová Spišáková, PhD.

University of Economics in Bratislava
Faculty of Business Economy with seat in Košice
Tajovského 13, 041 30 Košice

E-mail: emilia.spisakova@euke.sk