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Stylised Facts about Cyclical Fluctuations of Business Survey Data Part I

Abstract

The paper discusses cyclical fluctuations of business activity in selected sectors of the Polish economy, with the use of business confidence indicators. We analyse main morphological features of the cyclical fluctuations: phase duration, timing of turning points, amplitudes, intensity and leads/lags of qualitative indicators in reference to GDP, and cross-correlations. Four sectors of the economy are analysed: manufacturing, construction, motor transport and retail trade. We make an insight into empirical regularities of cyclical fluctuations, known as *stylised facts*. We particularly aim to examine the following *stylised facts* about business cycles in Poland, ie (1) whether manufacturing contributes the highest to a business cycle, (2) construction and transport are leading sectors of the economy, and (3) retail sales stabilise general business activity.

Keywords: business cycles, qualitative business cycle indicators, leading indicators

JEL classification: E32, E44

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1. Introduction

Fluctuations of business activity are recurrent. A period of increased business activity is followed by economic slowdown. The changes are, however, not mechanical. Despite their recurrence they usually surprise economic agents. It is hard not only to forecast a turning point but also to determine factors that cause it to come. Research on the nature of volatility of business activity has delivered a series of theoretical models and, on the other hand, revealed empirical regularities one may observe in the course of cyclical economic development. Nowadays, business tendency research focus on the two areas: to search for new theories which would explain the mechanics of cyclical fluctuations and to establish repeating stylised facts, and, in this way, to fully explore and know the behaviour of economic agents: firms, consumers and a government. Our analysis is conducted in the framework of the latter stream of research.

Arthur Burns and Wesley Mitchell, who classically defined a business cycle, were pioneers of the research on stylised facts. They stressed an analysis of cyclical fluctuations should have encompassed, as much as possible, various aspects of aggregated business activity (Mitchell, 1927; Burns & Mitchell, 1946). They gave rise to identification of business cycles' regularities and Mitchell himself impressed the history of economics as a proponent of measurement without theory. Burns & Mitchell have been followed by Moore (1983, 1985, 1986), Zarnowitz (1973, 1986, 1992), Lucas (1981), Altug (2010) and many others.

Using business survey data to analyse stylised facts reflects the idea, of those who develop composite indicators and elaborate forecasting models, that research into business cycles should allow for business confidence and consumer sentiments. Due to the fact that general business activity is comprehensive business cycles analysis ought not to study individual variables. In order to understand the mechanics of cyclical fluctuations of business activity it is necessary to study interrelations between various segments of an economy for a business cycle affects the entire economy. The approach taken by Burns & Mitchell to analyse reference variables makes possible to sequence economic phenomena in order of ocurrance and, in the result, to identify the economic variables which fluctuate in the rhythm of general business activity, or not[1]. This let us distinguish three types of variables:

- coincident, ie those whose turning points occur at the same time as of general business activity,

[1] Burns & Mitchell analysed over 1000 time series for 4 countries: USA, UK, France and Germany.

- leading, ie those whose turning points occur before aggregated business activity swings downward or upward,
- led, ie those whose turning points follow downturns or upturns of general business activity.

To qualify the very nature of these relationships is essential for:

- indicators be developed that would lead forthcoming recession or recovery,
- relationships between individual economic variables be statistically and econometrically analysed and
- stylised facts be identified.

The approach Burns & Mitchell took was criticised by proponents of studying a business cycle on the grounds of economic theory. Objections were raised by Koopmans (1947), who claimed the approach to have no theoretical background and be limited to as little as statistical description. The discussion that ran high in the 1950s, after Koopmans published *Measurement without theory*, involved many prominent researchers of business cycles, *inter alia*, Rutldge Vining (1949), who forcefully advocated the method based on observations and measurement of empirical facts. The majority of reasearchers acknowledged the pioneering contribution of Burns & Mitchell and extensively applied their methods[2]. A study of empirical regularities of cyclical fluctuations, known as *stylised facts*, became an established element of business cycles analysis and contributed to development of business cycles theory[3].

2. Methods of analysis

In this paper, with the use of time series collected within the Research Institute for Economic Development (RIED) and the Motor Transport Institute (MTI) business surveys we study stylised facts about business cycles in Poland. Identyfying them is crucial for research into economic incidents during consecutive stages of a business cycle. We study coincidence of cyclical fluctuations of particular macroeconomic variables, by investigating, specifically:

- maximum and minimum values,
- amplitudes,
- duration,

[2] Robert E. Lucas was one of them. He thought of the Burns & Mitchell's seminal work as the first and excellent description of the very characterics of a business cycle that should come as a part of any general economic theory (see Lucas, 1981, p. 236).

[3] Contemporarily, it is being practiced by Allan Harding (2003), among others, who replied to Koopmans' critique with the saying *measurement before theory.*

- turning points,
- intensity,
- timing of changes in each of the business sectors surveyed by RIED and MTI.

The study is split into two parts. First, we analyse cyclical fluctuations at the macroeconomic level, setting GDP for reference. We choose four NACE rev.2 sectors: manufacturing (NACE C), construction (NACE F), motor transport (NACE H49.41) and retail trade (NACE G47). The selection was motivated by character of interrelations between the four sectors and general business activity as well as by availability of time series. The business confidence indicators for these sectors are powerful predictors of GDP (Klimkowska & Stolorz, 2008). Construction and manufacturing are the sectors that have been surveyed by RIED at the earliest. At the same time they strongly affect the economy's output. Till recently the share of manufacturing in GDP was overwhelming, and it is on the decline now, giving way to services. Nevertheless, it highly contributes to the business cycles. Construction, in turn, is generally considered to lead changes of general business situation. And transport services all business activities. It is assumed to lead other businesses as it provides them with intermediate goods. It may, however, be argued that transport delivers finished goods to final customers, and, due to this fact, might be a coincident indicator as well. We elaborate on this too. Finally, retail sales reflect consumers behaviour. Research into cyclical fluctuations of retail trade is expected to give an answer to the question whether smoothing consumption is a matter of fact[4] and it makes an economy more stabilised. We primarily aim to examine the following stylised facts about business cycles in Poland:

1. Manufacturing contributes the highest to a business cycle.
2. Construction and transport are leading sectors of the economy.
3. Retail sales stabilise general business activity.

In the second part of the study we analyse cyclical fluctuations within each of the sectors. The results of this part of the study will be published in another volume of *Papers and Proceedings*.

We analyse the following composite indicators:

- Industrial Confidence Indicator (ICI),
- Construction Confidence Indicator (CCI),
- Transport Confidence Indicator (TCI),
- Retail Confidence Indicator (RCI).

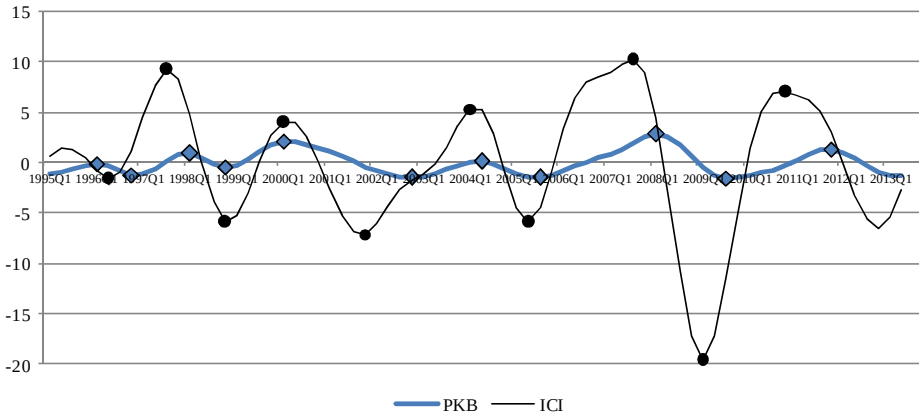
[4] Smoothing consumption is the key hypothesis of the permanent income theory by Friedman (1957) and the life-cycle theory of consumption by Ando & Modigliani (1957).

All the indicators are calculated according to the guidelines by the European Commission.[5] Business indicators are matched with the single-base index of real GDP (2005=100). We follow the growth-cycle approach, by analysing deviations of cyclical components from the trend. The cyclical components were estimated by the Christiano-Fitzgeralnd filter (Christiano & Fitzgerald, 2003). Turning points were detected by applying the Bry-Boschan technique (1971)[6]. The data covers the period of 1995Q1-2013Q2.

3. Results

By examining the cyclical component of GDP, which is both an indicator of general business activity and the reference for the selected confidence indicators, we identified 11 turning points. They make four full cycles measured between troughs (T-T). The first one, lasting from 1996Q4 to 1998Q4, is called 'the Russian crisis' as it was sparked by tightening the Eastern markets for Polish products. The upward phase was five-quarters long and the downward one lasted three quarters. The second cycle is known as the dot.com crisis for it was brought about with a burst of the speculative bubble of Internet-based companies on foreign markets. It was 17-quarters long, since 1998Q4 till 2002Q4. The boom was six-quarters long and the contraction lasted 11 quarters. The third cycle, called 'the Accession boom', was three-years long and lasted since 2002Q4 till 2005Q3. The upward phase was 7-quarters long and the downward one – 5-quarters long. The fourth cycle lasted 4 years, from 2005Q3 to 2009Q3. Its upward phase ended up at the beginning of 2008 with the US subprime mortgage crisis that led to a global recession. The contraction was 6-quarters long and finished in 2009Q3. The economy is on another decline now that was caused by fiscal problems of some euro-zone economies. The downturn came on 2011Q4 after 9 quarters of recovery and boom. The subsequent contraction is 6-quarters long and we look to its termination with an increasing restlessness[7]. The lower turning point has not been formally detected yet, although some signs of an upturn showing up are being noted (troughs detected in construction industry and retail trade) (see Graph 1).

[5] See details in *The joint ...* (2007).
[6] These methods have been frequently used in research by RIED since the report by Adamowicz *et al*. (2008) was published.
[7] As of 2Q2013.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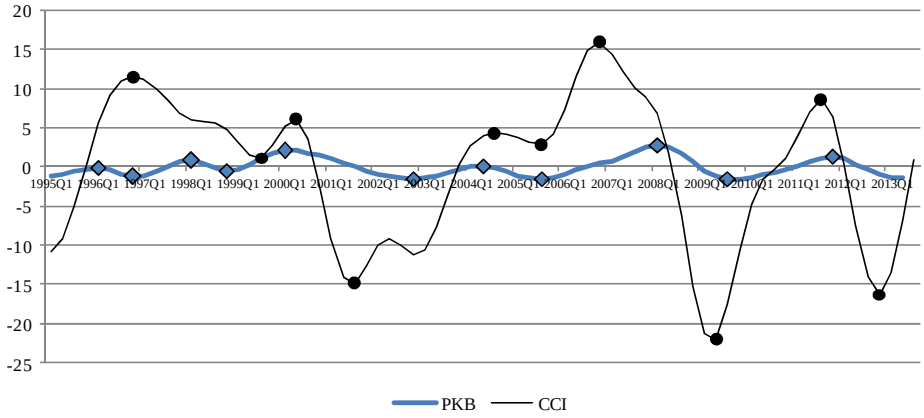
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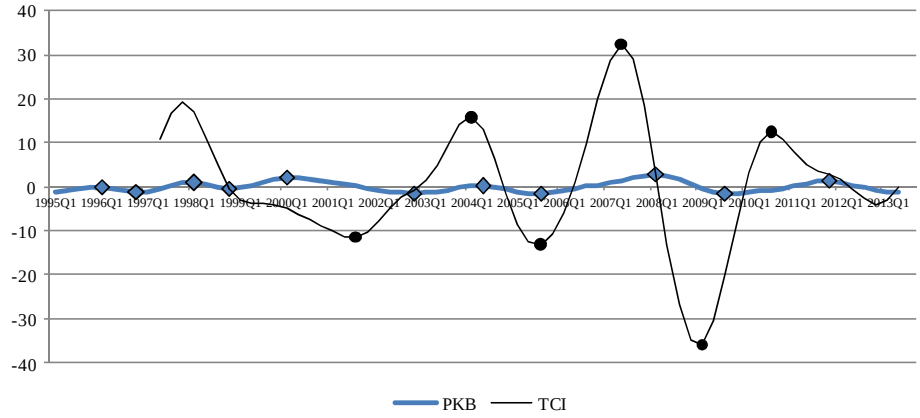
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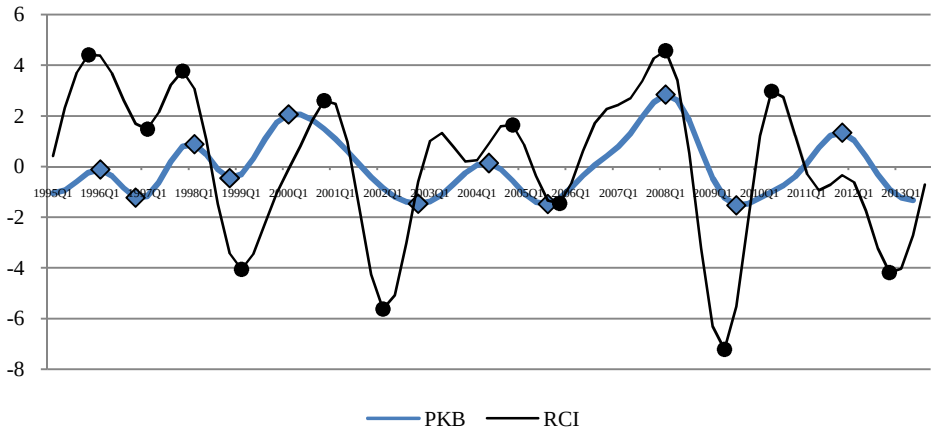

Graph 1. Cyclical components of ICI, CCI, TCI and RCI against GDP (PKB), Poland, 1995-2013.

Source: own compilation.

The same number of T-T cycles is found for the industrial confidence indicator and the retail confidence indicator. We distinguish four cycles for the construction confidence indicator as well, however, the very recent cycle of construction industry follows the last cycle of GDP. There are only two full cycles identified for the transport confidence indicator in the period under the study. The time paths of the cyclical components differ from each other. The same number of turning points of the reference series is found for RCI only. We identify 10 turning points for ICI, 10 for CCI and 6 for TCI. There are two additional turning points in cyclical fluctuations in construction and retail trade.

Diversity in timing of turning points results in diversity in duration of subsequent phases (see Table 3 for details). Differences can also be found in overall statistics of the variables (see Table for details). Maximum (minimum) values of the cyclical components of the indicators are higher (lower) than the corresponding figures of the reference series, resulting in higher amplitudes of the quantitative data. It needs to be stressed that the absolute values of the minima of the indicators are higher than the maxima. In other words the declines in periods of recessions are greater than the increases during booms.

The amplitudes differ from a phase to a phase and across variables. The maximum deviations from trend of the TCI cyclical component are the highest of all and sums to over 60 pts. The maximum and minimum values exceed 30 pts and the standard deviation amounts to 13.84 pts. High volatility is also found for CCI. The maximum deviation above the trend amounts to 15.99 pts, and beneath the trend – 22.04 pts. In effect the standard deviation is high too,

and equals to 9.3 pts. The maximum range of cyclical fluctuations of ICI is less than 30 pts and the standard deviation amounts to 6.36 pts. The least volatility of fluctuations is noted for the retail confidence indicator. The difference between the maximum and the minimum is less than 12 pts, and the standard deviation amounts to 2.82 pts. For all the variables the highest deviations from trend were recorded during the global financial and economic crisis of 2007-2009. The majority of the indicators hit record high/low (in the upper/lower turning point).

Table 1. Statistics of the cyclical components of GDP, ICI, CCI, TCI and RCI, Poland, 1995-2013.

	sample	no. obs.	max	min	σ	r_0	r_{max}
PKB	1995Q1-2013Q2	74	2.84	-1.53	1.15	-	-
ICI	1995Q1-2013Q2	74	10.28	-19.59	6.36	0.322	0.662 (-2)
CCI	1995Q1-2013Q3	75	15.99	-22.04	9.30	0.361	0.606 (-3)
TCI	1997Q2-2013Q2	65	32.42	-35.91	13.84	0.186	0.567 (-3)
RCI	1995Q1-2013Q3	75	4.57	-7.22	2.82	0.373	0.43 (-1)

Notes: max – maximum value (in pts), min – minimum value (in pts), σ – standard deviation (in pts), r_0 – correlation coefficient ($t = 0$) (with GDP), r_{max} – maximum correlation coefficient (in brackets lead (-) / lag (+) in quarters).

Source: own calculations.

High volatility of cyclical fluctuations in construction and retail trade effects in higher volatility of general business activity. The impact of cyclical fluctuations in manufacturing is weaker. Their pattern resembles, to some degree, the pattern of cyclical fluctuations of GDP. On the other hand, retail trade is less volatile and contribute to stabilise the economy. It is most probably due to consumers who tend to smooth their consumption in time. This conclusion requires further research.

Timing of turning points of each of the variables is more or less different from another. This impinges upon quite weak synchronicity of cyclical fluctuations of the confidence indicators with GDP. The cross-correlation coefficient amounts to 0.322 for ICI, 0.361 for CCI, 0.186 for TCI and 0.373 for RCI. However, the coefficient is much higher with a lead. It takes the highest value, 0.662, for ICI leading by 2 quarters. Thus, the correlation analysis confirms the stylised fact about highly significant contribution of

cyclical fluctuations in manufacturing to aggregated cyclical fluctuations. The highest coefficient of cross-correlation between cyclical fluctuations of CCI and GDP amounts to 0.606, with a 3-quarters lead. This might suggest CCI be a leading indicator of GDP, the most of all. The same lead is found for TCI, however the cross-correlation coefficient is lower (0.567). For RCI the highest coefficient is 0.43, with one-month lead. The results of the correlations analysis are confirmed by detailed data on leads and lags of turning points (see Table 2).

The average lead of troughs ranges from 0.5 quarter for RCI to 2.3 quarters for TCI (1.8 quarter for ICI and 0.75 quarter for CCI). The average lead of peaks ranges from 0.2 to 3 quarters. In general, the average lead of upper and lower turning points is the highest (2.7 quarters) for TCI. For ICI it equals 1.8 quarter and, much less, only 0.4 quarter for CCI and RCI. As the time series are not long (or, in other words, the number of the turning points is small), the average values might be misleading. Nevertheless, detailed analysis of each of the turning points does not change the conclusion. For example, of the 10 GDP turning points signalled by the ICI turning points two were coincident (the lower turning point of the 'Russian' crisis and the upper turning point of the dot.com bubble) and all the others were leading with leads of 1 to 4 quarters. In the case of CCI such synchronicity was recorded only once, at the dawn of the accession boom. For TCI and CCI only one turning point (2005Q3) coincided with the turning point of the GDP cyclical component. RCI is another indicator that recorded only one turning point overlapped with the GDP cyclical component turning point, ie at the downturn following the US financial crisis (2008Q1). Taking into account calculated values of the cross-correlation coefficient and particular leads we conclude that at least one of the confidence indicators, namely ICI, is a reliable leading indicator of GDP.

The results obtained for the cyclical component of the construction confidence indicator are ambiguous. Three times it was lagged in reference to GDP (two peaks and one trough lagged). The lags were, respectively, 3 and 2 quarters. The results are not consistent with the stylised fact that construction is leading against other sectors of an economy. Since the sample is short and many outliers come up in the period under the study we cannot definitely reject the stylised fact. The issue requires further insight.

Table 2. Turning points and leads (-) / lags (+), Poland, 1995-2013.

	GDP	ICI	CCI	TCI	RCI
no. of GDP TPs signalled	11	10	9	6	11
no. of additional TPs	-	0	1	0	1
Recovery after the transition recesssion					
P	1996Q1	ns	3	-	-1
T	1996Q4	-2	ns	-	-1
'Russian crisis'					
T	1996Q4	-2	ns	-	1
P	1998Q1	-2	ns	ns	-1
T	1998Q4	0	3	ns	1
dot.com crisis					
T	1998Q4	0	3	ns	1
P	2000Q1	0	1	ns	3
T	2002Q4	-4	-5	-5	-3
Accession boom					
T	2002Q4	-4	-5	-5	-3
P	2004Q2	-1	1	-1	2
T	2005Q3	-1	0	0	1
Financial and economic crisis					
T	2005Q3	-1	0	0	1
P	2008Q1	-2	-5	-3	0
T	2009Q3	-2	-1	-2	-1
Indebtness crisis					
T	2009Q3	-2	-1	-2	-1
P	2011Q4	-4	-1	-5	-6
average lead of troughs		-1,8	-0,75	-2,3	-0,5
average lead of peaks		-1,8	-0,2	-3,0	-0,2
average lead		-1,8	-0,4	-2,7	-0,4

Notes: P – peak (upper turning point), T – trough (lower turning point), ns – not signalled.

Source: own calculations.

The study of timing of the TCI cyclical component turning points paints another picture. It shows the least number of turning points and as many as three reference turning points are not signalled at all. However, five out of six turning points are leading. Thus, there is no ground to claim TCI a coincident indicator of GDP.

RCI is the variable of the same number of turning points as GDP but their timing is not congruent. Alternating lags and leads do not show any regularity. Short leads/lags and the value of the correlation coefficient evidence for RCI to be a coincident indicator of GDP. This calls, however, for further research.

Diverse timing of turning points results in differences in duration of the cycles and the phases of particular indicators (see Tables 3 and 4 for details). The highest average duration of an upward phase was estimated for TCI, 7.7 quarters, and the lowest for RCI, 6.8 quarters. The average duration of a downward phase was the highest for CCI, 7 quarters, and the lowest for RCI, 5.7 quarters (similar to the reference series). For all the confidence indicators duration of upward phases was higher than duration of downward phases. This is in line with the fact that booms tend to last longer than recessions.

Diversity in duration and amplitudes made intensity of the cycle and their phases vary. Retail trade is characterised with the lowest intensity. Downward phases are more intense than upward ones. Manufacturing and construction show higher intensity and the highest intensity is found for motor transport. The average intensity for upward phases amounts to 2.23 pts/quarter for ICI, 2.32 pts/quarter for CCI, 5.77 pts/quarter for TCI and 1.12 pt/quarter for RCI. The respective figures for upward phases are as follows: 2.96 pts/quarter for ICI, 2.86 pts/quarter for CCI, 7.29 pts/quarter for TCI and 1.27 pt/quarter for RCI. In manufacturing, construction and transport the intensity was record high during the recession that followed the US subprime mortgage crisis. RCI recorded the highest intensity in the next phase. It needs to be stressed however, that as the sample is quite short average values might be misleading and one should thoroughly examine detailed results presented in Tables 3 and 4.

Note that the business confidence indicators under the study diverge from each other in the beginning of the period, then – especially after the EU accession – the divergence diminishes. This tendency manifests transition process from the command economy to the market-oriented economy and the path that Polish firms made to know market rules. Another problem, caused by numeric procedures (extraction of a cyclical component), come into consideration at the end of the sample, ie in order to monitor business activity in real time we need to have in mind that updating time series might change estimations of last observations.

Table 3. Statistics of the successive phases of the cycles.

	GDP	ICI	CCI	TCI	RCI
Recovery after the transition recesssion downward phase	1996Q1-1996Q4				1995Q4-1997Q1
Δ	-1.1				-2.9
d	3				5
i	-0.37				-0.59
'Russian cisis' upward phase	1996Q4-1998Q1	1996Q2-1997Q3			1997Q1-1997Q4
Δ	2.1	10.9			2.3
d	5	5			3
i	0.42	2.17			0.77
'Russian cisis' downward phase	1998Q1-1998Q4	1997Q3-1998Q4	1996Q4-1999Q3		1997Q4-1999Q1
Δ	-1.3	-15.2	-10.4		-7.8
d	3	5	11		5
i	-0.45	-3.03	-0.95		-1.57
dot.com crisis upward phase	1998Q4-2000Q1	1998Q4-2000Q1	1999Q3-2000Q2		1999Q1-2000Q4
Δ	2.5	9.9	5.0		6.7
d	5	5	3		7
i	0.50	1.98	1.67		0.95
dot.com crisis downward phase	2000Q1-2002Q4	2000Q1-2001Q4	2000Q2-2001Q3		2000Q4-2002Q1
Δ	-3.5	-11.2	-21.0		-8.2
d	10	7	5		5
i	-0.35	-1.60	-4.20		-1.64

Accession boom upward phase	2002Q4-2004Q2	2001Q4-2004Q1	2001Q3-2004Q3	2001Q3-2004Q1	2002Q1-2004Q4
Δ	1.6	12.5	19.2	27.3	7.3
d	6	9	12	10	11
i	0.27	1.39	1.60	2.73	0.66
Accession boom downward phase	2004Q2-2005Q3	2004Q1-2005Q2	2004Q3-2005Q3	2004Q1-2005Q3	2004Q4-2005Q4
Δ	-1.6	-11.1	-1.4	-28.9	-3.1
d	5	5	4	6	4
i	-0.32	-2.23	-0.36	-4.82	-0.77
Global financial and economic crisis upward phase	2005Q3-2008Q1	2005Q2-2007Q3	2005Q3-2006Q4	2005Q3-2007Q2	2005Q4-2008Q1
Δ	4.3	16.1	13.1	45.6	6.0
d	10	9	5	7	9
i	0.43	1.79	2.62	6.51	0.67
Global financial and economic crisis downward phase	2008Q1-2009Q3	2007Q3-2009Q1	2006Q4-2009Q2	2007Q2-2009Q1	2008Q1-2009Q2
Δ	-4.4	-29.9	-38.0	-68.3	-11.8
d	6	6	10	7	5
i	-0.73	-4.98	-3.80	-9.76	-2.36
Indebtness crisis upward phase	2009Q3-2011Q4	2009Q1-2010Q4	2009Q2-2011Q3	2009Q1-2010Q3	2009Q2-2010Q2
Δ	2.9	26.7	30.7	48.4	10.2
d	9	7	9	6	4
i	0.32	3.81	3.41	8.07	2.55
Indebtness crisis downward phase	2011Q4-	2010Q4-	2011Q3-2012Q4	2010Q3	2010Q2-2012Q4

Δ			-25.0		-7.2
d			5		10
i			-5.00		-0.72
average of downward phases					
Δ	-2.4	-16.9	-19.2	-48.6	-6.8
d	5.4	5.8	7	6.5	5.7
i	-0.44	-2.96	-2.86	-7.29	-1.27
average of upward phases					
Δ	2.7	15.2	17.0	40.4	6.5
d	7	7	7.3	7.7	6.8
i	0.39	2.23	2.32	5.77	1.12
average of all					
Δ	1.8	10.2	11.7	15.6	5.3
d	6.2	6.4	7.1	7.1	6.2
i	0.30	1.64	1.69	2.28	0.95

Notes: *d* – duration of phase (in quarters), Δ - change in phase (in pts), *i* – intensity (in pts per quarter).

Source: own calculations.

Table 4. Statistics of the successive cycles.

	GDP	ICI	CCI	TCI	RCI
P-P	1996Q1-1998Q1				1995Q4-1997Q4
Δ	1.0				-0.6
d	8				8
i	0.40				0.68
T-T	1996Q4-1998Q4	1996Q2-1998Q4			1997Q1-1999Q1
Δ	0.8	-4.3			-5.5
d	8	10			8
i	0.44	2.60			1.17
P-P	1998Q1-2000Q1	1997Q3-2000Q1	1996Q4-2000Q2		1997Q4-2000Q4
Δ	1.2	-5.3	-5.4		-1.2
d	8	10	14		12
i	0.48	2.50	1.31		1.26
T-T	1998Q4-2002Q4	1998Q4-2001Q4	1999Q3-2001Q3		1999Q1-2002Q1
Δ	-1.0	-1.4	-16.0		-1.6
d	15	12	8		12
i	0.43	1.79	2.93		1.30
P-P	2000Q1-2004Q2	2000Q1-2004Q1	2000Q2-2004Q3		2000Q4-2004Q4
Δ	-1.9	1.3	-1.8		-1.0
d	16	16	17		16
i	0.31	1.50	2.90		1.15

T-T	2002Q4-2005Q3	2001Q4-2005Q2	2001Q3-2005Q3	2001Q3-2005Q3	2002Q1-2005Q4
Δ	0.0	1.4	17.8	-1.7	4.2
d	11	14	16	16	15
i	0.29	1.81	0.98	3.78	0.72
P-P	2004Q2-2008Q1	2004Q1-2007Q3	2004Q3-2006Q4	2004Q1-2007Q2	2004Q4-2008Q1
Δ	2.7	5.0	11.7	16.6	2.9
d	15	14	9	13	13
i	0.38	2.01	1.49	5.67	0.72
T-T	2005Q3-2009Q3	2005Q2-2009Q1	2005Q3-2009Q2	2005Q3-2009Q1	2005Q4-2009Q2
Δ	-0.1	-13.8	-25.0	-22.8	-5.8
d	16	15	15	14	14
i	0.58	3.38	3.21	8.13	1.51
P-P	2008Q1-2011Q4	2007Q3-2010Q4	2006Q4-2011Q3	2007Q2-2010Q3	2008Q1-2010Q2
Δ	-1.5	-3.2	-7.3	-19.9	-1.6
d	15	13	19	13	9
i	0.52	4.40	3.61	8.91	2.45
T-T			2009Q2-2012Q4		2009Q2-2012Q4
Δ			5.7		3.0
d			14		14
i			4.21		1.63
average of P-P cycles					
Δ	0.3	-0.6	-0.7	-1.7	-0.3

d	12.4	13.3	14.8	13	11.6
i		2.60	2.33	7.29	1.25
average of T-T cycles					
Δ	-0.1	-4.5	-4.4	-12.2	-1.1
d	12.5	12.8	13.3	15	12.6
i		2.40	2.83	5.96	1.27

Notes: : *d* – duration of cycle (in quarters), Δ - change in cycle (in pts), *i* – intensity (in pts per quarter), T-T – trough-to-trough cycle, P-P – peak-to-peak cycle.

Source: own calculations.

All the business confidence indicators record a peak of the recent cycle, which signalled the reference upper turning point with a lead of 4 quarters in the case of ICI, 1 quarter for CCI, 5 quarters for TCI and 6 quarters for RCI. And the subsequent downward phase even finished in construction and retail trade in 2012Q4. There are signs of an upturn coming in manufacturing and motor transport, however, the Bry-Boschan technique do provide no evidence for this.

4. Stylised facts

The analysis of cyclical fluctuations of indicators of business activity in the four sectors indicates that signals of the changes in economic dynamics appear first and with the greatest regularity in the manufacturing sector. For the lower turning points the lead with respect to the changes in the GDP is 1.8 quarter with a similar magnitude for the upper turning points. Ambiguous results have been obtained for the construction sector. The variable has a more leading character at times of an increased economic activity. For the troughs the average lead is 0.75 quarter. The peaks, indicating a decline in economic activity, are closely located to the changes in the GDP. The largest leads in the fluctuations of the cyclical component of the business indicator have materialised in the transport sector with the smallest number of turning points signalled, however. In addition, ambiguous results have been obtained for retail trade. Fluctuations in the indicator in this sector indicate with a lead of 0.5 quarter an increases in economic activity. The lead is 0.2 quarter relative to the reference variable for declines in economic activity.

Obtained results confirm the leading character of the composite qualitative variables. In addition, the results show that the course of fluctuations varies by sectors of the economy. The fit is the closest to the reference variable for the manufacturing sector. The morphological features of the cyclical component of ICI are the closest to the fluctuations in the GDP. This confirms a verifiable property that the course of the cyclical fluctuations of manufacturing has the highest impact on the fluctuations of the aggregate economic activity (hypothesis 1). The property that construction is the sector with earliest materialisation of the changes in economic activity is not fully supported (hypothesis 2). Our analysis, however, cannot serve as a basis for a rejection of such a hypothesis as it is visible in multiple phases. Higher leads have been confirmed for the transport sector with the smallest number of turning points. Also this observation requires further insight. Similarly, ambiguous results have been found in retail trade. In this case as well there is no basis, given the amplitude of the fluctuations and the intensity of the changes

in different phases of the cycle, for a rejection of the property indicating a stabilising impact of this sector (hypothesis 3). An unambiguous clarification of those issues requires additional research and more extended time series data.

Our analysis allows for a positive verification of the hypothesis that the impact of the cyclical movements in manufacturing on the course of business cycle in Poland is the highest as the changes in economic activity are signalled with the greatest lead and highest regularity by the turning points of the business confidence indicator in the manufacturing sector. The cross-correlations confirm the existence of strong connections between fluctuations in GDP and ICI. The leading character of changes in the construction sector has not been confirmed. There is no basis for a rejection of this hypothesis, either. Unusual events in this area of economic activity increasing the uncertainty and risk in economic activity materialised during the course of the researched time frame. The issue requires further research. There is no basis for a rejection of a statement that cyclical changes in retail trade have a stabilising impact on the course of fluctuations in the aggregate.

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