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Empirical Properties of the Credit and Equity Cycle within Almost Periodically Correlated Stochastic Processes - the Case of Poland, UK and USA

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Abstract

We discuss the notion of the financial cycle making a clear indication that the thorough study of its empirical properties in case of developing economies is still missing. We focus on the observed series of credit and equity and make formal statistical inference about the properties of the cycles in case of Polish economy. The non-standard subsampling procedure and discrete spectral characteristics of almost periodically correlated time series are applied to make formal statistical inference about the cycle. We compare the results with those obtained for UK and USA. We extract the cyclical component and confront empirical properties of the financial cycle for small open economy with those established so far in case of developed economies.

Keywords: financial cycle, business cycle, discrete spectral analysis, APC processes, subsampling approach

JEL Classification: C14, C46, E32

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1 Introduction

The cyclical nature of changes in activity of economic systems is one of the most important research project in economics. It was originated on the field of empirical macroeconomics many decades ago; see Burns and Mitchel (1946), however the theoretical considerations of economic cycles has its roots in the mid XIX century; see Juglar (1856). Prior to the global financial crisis, occurred at the late 2000's, the most important questions related to the cyclical nature of economic activity were put on the field of the real sector of economy, making the business cycle the most important subject of inquiry. As it was pointed by Drehmann et al. (2012) the pre-crisis paradigm was dominated by opinion that fluctuations on the financial system, observed as financial booms and busts, were of minor importance; see Woodford (2003) as a good example. Hence, the notion of the financial cycle was not represented in the postwar mainstream.

The financial crisis made the most of well developed economies to fall into recession, and has prompted a major rethink in macroeconomics and finance. The way how financial factors can be incorporated into macroeconomic models seems the most important topic of frontiers in macroeconomics. Consequently, last years have seen resurgence of an idea of the cyclicality in the financial sector; see Borio (2012), Drehmann et al. (2012), Aikman et al. (2012), Schularick and Taylor (2012), Jordá et al. (2011), Dell'Arriccia et al. (2012).

The main purpose of this paper is to characterize the financial cycle in Poland using novel approach . We apply non-standard subsampling procedure, in order to make formal statistical inference about the stylised facts about the cycles observed in the financial system. We show that cyclical nature under consideration can be modelled by parameterisation of the discrete spectra of the Almost Periodically Correlated (APC) time series. The APC class is a generalisation of Periodically Correlated (PC) class of time series, introduced by Gladyshev (1961), white PC is a generalization of covariance stationary class of time series. The vast literature confirmed substantial empirical importance and flexibility of PC class in many time series applications, see: Parzen and Pagano (1979), Osborn and Smith (1989), Franses (1996), Bollerslev and Ghysels (1996), Franses and Boswijk (1996), Burridge and Taylor (2001), Lenart and Pipień (2013a,b), Lenart (2013). According to Hurd and Miamee (2007), the periodically correlated time series are nonstationary, where non-constant unconditional expectation of the process exhibit regular periodic evolution in time domain. The generalisation presented in Hurd (1989, 1991); Hurd and Miamee (2007) and adopted in this paper assumes that the mean of the nonstationary time series can be described by almost periodic function.

From the definition, APC time series may describe irregular character of unconditional means for nonstationary time series. Assuming, that detrended observed time series follows APC, we relax assumption of stationarity of cyclical factor, very commonly imposed in filtering approaches. Nonstationarity of the cycle component of the series, together with possible irregularities in time pattern of the unconditional mean, makes

our approach relatively flexible and general. Consequently, incorporating the APC factor into the model of observed discrete time series should result in much more accurate approach to financial cycle extraction than those proposed so far.
We discuss the notion of the financial cycle making a clear indication that the thorough study of its empirical properties in case of developing economies is still missing. This is due to the lack of appropriately long time series of variables containing information about the financial cycle. A well documented set of stylised facts, discussed in detail by many authors, results from the analyses based on the data representing developed economies. Drehmann et al. (2012) considered monthly data for seven countries (Australia, Germany, Japan, Norway, Sweden, UK and USA). The database used by Claessens et al. (2011) in study of financial cycles covered extended set of time series from 21 OECD advanced countries, covering the period 1960-2007.
In the empirical part of the paper we focus on the observed series of credit and equity and make formal statistical inference about the properties of the cycles of Polish economy. We compare the results with those obtained in case of the UK and USA. We discuss the properties of cyclical component within the proposed spectral methodology and finally we extract its using well known HP filter. We confront empirical properties of the financial cycle for small open economy of Poland with those established so far in research concerning developed economies.

2 The notion of the financial cycle

The formal theoretical foundations of changes in activity in the financial system predates those established for the purpose of analysis of the business cycle. However, theories postulating existence of the financial cycle were outside of the leading stream in the history of economic thought. The important considerations in this topic was contributed by Hyman Minsky; see Minsky (1982). He developed a concept of the Wall Street paradigm, a financial theory of investment and an investment theory of the business cycle, often called the financial instability hypothesis (FIH). According to Minsky (1990), since the production precedes the exchange (of goods, production factors) in economic systems, there is no doubt that finance also precedes production. Consequently, finance should be central part of the theory describing economics growth, because credit is essential to the process of development in capitalism.
When explaining the development of the financial system Minsky indicated that Schumpeterian forces of creation and destruction are not only good in explaining processes in production and manufacturing but seem to be particularly good choice for units constituted financial system. Minsky claimed that it is hard to find a more evident example of existence of the evolution, change and Schumpeterian entrepreneurship than banking and finance. Also in this case the drive for profit is the most important factor making for change and development.
The empirical origins making analyses of the financial cycle important were established in the topic of procyclicality of the financial system, very popular in last

15 years; see Borio et al. (2001), Danielsson et al. (2004), Kashyap and Stein (2004), Brunnermeier et al. (2009), Adrian and Shin (2010) or Olszak and Pipień (2015). The main purpose of this research path was not to identify the properties of the financial cycle, but to express empirically supported hypotheses about important factors determining cyclical nature of activity in the financial system. Consequently, the vast literature discussed the origins of the cyclicality in the financial system, from both, micro and macro perspectives. From microeconomic viewpoint financial frictions between lenders and borrowers, like collateral constraints, information asymmetries and others, can explain booms and busts observed in the financial system and particularly in the credit; see Kiyotaki and Moore (1997), Holmstrom and Tirole (1997), Bernanke et al. (1999), Lorenzoni (2008), Gorton and He (2008), Bianchi (2011) and others. The empirical macroeconomic perspective is also important, since there was a strong belief about existence of linkages between real economy and the financial system. This point of view, formulated initially by Fisher (1933), was studied in detail by Bernanke et al. (1996), Gilchrist and Zakrajsek (2008). Sinai (1992) gave comprehensive literature overview for this topic.

The role of financial markets in the real economy has been also a subject of the post-crisis policy debate, making substantial effort towards the optimal and efficient design of macroprudential tools. Those policy interests arise from the statement that effects of asset prices and credit booms may be potentially harmful on the real economy. A careful insight into the empirical properties of the financial cycle in general and credit cycle particularly can be motivated by the existence of risk that excessive credit growth may result in contraction or even deep recession. Hence, a variety of macroprudential policy tools have been designed in order to reduce the vulnerability to crises by smoothing the credit cycle. Examples for such measures include counter-cyclical capital buffers and risk weights, as well as time varying loan-to-value ratios, debt-to-income ratios, and margin requirements; see Galati and Moessner (2013). The assessment of the effectiveness and the transmission mechanism of macroprudential policy is still at stage *work in progress*; see Galati and Moessner (2014). But there is no doubt that financial cycle and its components is crucial for assessing the effectiveness of macroprudential policy tools; see ESRB (2014).

Despite of the importance of the financial cycle from many perspectives sketched above, it suffers from the lack of formal and sharp definition. As Borio (2012) claims, there is no consensus about the definition, but he puts very intuitive description of the financial cycle as *the self-reinforcing interactions between perceptions of value and risk, attitudes towards risk and financing constraints, which translate into booms followed by busts. These interactions can amplify economic fluctuations and possibly lead to serious financial distress and economic dislocations*; see Borio (2012).

For the sake of empirical analyses one has to chose a parsimonious set of observed time series of financial factors with strong linkage with both, financial crises and the business cycle. Drehmann et al (2012) suggest that the most sparing description of the financial cycle can be obtained in terms of credit and property prices. Additionally

empirical properties of the cyclical components in equity, volatility, risk premium, default rates, non-performing loans, asset prices and leverage are also subject to analysis; English et al. (2005), Ng (2011), Hatzius et al. (2011). The separate and leading topic is connected with analysis of the empirical properties of the credit cycle; Aikman et al. (2010), Schularick i Taylor (2009), Jordá et al. (2011), Dell'Arriccia et al. (2012).

Borio (2012) also puts another important remark concerning the data used in research. Since filtration approach that bases on the band-pass filters is commonly used to extract the cyclical component, the required time span of observed series excludes many countries from analyses. The most important empirical finding of Drehmann et al. (2012) was that the financial cycle has a much lower frequency than the traditional business cycle. The average length of the financial cycle in a sample of seven industrialised countries since the 1960s has been around 16 years. Due to the much shorter time series accessible for modelling the empirical investigations of the financial cycle for emerging economies is rather difficult but worth taking. The most important inquiry in this topic involves hypothesis whether the properties of the financial cycle are universal or, in case of developing economies, are specific. Therefore in this paper we confront the results of a non-standard techniques obtained when analysing developed economies with those received in case of an example of catching-up economy.

3 Nonparametric model of cyclical fluctuations

In this section we recall the nonparametric model framework introduced in Lenart and Pipień (2013a) and applied for the problem of statistical inference about the properties of the business cycle. The underlying approach was also applied by Lenart and Pipień (2013b) in the problem of testing the existence of seasona fluctuations in the observed macroeconomic time series. Let us consider the natural logarithm of the observed real-valued time series, denoted by $\{P_t : t \in \mathbb{Z}\}$. We assume that the unconditional expectation, denoted by $\mu_P(t) = E(P_t)$ for the process $\{P_t : t \in \mathbb{Z}\}$, exists for any $t \in \mathbb{Z}$ and is represented by the sum of deterministic function $f(t, \beta)$, parameterised by $\beta \in \mathbb{R}^p$, and almost periodic function $g(t)$ (for the definition see to Corduneanu (1989)) of the form:

$$g(t) = \sum_{\psi \in \Psi_P} m_P(\psi) e^{i\psi t}, \tag{1}$$

parameterized by unknown set $\Psi_P = \{\psi \in [0, 2\pi) : |m_P(\psi)| \neq 0\}$ and corresponding Fourier coefficients $m_P(\psi) = \lim_{n\to\infty} \left(\frac{1}{n} \sum_{t=1}^{n} g(t) e^{-i\psi t} \right)$. The function $g(t)$ can be written equivalently as:

$$g(t) = \sum_{\psi \in \Psi_P \cap [0,\pi]} a_P(\psi) \cos(\psi t) + b_P(\psi) \sin(\psi t).$$

The unconditional expectation of the process $\{P_t : t \in \mathbb{Z}\}$ is given by the formula:

$$\mu_P(t) = f(t, \beta) + \sum_{\psi \in \Psi_P} m_P(\psi) e^{i\psi t}. \tag{2}$$

In our approach we refer to standard decomposition of the observed series to a trend and cyclical fluctuations. The latter component is described by almost periodic function with the use of a countable set of frequencies Ψ_P; see Corduneanu (1989). Lenart and Pipień (2013a) proposed a subsampling method to approximate the distribution of the test statistics that corresponds to the following testing problem, formulated for any $\psi \in (0, 2\pi]$:

$$\begin{aligned} H_0 &: \psi \notin \Psi_P \\ H_1 &: \psi \in \Psi_P, \end{aligned} \tag{3}$$

which is equivalent to the testing problem of the form:

$$\begin{aligned} H_0 &: |m(\psi)| = 0 \\ H_1 &: |m(\psi)| \neq 0. \end{aligned} \tag{4}$$

The rejection of the null hypothesis in (4) is interpreted as the data support in favour of existence of nonzero amplitude corresponding to a frequency $\psi \in (0, 2\pi]$. Such a frequency contributes as a cycle of a particular length in the observed deviations of a process $\{P_t : t \in \mathbb{Z}\}$ from the trend. The details of both, the analytical form of the test statistics and critical values of the proposed test, as well as discussion about consistency of the method can be found in Lenart (2013) Lenart and Pipień (2013a and 2013b).

4 Empirical results

We present the results conducted in case of three economies, namely Poland, UK and USA. Since we test the usefulness of the proposed procedure of testing existence of cyclical processes, we chose two developed economies, namely USA and UK, to confront our results with existing consensus about empirical properties of the financial cycle. The analysed time series observed for Polish economy are much shorter and consequently there is no empirical evidence about the financial cycle in this case. This motivates our effort to apply the approach in this case.

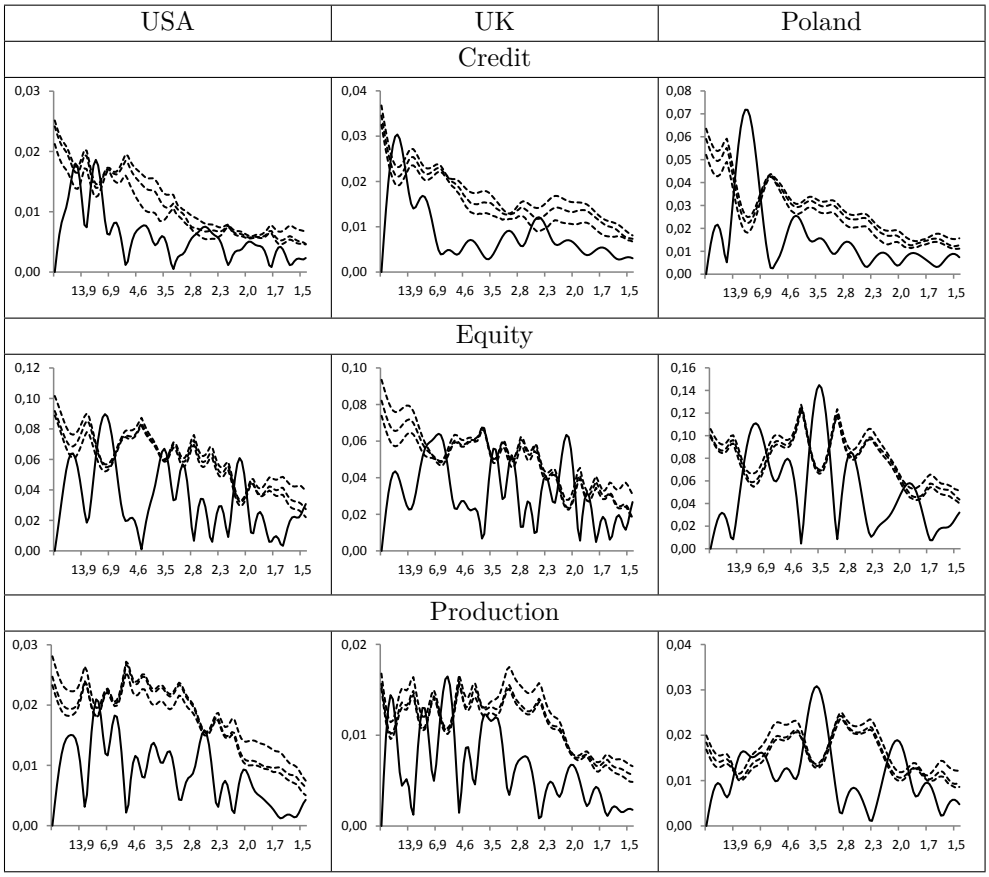
We analyse time series representing credit and equity on the monthly basis, provided the availability. Monthly series of the credit covers the period from January 1947 to October 2014 in case of USA (814 observations), the period from July 1996 to October 2014 in case of UK (220 observations) and the period from December 1996 to October 2014 in case of Poland (215 observations). The series representing changes in the equity market are MSCI indices for USA, UK and Poland, covering the period from

Table 1: The length of cycles (in years) corresponding to statistically significant frequencies, at significance level $\alpha = 0.02$. The case of testing procedure (4)

	Credit	Equity	Production
USA	9.3	2.1	2.5
	18.5	3.5	8.8
		7.6	
UK	23.8	2.1	5.7
		2.9	9.3
		3.4	41.7
		6.7	
Poland	9.8	1.9	2.0
		3.5	3.5
		8.3	10.4

December 1969 to November 2014 in case of USA and UK (540 observations) and the period from December 1992 to November 2014 in case of Poland (264 observations). In case of Poland we take series starting from January 1995 to October 2014 to exclude data directly after the system transformation. In case of USA and GB the dataset covers the period from January 1986 to November 2014. The results of cycles in the credit and equity are compared with those obtained for the business cycle, while the latter being extracted on the basis of the monthly series of the industrial production observed for a particular country. Figure 1 presents results of the subsampling testing procedure applied in case of nine monthly series of credit, equity and production(first, second and third row respectively) for USA (first column), UK (second column) and Poland (third column). We plot the test statistics (solid line) for testing procedure in Lenart and Pipień (2013a) calculated for the cycles with length longer then 1.5 years together with approximated critical values obtained via subsampling conditional to the significance levels $\alpha = 0.08$, $\alpha = 0.05$and $\alpha = 0.02$ (dashed lines). It is clear that changes in values of the test statistics are of irregular nature, making inference about empirical importance of a particular frequency very difficult. However the test statistics indicates rejection of the hypothesis of insignificance stated in Lenart and Pipień (2013a) only for a few values of frequency. The credit cycle can be described by cyclical component with longer period than in case of production, as the test statistics are greater that critical values in case of frequencies much lower than those obtained for series of industrial production. The equity cycles are very irregular and can be described by a composition of a couple of cyclical components with different periods. In this case we obtained data evidence in favour of the existence longer cycle than in case of the production and additionally there is evidence about existence of cycles with much shorter period (2-3 years). In Table 1 we put the length of cycles (in years) corresponding to statistically significant frequencies for modelled series, conditional

Figure 1: The test statistics (solid line) and subsampling critical values (dashed lines) at the significance levels $\alpha = 0.08$, 0.05 and 0.02 for testing problem (4)

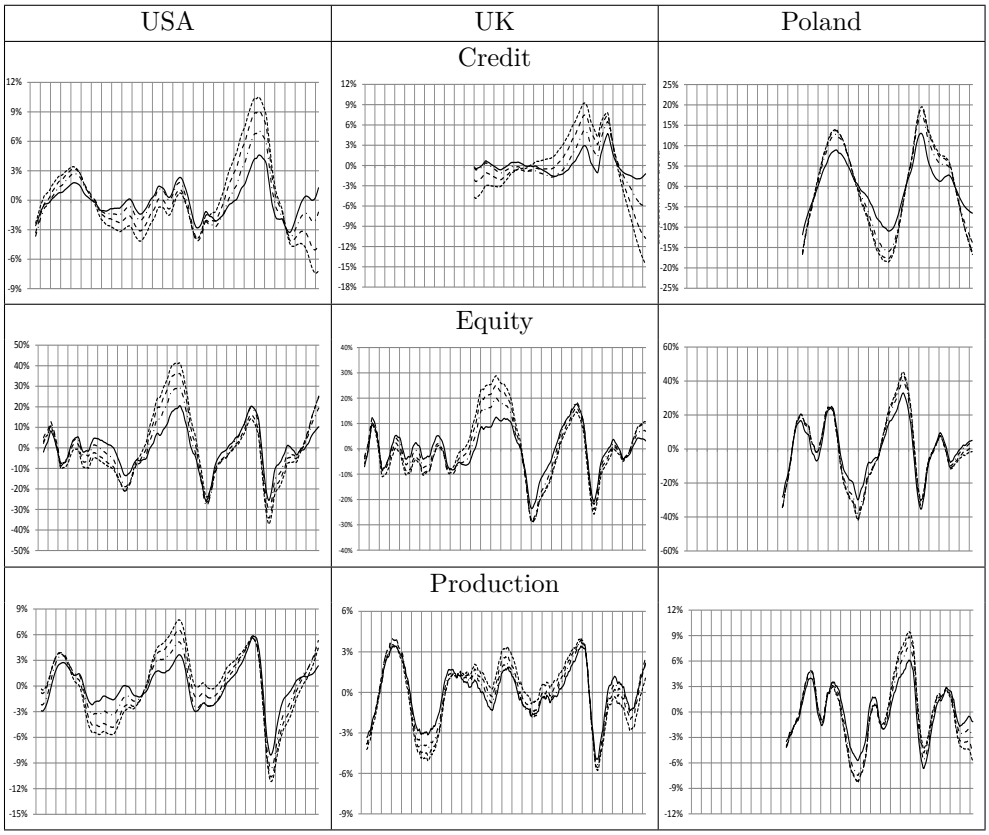


to the significance level $\alpha = 0.02$. The analysis of the credit cycle confirms some stylised facts in case of USA and UK. For those countries there is data evidence in favour of existence much longer cycles than in case of the business cycle. The credit cycle in USA can be described by two cyclical components with length 9.3 and 18.5 years. The credit cycle in UK is longer and its length is identified around 23 years. In case of Poland cyclical fluctuations in the credit are of much shorter period. It is still three times longer than the period of the production cycle, identified for the Polish industrial production as 3.5 years period. This result clearly distinguishes inference about the credit cycle in developed economies with those obtained for exemplary catching-up economy.

The equity cycle exhibit rather irregular shape since the procedure identifies many cyclical components with qualitatively similar period. In case of USA and Poland we obtained three statistically significant frequencies, while in case of UK even four. What clearly distinguishes the inference in case of Poland is that we obtained statistically significant frequencies very similar to those established for the cycle in the industrial production. Since statistically significant frequencies, obtained for equity in USA and UK, correspond to the cycles of length much different than in case of the production cycles, those economies, with developed and very innovative financial markets are characterised by rather weak linkage between existed cyclical processes in the industry sector and capital market. Next we extracted the cyclical components from the analysed monthly series and present it in Figures 2 and 3. The extraction procedure bases on the HP filter with smoothing parameter corresponding to frequency of period 10 years (solid line) and 15, 20 and 25 years (appropriate dashed lines) (Figure 2) and shorter frequencies (Figure 3). We see regular cyclical changes in case of the credit in Poland, making clear evidence about existence of two expansion phases (occurred in 2000 and 2009) and two contraction phases (2006 and 2014) in credit dynamics. The cyclical components extracted for credit in USA and UK are much more irregular. However the amplitude of the credit cycle, as measured by the percentage maximum deviations from the long term trend, is not precisely identified and exhibit variability with respect to changes in smoothing parameter in HP filter. In particular, two expansion phases of the credit, that has occurred in 2001 and 2009 in Poland can be described by positive deviation from the trend reaching values from 9% (HP parameter set to 10 years) to 15% (HP parameter set to 25 years). Also in case of expansion in 2009, the deviation from the trend differs and can reach the value 12% (HP parameter set to 10 years) or 19% (HP parameter set to 25 years). Also for the credit in USA and UK, expansion in 2008 make the gap between cyclical component and the long term trend different, and reach values between 5% (HP parameter set to 10 years) to 10% (HP parameter set to 25 years) in case of USA and 3% (HP parameter set to 10 years) to 9% (HP parameter set to 25 years) in case of UK.

Analysing contraction phases in the credit the same conclusions apply. For example, in case of Poland, the negative deviation from the long term trend in 2005-2006 may

Figure 2: Cyclical components extracted on the basis of HP filter with smoothing parameter λ corresponding to length of cycle 10 years (solid line) and 15, 20 and 25 years (appropriate dashed lines)



reach values from 11% (HP parameter set to 10 years) to 19% (HP parameter set to 25 years). Also in 2014, the deviation from the cycle may differ in a comparable way. Also, the phase of the credit cycle in 2014 in case of USA and UK is not clearly identified. The variability of the deviation from trend with respect to changes in the smoothing parameter is substantial and shows serious doubts about the true stage of the credit cycle in those countries. In case of UK the deviation from the trend in 2014 may reach the value -2% (HP parameter set to 10 years) or -15% (HP parameter set to 25 years), while the former being interpreted as the small contraction, while the latter clearly indicating credit contraction of very deep nature. In case of USA the deviation from the trend in 2014 may reach the value 2% (HP parameter set to 10 years) or -7% (HP parameter set to 25 years). The first case can be interpreted as the beginning of expansion, while the second case confirms continued recession stage in the credit cycle. The equity cycle in case of UK and USA is rather invariant with respect to changes in the smoothing parameter, except expansion phase in 1999-2001 period. The positive deviation from the trend may take value 20% (HP parameter set to 10 years) or 40% (HP parameter set to 25 years). For UK those values are 10% and 30% respectively.

Consequently, our analysis shows some concerns about one of the important stylised fact of the financial cycle in general, and the credit or equity cycle particularly, that the amplitude of deviations is much greater that the amplitude of the business cycle. Beside substantial changes in the amplitude, this can be true for the equity cycle, but in case of the credit cycle this may not be true, especially for catching-up economies like Poland. Since the cyclical component in credit may have amplitude, which is very sensitive to changes in smoothing parameters of the filter, the thorough analysis of the formal inference about the properties of the cycle is necessary. The particular choice of this parameter is obvious provided the results of statistically significant frequencies, presented in Figure 1 and Table 1. According to our results, the optimal choice for the smoothing parameter for UK and USA corresponds to the cycle of length 20-25 years, however in case of Poland, the choice of 10 years is more appropriate and supported by the data.

The results of qualitative lead-lag analysis of the credit and equity cycle with the production cycle is presented in Table 2. We report sample correlations $Corr(C_t, P_{t+n})$ and $Corr(E_t, P_{t+n})$ between cycles in Credit (C_t) or Equity (C_t) and Production (P_t), with shift $n = -8, -7, ..., 0, 1, 2, ..., 8$. We calculated correlations for the whole period and also separately in case when the data from the crisis period (from March 2008 to March 2009) is excluded. The time structure of correlations are qualitatively the same if calculated for the whole sample and for the series with some data excluded. The current value of equity cycle is positively correlated with the future observations of the business cycle component in all three analysed economies. In case of USA the changes in the business cycle exceeds the changes in the equity cycle by at least four months, while in the UK by at least 5-8 months.

Figure 3: Cyclical components extracted on the basis of HP filter with smoothing parameter λ corresponding to length of cycle 4 years (solid line) and 6, 8 and 10 years (appropriate dashed lines)

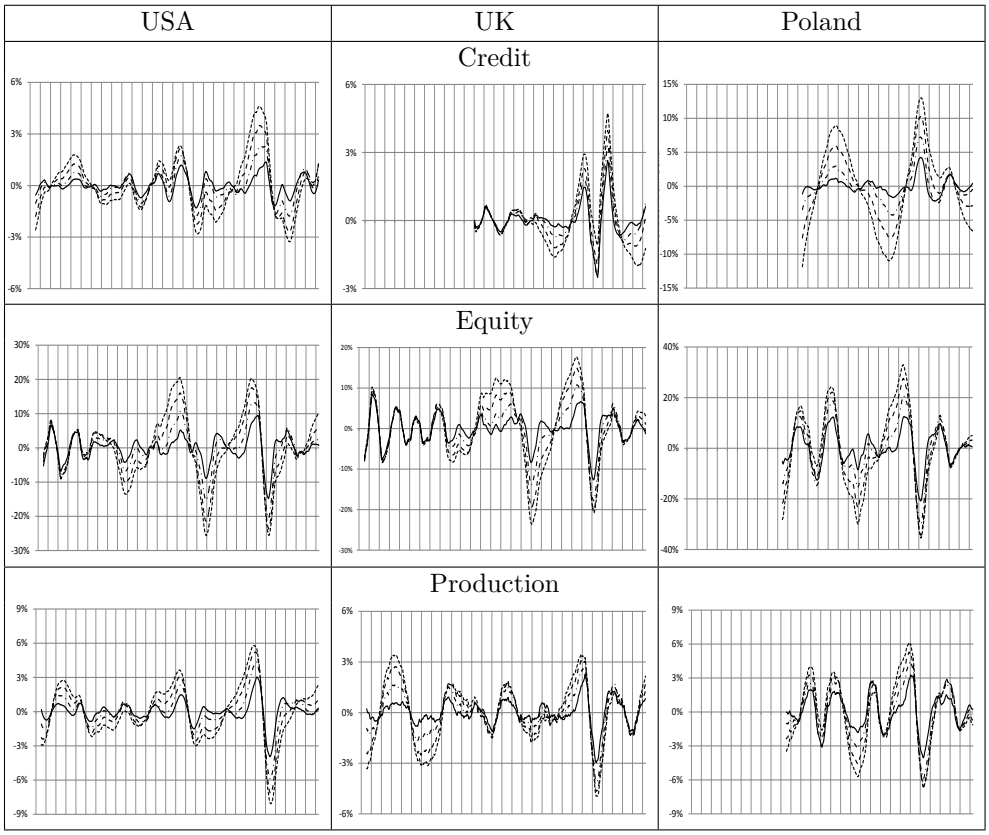


Table 2: Sample correlations $Corr(C_t, P_{t+n})$ and $Corr(E_t, P_{t+n})$ between cycles in credit (C_t) or equity (C_t) and Production (P_t), with shift $n = -8, -7, ..., 0, 1, 2, ..., 8$. The case of USA, UK and Poland for deviation cycles. Smoothing parameter λ corresponds to 10 years.

	Lag									Forward							
	USA																
n	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Credit	0.68	**0.69**	0.68	0.65	0.60	0.53	0.45	0.36	0.28	0.20	0.12	0.03	-0.04	-0.12	-0.19	-0.24	-0.28
Credit*	0.51	0.55	0.57	**0.58**	0.56	0.51	0.46	0.39	0.32	0.22	0.11	0.01	-0.07	-0.15	-0.21	-0.26	-0.29
Equity	0.00	0.04	0.09	0.15	0.22	0.29	0.36	0.43	0.49	0.56	0.61	0.65	**0.66**	0.64	0.61	0.56	0.50
Equity*	0.16	0.12	0.08	0.05	0.04	0.05	0.07	0.11	0.18	0.26	0.34	0.41	0.44	0.46	**0.47**	0.46	0.45
	UK																
Credit	-0.19	-0.11	-0.06	0.01	0.12	0.23	0.32	0.41	0.47	**0.50**	0.48	0.43	0.37	0.34	0.31	0.26	0.20
Credit*	-0.11	-0.07	-0.05	-0.05	-0.01	0.06	0.15	0.24	0.34	**0.37**	0.36	0.31	0.27	0.28	0.30	0.31	0.30
Equity	-0.11	-0.08	-0.05	-0.01	0.06	0.13	0.19	0.27	0.33	0.38	0.42	0.44	0.45	**0.46**	0.45	0.42	0.38
Equity*	0.00	-0.01	-0.04	-0.06	-0.04	-0.01	0.04	0.09	0.14	0.18	0.22	0.24	0.26	0.29	**0.30**	0.29	**0.30**
	Poland																
Credit	0.25	0.20	0.14	0.06	0.00	-0.07	-0.12	-0.16	-0.18	-0.21	-0.23	-0.27	-0.29	-0.30	-0.30	-0.31	-0.32
Credit*	0.23	0.24	0.22	0.18	0.16	0.13	0.10	0.09	0.06	0.04	0.01	-0.05	-0.09	-0.12	-0.15	-0.18	-0.22
Equity	-0.08	0.01	0.10	0.21	0.33	0.44	0.53	0.59	0.64	0.69	0.72	**0.73**	0.72	0.69	0.65	0.60	0.53
Equity*	-0.03	0.01	0.06	0.13	0.22	0.32	0.40	0.45	0.50	0.56	0.60	0.63	**0.64**	0.64	0.63	0.59	0.53

* - in this case we excluded the crisis period, from March 2008 to March 2009

In case of Poland the greatest value of the correlation is obtained for the current value of the equity cycle and exceeded value of the business cycle by 3-4 months.
As regards to the credit cycle the synchronisation with the production is different in all three cases. For USA the greatest value of the sample correlation was obtained for the current value of the credit cycle and lagged value (with lag -7 to -5) of the production cycle. In USA the changes in the credit cycle preceed changes in the production cycle by at least 5 months. We observe in case of UK rather strong synchronisation of the credit cycle with the production cycle. The greatest value of sample correlation was obtained for the current value of the credit cycle and the production cycle observed in the next month.
The synchronisation of the credit cycle and the production cycle in case of Poland is rather different. For the lagged values of the production cycle we obtained positive correlation, however stronger negative correlation characterises changes in the current values of the credit cycle and exceeded values of the production cycle. Consequently, the nature of synchronisation in case of the Polish economy seems different and much more complicated than in case of USA and UK. Again some stylised facts derived for well developed economies may not fit to other countries, especially small open economies with relatively young financial system.

5 Conclusions

The main goal of the paper was to discuss the notion of the financial cycle from the viewpoint that the thorough study of the its empirical properties in case of developing economies is still missing. We focus on the observed series of credit and equity and make formal statistical inference about the properties of the cycles in case of Polish economy. We compare the results with those obtained for UK and USA. We extract the cyclical component and confront empirical properties of the financial cycle for small open economy with those established so far in case of developed economies.
We apply subsampling procedure to make formal statistical inference about the financial cycle. The thorough analysis of the properties of the financial cycle in catchin-up economies is still a work in progress, but due to relatively poor statistical reporting requires nonstandard techniques. We show that some characteristics of the financial cycle can be modelled in a non-parametric way by discrete spectrum of the almost periodically correlated time series.
The most important results of our analysis is that empirical properties of the financial cycle for developed economies reported in the existed literature may not fit to catching-up economies. Both, the length and the amplitude of the credit and equity cycle in case of the Polish economy is different than in case of reference countries under analysis, namely USA and UK. The well developed economies are characterized by the financial cycle of rather long period, while in case of Poland this period does not exceed a decade. It is still much longer than the production cycle, however conclusions drawn on the basis of analyse of UK and USA economies, that financial cycle may

have a period of 20-25 years, are not valid for Poland.
The equity cycle in case of UK and USA is weakly synchronized with the production cycle. We explain this phenomenon by the existence in those countries historically the oldest - and currently the most advanced - financial markets driving for innovations. In case of the Polish economy, with the financial market at stage of continuous development, the equity cycle is described by cyclical components very similar to the production cycle.

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