RESEARCHING THE FINANCIAL CYCLE PATTERNS OF THE ECONOMIES OF THE WORLD’S COUNTRIES AND UKRAINE

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UDC 339.97
JEL: C10; E32; F15; F36

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The cyclicity of the world economy necessitates an analysis of the interrelationship between different economic phenomena, as they have a direct impact on the emergence of cyclical shifts in the process of movement of both local and global financial cycles. The article is aimed at analyzing the dynamics of the relevant financial indicators for the countries with advanced economies, developing countries and Ukraine, as well as checking these indicators for cyclicity during the period under review. This analysis is based on a methodical approach to identifying the cyclical nature of the movement of financial cycles, built up with account of the impact of the relevant financial indicators on the patterns of occurrence of fluctuations during the period of 2008-2019. The main economic indicators, characterizing the features of the fluctuations in financial cycles, which are taken as a basis in carrying out the research, are: the level of growth in real GDP; total volume of loans to the non-financial sector of the economy; the ratio indicator of the total volume of loans to the non-financial sector of the economy to nominal GDP; real estate prices index. In analyzing the cyclicity of both local and global financial cycles, the Durbin–Watson criterion was the main statistical criterion for identifying the relationship between existing cycles. The research results in the identified key causes of the corresponding phase of cyclicity of the local financial cycle, depending on the current status of the global financial cycle. The hypothesis of a relationship between the cyclical movement of local and global financial cycles is substantiated. A direct dependence of the movement of the local financial cycle on fluctuations in the global financial cycle is identified.

Keywords: financial cycle, financial integration, Durbin – Watson criterion, GDP, loans, real estate prices index.

DOI: https://doi.org/10.32983/2222-4459-2020-6-252-259


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UDK 339.97
JEL: C10; E32; F15; F36

Laktionova A. A., Benzar O. V. Исследование закономерностей проявления циклического характера финансовых циклов стран мира и Украины

Цикличность мировой экономики вызывает необходимость анализа взаимосвязей между различными экономическими явлениями, так как они оказывают прямое влияние на возникновение циклических сдвигов в процессе движения как локального, так и глобального финансовых циклов. Целью статьи является анализ особенностей динамики соответствующих финансовых показателей для стран с развитой экономикой, развивающихся стран и Украины. Анализ осуществляется на основе методического подхода к идентификации циклического характера движения финансовых циклов, сформированных на основе воздействия соответствующих финансовых индикаторов. Основными исследованиями в период с 2008 по 2019 год, были: уровень экономического роста; общемировой объем кредитов; отношение объема кредитов в нерасширенной экономике к валовому внутреннему продукту; индекс цен в нерасширенном секторе экономики. В результате исследований было выявлено, что цикличность локального финансового цикла зависит от текущего состояния глобального финансового цикла. Обращено внимание на взаимосвязь между цикличностью локального и глобального финансовых циклов.

Ключевые слова: финансовый цикл, финансовая интеграция, уровень экономического роста, кредиты, индекс цен.

DOI: https://doi.org/10.32983/2222-4459-2020-6-252-259


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DOI: https://doi.org/10.32983/2222-4459-2020-6-252-259

The issue of reducing negative effects of the global economic crisis is on the agenda in professional spheres of the world community and a matter of concern of governments all over the world. Under conditions of financial integration and globalization, timely analysis of the patterns of financial cycles at both global and local levels is required. It is intended for early detection of signals of possible imbalances and early warning of crisis phenomena in the economy, a long recession, with regard to the cyclical influence of the behavior of financial indicators on these phenomena. Examining the relationship between key financial and economic macroeconomic indicators that reflect cyclical development is crucial for ensuring both global and local financial equilibrium.

Theoretical aspects of the essence of the financial cycle and its role in shaping the cyclical patterns of economic development are formulated by a number of foreign scientists including C. Borio, H. Rey, N. Kennedy, S. Prowse, P. Disyatat, etc. A significant contribution to the methodology of analysis and research of financial cycles is made by M. Drehmann, C. Borio and K. Tsatsaronis [1], who use in their research two approaches to measuring the financial cycle: turning point analysis and bandpass filter developed by L. Christiano and T. Fitzgerald [2]. The aforementioned scientists created a theoretical and methodological basis for studying financial cycles, but there is a need for a more thorough investigation of the characteristics of financial cycles of countries with different levels of economic development. The issue of analyzing the patterns of the financial cycle of Ukraine and investigating the causal relationship of certain changes at the local level with the situation at the global level remains relevant.

The aim of the article is to analyze the patterns of cyclical fluctuations of local financial cycles of countries with different economic development including Ukraine and to study their relationship with the global financial cycle.

The periodicity and nature of fluctuations in domestic and global financial cycles are inherent signs of cyclicity. The dynamic patterns and trends in cycles are determined by the influence of changes in a number of economic and financial indicators that are directly related to the occurrence of cyclical shifts in local and global financial cycles.

To study financial cycles, many scientists formed an appropriate system of indicators to assess the nature of cyclicality. In particular, H. Rey [3] in her research associates frequency of financial cycles with movement of asset prices and gross capital flows. G. Gorton and G. Ordorance [4] substantiate the effectiveness of asset prices and loans as financial indicators to investigate financial cycles. On the other hand, P. Giordani with his co-authors [5] identify indicators that characterize the dynamic patterns of financial cycle in the early stages: the credit-to-GDP gap, house prices, and the ratio of unstable over stable sources of funding of the banking sector. At the same time, in [6] O. Jordà and the co-authors highlight the vision of analyzing financial cycles by the comovement of internal financial variables, namely: real credit (measured by total loans), real house prices, and real equity prices. Indicators identified by the scientists are directly related to the main economic phenomena in the functioning of both individual countries and the global economic system.

The study and analysis of the periodicity of financial cycles has received sufficient attention at the global level. However, today it is important to study the relationship between domestic and global financial cycles by the appropriate division of countries into groups according to economic development: developed countries and develop-
The key element in determining the nature and frequency of fluctuations in the financial cycle is the level of real GDP growth. This indicator allows to determine the process of analyzing the cyclical nature of local and global financial cycles. First of all, trend lines to describe the behavior of this economic indicator in two groups of countries and Ukraine (Fig. 1) were constructed. The second step was to calculate the Durbin – Watson (DW) statistic to detect fluctuations and lack of periodicity.

The value of the coefficient ranges from –1 to +1, with a need to repeat the previous steps for subsequent lags. The obtained critical values are the general limits for the analysis of the following financial indicators. As a result, the Durbin – Watson (DW) statistic for the level of real GDP growth in the group of developed countries (Tbl. 1) showed that according to the tabular values at \( m = 1 \) the critical points for the significance level of 0.01 and the number of observations 12 are as follows: \( d_1 = 0.697 \) and \( d_2 = 1.023 \), respectively.

Thus, the next stage of the analysis will be the calculation of the autocorrelation coefficient of deviations of the residuals of this indicator according to the following formula:

\[
R_{\tau \tau+1} = \frac{\sum_{t=1}^{n-2} e_t e_{t+1}}{\sum_{t=1}^{n-1} e_t^2}.
\]

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\[
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\]

The value of the coefficient ranges from –1 to +1, in the absence of autocorrelation \( R_{\tau \tau+1} = 0 \). In the case of a group of countries with developed economies, the autocorrelation coefficient of deviations of the residuals is equal to (–0.52). This result must also be checked for statistical significance of the presence of autocorrelation with a certain lag of delay using the Student’s t-test:

\[
t_p = \frac{|R| \sqrt{n-l-2}}{\sqrt{1-R^2}}.
\]

Using the tables of t-distribution, we found the tabular value of the criterion \( t_p \) with the number of degrees of freedom \( m = n - 1 - 2 \) and a given level of statistical significance \( \alpha \). According to the analysis with the available number of degrees of freedom \( m = 9 \) and the level of statistical significance of 5%, \( t_p = 2.262 \). Thus, \( t_p \) with the value of 1.827 was obtained. Therefore, \( t_p < t_p \), which indicates the insignificance of this parameter, so there is a need to repeat the previous steps for subsequent lags.
The calculation of the autocorrelation coefficient of deviations for lag 2, 3, 4 also confirmed the lack of significance, which eliminates the need for further analysis of this financial indicator. Thus, the changes in the real GDP growth for developed countries during 2008–2019 are random and reflect the lack of cyclicity. That is, changes in this indicator are due to fluctuations in the global financial cycle.

The next object of the analysis of the cyclical nature of the level of real GDP growth in 2008–2019 is a group of developing countries. According to the selected equation of the trend shown in Figure 3, the residuals and

**Table 1**

<table>
<thead>
<tr>
<th>Year</th>
<th>$y$</th>
<th>$y(x)$</th>
<th>$e_t$</th>
<th>$e_t^2$</th>
<th>$(e_t - e_{t-1})^2$</th>
<th>$DW$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>0.20</td>
<td>-0.77</td>
<td>0.97</td>
<td>0.95</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>-3.30</td>
<td>-0.05</td>
<td>-3.25</td>
<td>1.56</td>
<td>17.85</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>3.10</td>
<td>0.58</td>
<td>2.52</td>
<td>6.37</td>
<td>33.33</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>1.70</td>
<td>1.10</td>
<td>0.60</td>
<td>0.35</td>
<td>3.72</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>1.20</td>
<td>1.53</td>
<td>-0.33</td>
<td>0.11</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>1.40</td>
<td>1.87</td>
<td>-0.47</td>
<td>0.22</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>2.10</td>
<td>2.10</td>
<td>0</td>
<td>0</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>2.30</td>
<td>2.24</td>
<td>0.06</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>1.70</td>
<td>2.27</td>
<td>-0.57</td>
<td>0.33</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>2.50</td>
<td>2.21</td>
<td>0.29</td>
<td>0.08</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>2.30</td>
<td>2.05</td>
<td>0.25</td>
<td>0.06</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>1.70</td>
<td>1.79</td>
<td>-0.09</td>
<td>0.01</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19.05</td>
<td>52.27</td>
<td>3.006</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the Durbin–Watson statistic were calculated with the value 2.565, which falls within the range of 1.023 < 2.565 < 2.977 (d₂ < DW < 4 – d₁), i.e., there is no autocorrelation. Thus, for this group of countries, there is a random nature of fluctuations caused by both individual internal factors and external shifts in the global financial cycle, or certain countries, which are most influential.

Further, a methodological analysis of cyclical fluctuations in the level of real GDP growth for Ukraine was carried out. As a result, the Durbin–Watson statistic of 2.161 was obtained to verify the presence of autocorrelation for available data. This value confirmed the absence of autocorrelation (1.023 < 2.161 < 2.977; d₂ < DW < 4 – d₁), which indicates the acyclic behavior of the analyzed indicator to identify the nature of the periodicity of the local financial cycle of Ukraine during the period 2008–2019.

The next financial indicator to study cyclicity, which helps to identify cyclical fluctuations in local and global financial cycles, is the total amount of loans to the non-financial sector of the economy. The non-financial sector of the economy is a key element of economic growth and financial balance of any country, as it includes economic agents responsible for the economic development of the country and regular quality support of domestic and international economic relations. Therefore, it is necessary to take into account the performance of the non-financial sector of the economy in order to study the cyclical nature of local and global financial cycles. The changes in the total volume of loans granted to the non-financial sector for 2 groups of countries and Ukraine, as well as the selected trend equation, are shown in Fig. 3.

The first group of countries to analyze the periodicity of this indicator includes developed countries. As a result of calculating the Durbin–Watson statistic for the analyzed financial indicator, the obtained value of 1.003 (0.697 < 1.003 < 1.023; d₁ < DW < d₂) suggests the need to continue the study by going through the next step of the methodological approach to detect cyclicity.

Checking the significance of the autocorrelation coefficient of first-order residuals for the total volume of loans to the nonfinancial sector based on Student's test showed statistical insignificance of the autocorrelation coefficient for lag 1 (1.368 < 2.262; t₁ < t₅).

In this case, it is necessary to recalculate the autocorrelation coefficient of deviations of the residuals and check it for subsequent lags of the available time series. The repeated analysis of the autocorrelation coefficients of 2, 3 and 4 lags allowed us to conclude that the dynamics of the financial indicator for developed countries is random fluctuations and the hypothesis of absence of cyclicity.

For the group of developing countries, the Durbin–Watson statistic with a value of 1.333 (1.023 < 1.333 < 2.977; d₂ < DW < 4 – d₁) confirmed the hypothesis of no autocorrelation of residuals for the total amount of loans granted to nonfinancial sector of the economy. This indicates the absence of cyclicity in the local financial cycle of this group of countries during the period under analysis.

The situation is similar with the determination of the cyclical indicator of the total volume of loans granted to the non-financial sector of the economy in Ukraine. This is confirmed by the value of the Durbin–Watson statistic – 1.348 (1.023 < 1.348 < 2.977; d₂ < DW < 4 – d₁). The lack of autocorrelation of residuals in this case indicates the random nature of fluctuations in the analyzed indicator during 2008–2019, so some changes in the dynamics are associated with fluctuations in the global economic cycle.

Finally, the financial indicator that needs to be examined for cyclicity is characterized by the ratio of total loans to the non-financial sector of the economy to nominal GDP. This indicator characterizes the comparison of the total debt of the non-financial sector to the annual volume of nominal GDP, which to a greater extent includes the results of activity of all enterprises for 1 year. Thus, this indicator expresses the share of domestic debt of non-financial sector entities in their total an-

**Fig. 3. Changes in total volume of loans to the non-financial sector of the economy in developed countries, developing countries and Ukraine (2008–2019)**

Source: compiled by [9; 10].
nual income. The behavior of this financial indicator for 2 groups of countries and Ukraine with the trend equations given for further research is presented in Fig. 4.

The calculation of the Durbin – Watson statistic for the data series of each group of countries and Ukraine showed that there is no autocorrelation between the available residuals. For developed economies, the statistic is 2.224 (1.023 < 2.224 < 2.977; \( d_2 < DW < 4 - d_2 \)), for developing countries \( \approx 1.195 \) (1.023 < 1.195 < 2.977; \( d_2 < DW < 4 - d_2 \)) and for Ukraine \( \approx 2.608 \) (1.023 < 2.608 < 2.977; \( d_2 < DW < 4 - d_2 \)). This confirms the hypothesis of the random nature of the cyclicality of the analyzed financial indicator during 2008–2019 and also explains the lack of periodicity. This conclusion suggests the dependence of changes in local financial cycles on cyclical shifts in the global financial cycle.

For the group of developed countries, the result of calculating the Durbin – Watson statistic with the value

![Fig. 4. The ratio of total loans to the non-financial sector of the economy to nominal GDP for developed countries, developing countries and Ukraine (2008–2019)](source: compiled by [9–11]).

The final financial indicator for identifying the cyclical nature of the local financial cycle is the real estate price index. This factor is the root cause of the financial crisis of 2007–2009 and has a rather complex forecasting mechanism, as it can cause sudden crises, which will have a negative impact on activities of economic entities and the world economy as a whole. Therefore, the analysis of real estate prices among the selected categories of countries is a very important factor in identifying the cyclical nature of the economy of a country and the global economy. The behavior of the real estate price index for 2 groups of countries and Ukraine during the period 2008–2019 with the trend equations used during the assessment of cyclicity is shown in Fig. 5.

For the group of developed countries, the result of calculating the Durbin – Watson statistic with the value

![Fig. 5. Real estate price index in developed countries, developing countries and Ukraine (2008–2019)](source: compiled by [12; 13]).
of 0.976 (0.697 < 0.976 < 1.023; $d_1 < DW < d_2$) indicates the need for a further more careful study of the autocorrelation of the residuals of the data series of the analyzed indicator.

However, the obtained autocorrelation coefficient of first-order residuals based on Student’s test was insignificant. Subsequent recalibration of the autocorrelation coefficient for 2, 3, 4 lags showed the same result. Thus, we can confirm the hypothesis of the random nature of fluctuations in the real estate index for developed countries, which indicates the dependence of the local financial cycle on any changes in the global financial cycle.

For developing countries and Ukraine, the study of autocorrelation of residuals based on the Durbin – Watson statistic with values of 1.859 and 1.932, respectively, confirmed the hypothesis of no autocorrelation, i.e. non-periodicity of data. The non-cyclical nature of local financial cycles relative to the analyzed financial indicators confirmed the previous results of the analysis, based on which it can be concluded that local financial cycles tend to change under the influence of cyclical shifts in the global financial cycle, i.e., there is a direct relationship between fluctuations in local and global financial cycles.

CONCLUSIONS

As a result of the study of the cyclical nature of local financial cycles and their relationship with the global financial cycle, the following patterns were identified: 1) assessment of the periodicity of local financial cycles according to the relevant financial indicators indicates the absence of autocorrelation of the residuals of available data series, this contributes to the hypothesis of random fluctuations of cycles and their non-periodicity during 2008–2019; 2) changes that occur in the process of movement of the relevant financial indicators of local financial cycles depend on the cyclical shifts of the global financial cycle. Thus, it is possible to hypothesise the direct dependence of the occurrence of the respective phases in the local financial cycle on any recessions and booms during the cyclical fluctuations of the global financial cycle. However, the study was based on the analysis of aggregate indicators for 2 groups of countries. Thus, to confirm the cyclical nature of financial cycles, it is necessary to examine the changes in the analyzed indicators over the past 15–20 years since there is a high probability of the next financial crisis in 2020, given the average duration of global financial cycle of 8–10 years.

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12. Real Residential Property Prices / Bank for International Settlements. URL: https://fred.stlouisfed.org/series/Q4TR628BIS
Бібліографія

Метою статті є розкриття особливостей функціонування ринку внутрішніх державних позик в Україні; визначення основних тенденцій його розвитку та розробка пропозицій щодо вдосконалення системи внутрішніх державних запозичень. Розкрито сутність та особливості здійснення внутрішніх державних запозичень в Україні; з’ясовано оцінку функціонування системи внутрішніх державних запозичень; виявлено основні тенденції розвитку ринку внутрішніх державних позик на основі аналізу динаміки платежей за внутрішнім державним боргом, обсягів розміщення облігацій внутрішніх державних позик (ОВДП) на первинному ринку та грандіозного рівня доходності облігацій протягом 2013–2019 рр. Досліджено ефективність функціонування ринку внутрішніх державних позик в Україні за допомогою аналізу строковості ОВДП, обсягів розміщення короткострокових ОВДП, номінальної та реальної динаміки короткострокових ОВДП за період 2013–2019 рр. З’ясовано основні проблеми функціонування ринку внутрішніх державних запозичень в Україні. Обґрунтована пропозиція щодо покращення подальшого функціонування ринку внутрішніх державних запозичень.

Перспективою подальших досліджень у даному напрямі є доведення необхідності при розробці фінансової політики держави акцентувати увагу на диференціації інструментів фінансового ринку та посиленні їх використання як джерела інвестиційних ресурсів держави.

Ключові слова: внутрішні державні запозичення, внутрішній державний борг, облігації внутрішніх державних позик, джерела фінансування дефіциту бюджету, фінансові інструменти фондового ринку.

DOI: https://doi.org/10.32983/2222-4459-2020-6-259-266

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