

5. Comparison of economic cycles morphology based on Polish gross domestic product analysis in years 2000–2013

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Abstract

For centuries economic fluctuations have been one of the most interesting phenomena to economists of different schools. Despite of different theoretical approaches it is human desire to understand the pattern behind cyclical nature of the economy. In this paper economic cycles in Poland in years 2000–2013 are investigated to verify how cycles morphology changed after the crisis of 2008 and whether they match theoretical characteristics of classic or modern cycle.

Results obtained based on analysis of Polish Gross Domestic Product show that the growth rate (although positive) has been lower since the crisis, cycles last for approximately 3.5–4 years, have sharp upper turning

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points, and turning zones instead of clearly visible troughs. Their length and turning points suggest that in terms of morphology they match characteristics of modern cycle.

The importance of this research is high, as it clearly shows that cyclical nature of Polish economy has changed. Findings may be very useful for further research (e.g. similar analysis of other economic aggregates), as well as to those all who are interested in forecasting future economic growth.

Introduction

After the economic turbulence of 2007–2008 it is important to understand whether the economy still follows pattern observed before the crisis or not. This is an essential piece of information regarding forecasting future behavior of the economy. If the economy followed known characteristics of classic or modern cycle, and no disturbances occurred after 2008, it would imply that the same forecasting tools and assumptions could be used in the future. Should any changes occur after 2008, methodology used to forecasting should be revised and adjusted to the new reality.

As it will be shown in the paper, economic cycles evolve. Based on their changes, they can be divided into two groups: classic and modern cycles. The aim of this paper is to analyze economic cycles in Poland which occurred since 2000 and verify whether they fit into morphological characteristics of classic or modern cycle.

In the paper the most important theories will be presented. This is to help the reader understand why there are fluctuations in the economy. Theories also indicate how the economic cycles can be analyzed. Following the theory, the concept of morphology is introduced. Only when very specific terminology is defined, the empirical analysis can be conducted. The analysis itself is a starting point for further research. For this, it is relatively simple, yet provides insight into how economic cycles behaved before and after 2008, and how this phenomenon can be analyzed.

5.1. Theoretical background

The reason for presenting theories in the paper is to underline the fact that:

1. The phenomenon is complex and important as a field of study.
2. The matter has been extensively researched by economists representing various approach, yet it has not been explained sufficiently.
3. Theories on economic cycles explain how and what economic indicators can be analyzed.

The official scientific announcement regarding existence of the economic cycles was made around 1860 by a French economist Clement Juglar (Marczak and Piech, 2008, p. 2–3). However, at that time, classical view on the economics was dominant. Classical economists (with J.B. Say as one of the most famous ones) claimed that economic fluctuations are totally coincidental and therefore investigating their cyclical nature is unnecessary (Say from Marczak and Piech, 2008).

Meanwhile, the number of alternative theories evolved. Some of them attempt to explain economic fluctuations with mathematics, some with psychology, or even astronomy (Malthus, St. Jevons, Prescott, from Marczak and Piech, 2008, p. 3–4). In this paper main economic theories will be presented.

They can be divided into two groups: endogenous and exogenous.

The endogenous concepts are associated with the Keynesian school, although Keynes himself focused on finding methodology to mitigate negative effects of economic crises rather than on cycles (Jędruchiewicz, 2012, p. 40). The theories developed, however, claim that the reasons for economic fluctuations are totally internal, meaning that they are caused by factors occurring within the economic system.

According to the Keynesian school, factors influencing economic fluctuations are divided into two groups: dependent and independent variables. The model of these variables is presented in the figure 5.1.

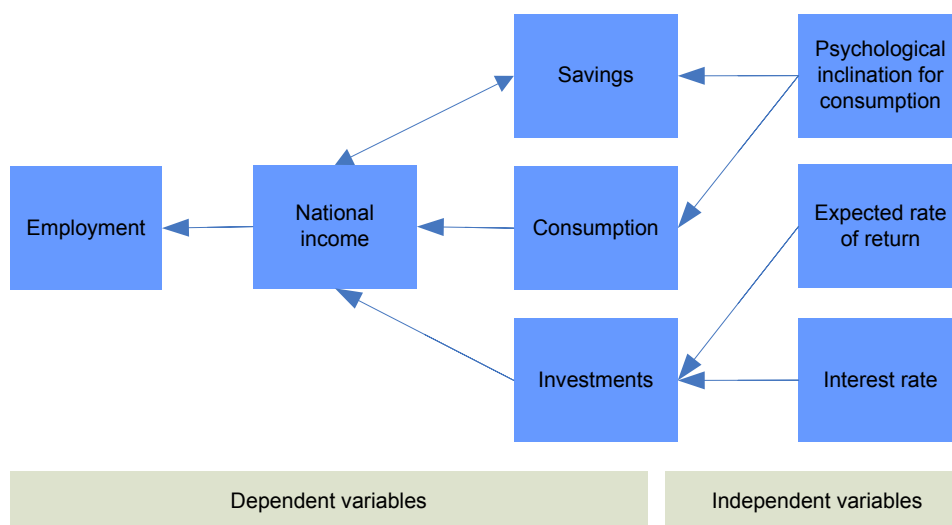


Figure 5.1. ‘Variables of the Keynes’ model
Source: (Górski and Sierpiński, 1979, p. 324).

The model states that the key element is the national income which is influenced directly by savings, consumption and investments, which on the other hand are influenced by psychological inclination for consumption, expected rate of return from investments and the interest rate. The dependency of the national income on investments is the core of the economic growth. Their level depends on the interest rate and 'animal spirit' of entrepreneurs, and is almost never equal to the level of savings, which makes the economy fluctuate. Further research introducing multiplier-accelerator model proved that types of fluctuations may differ (Hicks from Jakimowicz, 2005), however every next peak of the Gross Domestic Product tends to be attained at the higher level than previously (Smithies, 1966).

A model cycle developed by Keynes states that investments in the market start when the confidence level is high enough, i.e. that the rate of return on investments will increase (Jakimowicz, 2005, p. 42–45). For some time companies neglect rising costs of resources and rising interest rates, which results in the increase of the production volume, income and employment level. At some point rising costs of resources, or even lack of some commodities results in no faith concerning future growth. When the disappointment appears, income and the expected rate of return drop. Share prices decrease followed by consumption. That phase lasts until there is lack of some goods in the market and, in time, the expectation concerning rise of the rate of return appears again, which stimulates investments and starts new cycle.

The exogenous concepts, as opposed to the Keynesian school, claim that reasons for economic fluctuations are external, meaning that they are caused by factors which come from the outside of the economic system (Muth from Barczyk, 1993). Most of these theories grew on imperfections of the Keynesian school, e.g. the impossibility of including future expectations into the models (Kalecki, 1979, p. 272), as well as failure in explaining simultaneous occurrence of high inflation and high unemployment (Barczyk, 1993, p. 45). This can be explained with the help of monetary theories which relate economic fluctuations with financial markets. The crucial point here is the impact of monetary and fiscal policy on the economy, as supply of money causes disproportions between supply and demand in the market (Barczyk, 2006, p. 65–68). In the growth phase of the economic cycle market participants (e.g. companies), when the interest rates set by the central bank are lower than the natural ones (if the central bank never existed), are willing to take up loans even if they do not need it. This causes overproduction of goods, which need to be sold to pay back the loans. That implies lower prices, drop in revenues and risk of failure in the loan payback.

Some famous representatives of the exogenous concepts (e.g. Friedman, 1963) claim that fluctuations are generally positive phenomenon (Marczak and Piech, 2008, p. 5–11), as they simply result from optimal choices made by market participants. Moreover, even economic slowdown is needed to remove heavily indebted participants. For this, the state should focus on mitigating the negative effects of the economic slowdown only by minimizing the impact of the economic policy while the economy is still expanding, as aggressive expansion is followed by dramatic recession. An attempt to react to a post investment bubble breakdown in one sector of the economy, causes new investment bubble in another one (Białek, 2008).

Apart from the monetary concepts, among exogenous factors, there can be many other factors investigated. For instance the impact of climate changes, wars, technology shocks, political factors (Piech, 2003, p. 59–82). For the purpose of this paper, it is vital to realize that the economic cycles are a complex problem and there is still no one unique theory covering all aspects of the phenomenon.

5.2. Definition and types of economic cycles

Before the analysis of economic cycles can be conducted, it is crucial to define certain terminology. It will enable the reader understand very precise outcome of this, as well of some other research of the matter.

The main criterion based on which economic fluctuations may be classified is their time span (Rekowski, 1997, p. 18–19). This classification consists of:

- a) Development trend which is the direction of changes in the long-run. It can be positive (growth), negative (decline) or neutral (stability).
- b) Periodic fluctuations which are typically measured in days, weeks, months, or other short-term time units. They are caused by such factors as human habits, number of working days in a given period of time, climate and seasonal factors.
- c) Random fluctuations which are caused by unknown factors, but they are independent of the economy.
- d) Economic fluctuations which are oscillations of the economy around its trend line of short or medium duration. They are caused by economic factors.

Economic cycles are a specific type of economic fluctuations. However, not all economic fluctuations can be defined as cyclical, as cycles are only defined to be consecutive positive and negative change of a process. At this point it is vital to indicate three main definitions of cycles, all of which

result from the methodology used to analyze raw (in this case economic) data series:

a) Growth cycle (Mintz, 1972, p. 41)

Once the trend line of data series is established, phases of the cycle can be divided into two periods: of a relatively high growth rate and of a relatively low growth rate.

b) Deviation cycle (Mintz, 1972, p. 41)

If the trend line is presented on the horizontal *X* axis and the vertical (*Y*) axis represents deviation of the data series from its trend line, a deviation cycle is obtained.

c) Step cycle (Friedman and Schwartz, 1963, p. 32–78)

If a growth rate of a series of data (e.g. Gross Domestic Product quarter/previous quarter) is calculated and composed into new series of data, the step cycle is obtained. It is also possible to construct the step cycle by calculating growth rate between a given quarter and the corresponding quarter of the previous year.

The advantage of the step cycle is that it does not depend on the estimation of the trend line, which is necessary in case of growth and deviation cycles. For the purpose of this paper the economic cycle is defined as the step cycle of the Gross Domestic Product data series.

The literature provides characteristics of two types of economic cycles (Barczyk, 1993, p. 28).

1) Classic cycles which were observed before World War II;

2) Modern cycles which were observed after the World War II.

Their characteristic is presented in the table 5.1.

Morphology	Classic cycle	Modern Cycle
Number of phases defined	4 phases	2 phases
Turning points	Sharp points	Turning zones
Length: – growth phase – decline phase – cycle	4–6 years 4–6 years 8–12 years	2–3 years 1,5–2 years 3,5–5 years
Frequency	Low	High
Amplitude: – phases – cycle	– similar amplitudes – amplitude close to zero	– higher amplitude of growth phase than of the decline phase – growing amplitude
Intensity	High	Low
Symmetry/asymmetry	Asymmetry	Asymmetry

Morphology	Classic cycle	Modern Cycle
Structure:		
Lead/delay time	Long lead/delay times between turning points of different economic indicators	Short lead/delay times between turning points of different economic indicators
Cause and effect	Simple relations, small number of variables	Complex relations, numerous variables

Table 5.1. Comparison of classic and modern economic cycles

Source: Own, based on (Barczyk and Kowalczyk, 1993, p. 29).

As it can be observed in the table 5.1, the main difference is that modern cycles are much shorter, with turning zones instead of sharp turning points, and two phases instead of clearly visible four. Their amplitude is positive and growing, not close to zero as in the case of the classic cycle. It is also much more difficult to identify direct reasons for its morphology, as there are many complex relations of numerous variables.

There can be indicated three major reasons for this change:

1. Structural changes – privatisation in former centrally planned economies combined with growth of companies and monopolisation results in increasing efficiency, thus increasing amplitude of cycles.
2. Anticyclical policy of governments – cycles become shorter, turning zones smoother and amplitudes higher as policy makers tend to sustain constant economic growth and fight against economic crises.
3. Internationalisation of economic activities – flow of information, capital, people, goods and services is as easy as never before, which results in complex relations of variables that have impact on the economy on the national level.

5.2. Methodology

Identification of a cycle in a series of data requires introduction of a proper methodology. In this paper methodology of Bry-Boschan is used (Massmann and Mitchell, 2003, p. 102–103), which states the following:

- a) The peak of the cycle is attained in the quarter t , if the value of the cycle in the preceding and the following quarter is lower than in the quarter t ,
- b) The trough of the cycle is attained in the quarter t , if the value of the cycle in the preceding and the following quarter is higher than in the quarter t ,
- c) Each phase of the cycle must be at least 2 quarters long,

d) The length of the cycle cannot be shorter than 5 quarters,

e) When a given cycle ends, another one starts.

In order to conduct analysis of a cycle additional terminology needs to be introduced. It will enable further discussion on morphology¹ of the cycle.

Turning points – are the most important points of the cycle. They indicate where each phase starts and ends. Their location also indicates where the cycle starts and ends, as the beginning and the end of the cycle is limited by two consecutive points of the same type. The upper turning point of the cycle is called “peak” or “downturn”, while the lower one is called “trough” or “upturn”. If precise identification of a turning point is not possible due to similar values that cycle attains around it, the term “turning zone” is applied.

Phases – based on the definition of turning points, it can be stated that a phase is the time span between two opposite turning points. Basic classification distinguishes the growth phase (starting from the trough and lasting until the peak) and the decline phase (starting from the peak and lasting till the trough). However, these two phases can be divided into sub-phases: expansion, prosperity, depression and contraction (Barczyk, 2006, p. 140).

Length – time duration of a phase is called its length. The same applies to the length of the cycle, which is the duration of all phases of the cycle.

Frequency – is the inversion of the cycle length. It states how many cycles fit into a specific time interval.

Amplitude – can be defined with respect to the phase, as well as the cycle. Amplitude of the phase is the absolute value of the difference between values attained by the cycle at the beginning and the end of the phase. The amplitude of the cycle is the value equal to the difference between amplitudes of the phases. There are three types of cycle amplitude that can be distinguished. These are: constant, damping and explosive amplitude.

Intensity – is equal to the standard deviation of the data series. It measures strength of growth (decline) of either phase or the whole cycle.

Symmetry/asymmetry – a cycle is said to be symmetrical with respect to amplitudes of its phases if they are equal (thus the amplitude of the cycle equals to zero). A cycle is symmetrical with respect to length of its phases, if they are equal.

For the purposes of this paper data published by Eurostat is used. The time span of data covers period from 1st quarter of 2001 to 2nd quarter of 2014. Data series analyzed in the paper are the quarterly values of the Gross Domestic Product of Poland in million units of national currency

1 The term ‘morphology’ has been transferred to economics from other fields of study like biology or language studies. It comes from the Greek language (*morphe* = shape; *logos* = science). Source: *Słownik wyrazów obcych*, PWN, Warszawa, 1977, p. 492.

(Polish Zloty, PLN) at current prices. Data was also adjusted seasonally and adjusted by the number of working days. The database was last updated on 8.12.2014 and extracted on 9.04.2015.

Based on the above, step cycle was constructed according to the formula:

$$CYCLE_VALUE(t) = \frac{GDP(t)}{GDP(t-4)} - 1 \quad (5.1)$$

Equation 1 Formula used to calculate values of the GDP step cycle (Mintz, 1972).

5.3. Research results

Based on the Gross Domestic Product data series, quarter/quarter of the previous year, a cycle can be constructed. Its graphical representation is shown in figure 5.2. As it can be observed, in the time span from first quarter of 2001 to second quarter of 2014 three economic cycles occurred.

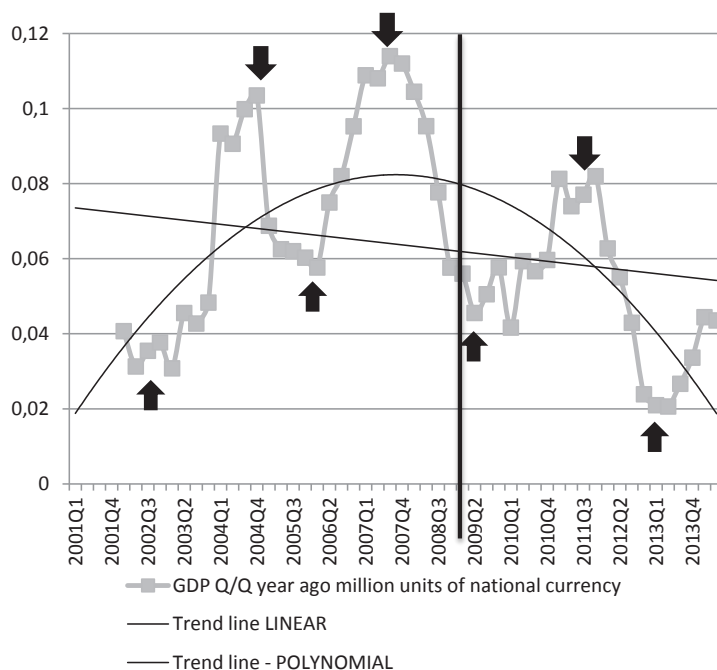


Figure 5.2. Graphical representation of GDP Quarter/Quarter prev. year, million PLN, current prices

Source: own, based on Eurostat data.

Cycle 1 started in 2002Q2 and lasted 15 quarters up to 2006Q1. That was the cycle which started recovery after global economic slowdown being result of the dotcom crash. Cycle 2 started in 2006Q1 and lasted 13 quarters until 2009Q2. During that cycle global crisis (famous Lehman Brothers bankruptcy²) took place. The cycle which followed that was Cycle 3. It started in 2009Q2 and lasted until 2013Q2. It can be stated that Cycle 3 was the first post-crisis cycle.

It is important to observe that in the investigated time span Poland has not been in a recession, as its GDP change never fell below the ZERO line. It can be noticed however, that the trend line of the cycle investigated is negative, which suggest that the rate of growth of the Polish economy is decreasing.

The last observation is in line with the research conducted by K. Beck and M. Grodzki (2014), who analyzed convergence and synchronization of economic cycles in the European Union. Slowing rate of growth of Polish economy results from the fact that it is catching up other, more developed countries within the EU³.

The question is whether the cycles of the GDP of Poland follow classic or modern cycle morphological pattern and if/how did it change after the crisis of 2008?

Characteristics of modern and classic cycles was presented in table 5.1 which can be compared with results obtained from the actual cycles analysis presented in table 5.2.

	Cycle 1	Cycle 2	Cycle 3
Begin	2002Q2	2006Q1	2009Q2
End	2006Q1	2009Q2	2013Q2
Turning points			
Lower	2002Q2	2006Q1	2009Q2
Upper	2004Q4	2007Q3	2011Q4
Length			
Growth phase	10	6	10
Decline phase	5	7	6
Cycle	15	13	16

2 See: "The New York Times" article *Lehman Files for Bankruptcy; Merrill Is Sold*, http://www.nytimes.com/2008/09/15/business/15lehman.html?pagewanted=all&_r=0.

3 See: Beck K., Grodzki M. (2014), *Konwergencja realna i synchronizacja cykli koniunkturalnych w Unii Europejskiej*, Wydawnictwo Naukowe Scholar, Warszawa, p. 9–10.

	Cycle 1	Cycle 2	Cycle 3
Amplitude			
Growth phase	7.2	5.6	3.6
Decline phase	4.5	6.8	6.1
Cycle	2.7	-1.2	-2.5
Symmetry	assymetry	symmetry wrt. Length	assymetry
Intensity			
Growth phase	0.005	0.018	0.013
Decline phase	0.019	0.023	0.021
Cycle	0.025	0.021	0.018

Table 5.2. Morphology of the economic cycles in Poland based on GDP Quarter/
Quarterprev. Year data

Source: own.

Results show that cycles 1 and 3 have 4 phases visible, while cycle 2 only 2 phases. What is more, all of them have sharp upper turning points. However, their lower turning points seem more like turning zones (cycle attains similar values for several quarters). From these observations we cannot precisely tell whether cycles follow modern or classic cycle characteristics. Also the morphology of their amplitudes does not match either classic nor modern pattern, as (1) they are different than zero and (2) last two cycles amplitudes are negative.

However, closer analysis of cycles length shows that each of them lasts approximately 4 years. This implies that they fulfill length condition of modern cycle. Results obtained in the morphology analysis of these cycles correspond to results obtained by other researchers (Skrzypczyńska, 2012, p. 11). The summary of the analysis is presented in table 5.3.

	Cycle 1	Cycle 2	Cycle 3
Numer of phases	4	2	4
CYCLE TYPE	modern	classic	modern
Turning points			
Upper	Sharp	Sharp	sharp
Lower	turning zone	turning zone	turning zone
CYCLE TYPE	cannot tell	cannot tell	cannot tell

	Cycle 1	Cycle 2	Cycle 3
Length	3–4 years	3–4 years	4 years
CYCLE TYPE	modern	modern	modern
Amplitude	Growing	Declining	Declining
CYCLE TYPE	cannot tell	cannot tell	cannot tell

Table 5.3. Comparison of cycles morphology with theoretical description of classic and modern cycles
Source: own.

It is important to observe the difference between cycles before and after the crisis. Clearly, the biggest difference is their amplitude. Cycle 2 and cycle 3 both have negative amplitudes. The length of all cycles and their symmetry are also similar. Cycle 3 is less intensive, though. From this, it can be stated that the cycles do not differ much, except of their amplitudes.

5.4. Discussion

In this paper we analyzed three economic cycles:
Cycle 1 – before the crisis,
Cycle 2 – ‘including’ crisis,
Cycle 3 – post-crisis.

It can be stated that either of them matches the description of classic and modern cycles, except of their length (appr. 4 years), which indicates that in terms of length the cycles match the characteristics of the modern cycle.

The fact that upper turning points of cycles area clearly visible, while lower turning points have characteristics of turning zones implies, that when an economic cycles reaches its peak, the following decline phase appears rapidly. On the other hand, economic trough smoothly becomes the beginning of the following growing phase. It is of a high importance to all who try to forecast future economic growth, as it turns out that at its peak, economic cycles rapidly change its behavior.

Their morphology also seems similar, except for their amplitudes which have been negative since the crisis. It implies that Polish economy is still in the slow-down phase. That is caused by time difference in the GDP components, which recover from the slow-down with different rate (Gradzewicz, Growiec, Hagemeyer and Popowski, 2010, p. 30). However that information alone should not be used as an assumption

for prognostic tool, as it may be expected that due to economic, political, social, or other factors, the declining trend line of the economic growth might stabilize or even change its gradient to positive one.

It is recommended to conduct similar analysis when data for following years are available. In time it will be possible to observe if the economy and its fluctuations have changed after the crisis. It is also advised to investigate how other economic aggregates behaved before and after 2008. That information would be of a great value to forecasting and understanding processes which take place within the economy.

Conclusion

In this paper the analysis of economic cycles in Poland in years 2000–2013 was conducted in order to verify whether the economy still follows pattern observed before the crisis of years 2007–2008 or not. Additionally, the similarities of their morphology with respect to characteristics of classic and modern cycles were examined.

The results clearly show, that in the examined period Poland was not in a recession, growth of Polish economy has become less dynamic after the crisis. As the last cycles lasted approximately 3–4 years with turning zones as their troughs, it can be stated that they partly fulfill the characteristics of modern economic cycle.

It is recommended to conduct similar analysis when more data is available. Moreover, it is advised to analyze other economic aggregates in terms of their behavior before and after the crisis.

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