

# Comparative Analysis of Synchronization of Kondratiev Long Waves between different countries and blocs of countries

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## I. INTRODUCTION

In our previous publication [1] we noted the interesting fact that there is a significant difference in the synchronization of economic development of Russia and Bulgaria to the dynamics of the global conjuncture. The dynamics of the Russian economy is **asynchronous** to the world economy, while that of Bulgaria is **fully synchronous** with the long waves of the global conjuncture. One reason is that the Russian economy is much larger and multisector than Bulgarian, and thus it is less disposed to the influence of the foreign conjuncture and therefore it is more influenced by its **internal laws of development**. Our studies of the Kondratiev long wave already has covered several other “socialist” countries – European countries Poland, Czechoslovakia and Hungary, and Asian countries China and Vietnam. We performed research of these indicators<sup>1</sup> also for a few capitalist countries – Great Britain, France and the USA. Based on these recent studies, we consider another series of questions about the synchronization of Kondratiev long waves.

Our new tasks are:

A. To reveal the synchronicity between long waves with similar periods between the countries;

B. To count for each pair of countries how many times there is synchronicity, phase shift or antiphase. Since the phase shift is one of the two types – preceding and delay, we have to determine how many times the dynamics of a particular country precedes others, and how many times the dynamics of this country lags behind the others.

C. To establish what is synchronicity when compared countries are in different blocs – “socialist” with “socialist”, “socialist” with capitalist and capitalist with capitalist.

<sup>1</sup> The indicators are “Output of coal per capita”, “Output of pig iron per capita”, “Output of crude steel per capita”, “Money wages in industry”, “Cost-of-living/consumer prices indices” and “GDP per capita”.

## II. COMPARATIVE ANALYSIS BETWEEN COUNTRIES

The obtained Kondratiev long waves allow us to make comparative analysis between countries. It will show whether a particular indicator in a concrete country varies synchronously with the same indicator in other countries.

### 2.1. COMPARATIVE ANALYSIS BY INDICATORS

#### 2.1.1. Output of coal per capita

The results for obtained Kondratiev long waves in the output of coal per capita are summarized in Table 1.

TABLE 1.  
OBTAINED KONDRATIEV LONG WAVES IN THE  
OUTPUT OF COAL PER CAPITA

Period	Bulgaria	Russia	Poland	Czechoslovakia	Hungary	China*	Vietnam*	Great Britain	France	USA
62			X							
61					X					
60				X						
58						X				
53		X								
48									X	X
46							X	X		
43					X					
42							X			
41	X	X								

\* For China and Vietnam the output of coal is not per capita.

The table shows that Kondratiev waves could be grouped according to the size of their period into four groups – 58-62 years, 53 years, 46-48 years and 41-43 years, and then we could count synchronicity, phase shift and antiphase in each group.



2.1.2. Output of pig iron per capita

The results for obtained Kondratiev long waves in the output of pig iron per capita are summarized in Table 2.

TABLE 2.  
OBTAINED KONDRATIEFF LONG WAVES IN THE OUTPUT OF PIG IRON PER CAPITA

Period	Russia	Poland	Czechoslovakia	Hungary	China*	Great Britain	France	USA
59	X	X						
58			X					
57						X		
56					X			
53	X							
51					X			
50							X	
47				X				
46	X					X		
45	X							
41							X	

\* For China the output of pig iron is not per capita.

The table shows that Kondratiev waves could be grouped according to the size of their period into four groups – 56-59 years, 50-53 years, 45-47 years and 41 years, and then we could count synchronicity, phase shift and antiphase in each group.

2.1.3. Output of crude steel per capita

The results for obtained Kondratiev long waves in the output of crude steel per capita are summarized in Table 3.

TABLE 3.  
OBTAINED KONDRATIEV LONG WAVES IN THE OUTPUT OF CRUDE STEEL PER CAPITA

Period	Russia	Poland	Czechoslovakia	Hungary	China*	Great Britain	France	USA
59		X						
58			X					
57	X							
56				X	X			
52	X							
51					X			
48						X		X
47							X	
41	X							

\* For China the output of crude steel is not per capita.

The table shows that Kondratiev waves could be grouped according to the size of their period into four groups – 56-59 years, 51-52 years, 47-48 years and 41 years, and then we could count synchronicity, phase shift and antiphase in each group.

2.1.4. Money wages in industry

The results for obtained Kondratiev long waves in the money wages in industry are summarized in Table 4.

TABLE 4.  
OBTAINED KONDRATIEV LONG WAVES IN THE MONEY WAGES IN INDUSTRY

Period	Czechoslovakia	Great Britain	France	USA – hourly earnings	USA – weekly earnings
59				X	
58			X		
54	X				
51		X			
50	X				
44					X
43					X
42		X			
41		X			
40			X	X	

The table shows that Kondratiev waves could be grouped according to the size of their period into four groups – 58-59 years, 54 years, 50-51 years and 40-44 years, and then we could count synchronicity, phase shift and antiphase in each group.

2.1.5. Cost-of-living/consumer prices

indices

The results for obtained Kondratiev long waves in the cost-of-living/consumers prices indices are summarized in Table 5.

TABLE 5.

OBTAINED KONDRATIEV LONG WAVES IN THE COST-OF-LIVING/CONSUMERS PRICES INDICES

Period	Bulgaria	Poland	Czechoslovakia	Hungary	Great Britain	France	USA
56					X		
53							X
49					X		
48						X	
47		X	X	X			
44	X					X	
43							X

The table shows that Kondratiev waves could be grouped according to the size of their period into four groups – 56 years, 53 years, 47-49 years and 43-44

years, and then we could count synchronicity, phase shift and antiphase in each group.

2.1.6. GDP per capita

The results for obtained Kondratiev long waves in GDP per capita are summarized in Table 6.

TABLE 6. OBTAINED KONDRATIEV LONG WAVES IN GDP PER CAPITA

Period	Russia	Czechoslovakia	Great Britain	France	USA*
59	X				
48					X
42	X	X			
40					X

\* For the U.S. the data consists of GNP per capita

The table shows that Kondratiev waves could be grouped according to the size of their period into three groups – 59 years, 48 years and 40-42 years, and then we could count synchronicity, phase shift and antiphase in each group.

2.2. COMPARATIVE ANALYSIS BY COUNTRY

Mutual dynamics of the different countries by the same indicators can take one of three forms – synchronicity, phase shift and antiphase. For each pair of countries we can count the number of times when we observed synchronicity, phase shift or antiphase. Further insight into the joint dynamics could be got by taking into account that the phase shift is one of two types – phase preceding or phase delay. The results of the counting are presented in Tables 7, 8 and 9.

TABLE 7. SYNCHRONICITY IN PAIRS OF COUNTRIES

	Russia	Poland	Czechoslovakia	Hungary	China	Vietnam	Great Britain	France	USA	Total
Bulgaria										0
Russia					1		1	1		3
Poland			4	1			1			6
Czechoslovakia				1			1			2
Hungary						1	1			2
China							1			1
Vietnam										0
Great Britain								2	5	7
France									3	3
Total	0	0	4	2	1	2	4	3	8	24



The numbers in the table show how many times the dynamics in the pair of countries has been synchronous. For instance the dynamics of Russian economy has been synchronized once with China, once with Great Britain and once with USA.

**TABLE 8. PHASE SHIFT IN PAIRS OF COUNTRIES**

		Delay									Total	
		Bulgaria	Russia	Poland	Czechoslovakia	Hungary	China	Vietnam	Great Britain	France		USA
Preceding	Bulgaria		1									1
	Russia			2	2	1						5
	Poland											0
	Czechoslovakia											0
	Hungary	1	3	2	2							8
	China		3	3	3	2				1		12
	Vietnam		1									1
	Great Britain		2	1	2	1		1		2		9
	France	1		1	1	1		1	1			6
	USA	1						1	3	4		9
Total		3	10	9	10	5	0	3	4	7	0	51

The numbers in the rows indicate how many times the dynamics of a particular country precedes the others and the numbers in columns indicate how many times the dynamics of this country lags behind the others. Thus the dynamics of Bulgaria once precedes dynamics of Russia, and once lags behind the dynamics of Hungary, France and the U.S.

**TABLE 9. ANTIPHASE IN PAIRS OF COUNTRIES**

	Russia	Poland	Czechoslovakia	Hungary	China	Vietnam	Great Britain	France	USA	Total
Bulgaria										0
Russia							1			1
Poland										0
Czechoslovakia										0
Hungary										0
China										0
Vietnam										0
Great Britain										0
France										0
Total	0	0	0	0	0	0	1	0	0	1

The numbers in the table show how many times the dynamics in the pair of countries has been in antiphase. The only one antiphase is between Russia and Great Britain.

Tables 7, 8 and 9 are a good basis for analysis because they show individual data about the comparison in each pair of countries. Summary information for each country is presented in Table 10.

TABLE 10.  
SYNCHRONIZATION, PHASE SHIFT AND ANTIPIHASE BY COUNTRY (PERCENTAGES)

Countries	Synchronicity	Phase shift – preceding	Phase shift – delay	Antiphase	Total
Bulgaria	0,0	25,0	75,0	0,0	100,0
Russia	15,8	26,3	52,6	5,3	100,0
Poland	40,0	0,0	60,0	0,0	100,0
Czechoslovakia	37,5	0,0	62,5	0,0	100,0
Hungary	23,5	47,1	29,4	0,0	100,0
China	14,3	85,7	0,0	0,0	100,0
Vietnam	33,3	16,7	50,0	0,0	100,0
Great Britain	44,0	36,0	16,0	4,0	100,0
France	31,6	31,6	36,8	0,0	100,0
USA	47,1	52,9	0,0	0,0	100,0

TABLE 11.  
SYNCHRONIZATION, PHASE SHIFT AND ANTIPIHASE BY BLOCS OF COUNTRIES (PERCENTAGES)

Blocs	Synchronicity	Phase shift – preceding	Phase shift – delay	Antiphase	Total
“Socialist” – “socialist”	25,7	74,3		0,0	100,0
“Socialist” – capitalist	23,8	4,8	66,7	4,8	100,0
Capitalist – capitalist	50,0	50,0		0,0	100,0

### III. CONCLUSIONS

From the data in Table 10 several important conclusions could be made:

1. For all countries the dynamics of their socio-economic indicators most often is phase shifted compared to the same indicators in other countries. Synchronicity takes the second place and antiphase occurs very rarely (only once).

2. The dynamics of socio-economic indicators of the U.S. and UK mostly have been synchronized with other countries. At the same time, in these two countries the part of phase shift is the lowest.

3. Poland and Czechoslovakia have similar distributions. About 40% of their dynamics is in synchronicity with other countries, and about 60% is in phase delay.

4. Bulgaria is a special case – 100% of the dynamics of its indicators has been phase shifted to other countries, and 75% is the observed phase delay.

5. China is the country with the highest percentage of phase preceding.

6. In Bulgaria, Russia, Poland, Czechoslovakia, Vietnam and France phase delay exceeds the phase preceding. Interesting special cases are Poland and Czechoslovakia, for which we found no phase preceding.

7. In Hungary, China, UK and USA phase preceding exceeds the phase delay. Interesting special cases are China and the U.S., for which we have found no phase delay.

Analysis by country can be summarized by combining the countries in blocs – well known in the

past “socialist” and capitalist bloc. In Tables 7, 8 and 9 comparisons “socialist” – “socialist” countries are positioned in the upper left rectangles of the three tables. Comparisons capitalist – capitalist countries are positioned in the lower right rectangles of three tables and comparisons “socialist” – capitalist countries are positioned both in the upper right and lower left rectangles of three tables. Numbers in tables 7, 8 and 9 can be summarized in the way shown in Table 11.

The interesting thing here is that synchronicity is the lowest when we compare countries in different blocs. When compared countries are of the capitalist bloc then the synchronicity is the highest, followed by the synchronicity within the “socialist” bloc.

Most often the dynamics of the countries in the “socialist” bloc is lagged behind the dynamics of the countries in the capitalist bloc.

### REFERENCES

- [1] Г. Найденов, Харалампиев, К. Длинные волны Кондратьева в России и Болгарии // Кондратьевские волны: аспекты и перспективы / Отв. ред. А. А. Акаев, Р. С. Гринберг, Л. Е. Гринин, А. В. Коротаев, С. Ю. Малков. – Волгоград: изд-во "Учитель", 2012. С. 342 – 360.