

MYSTERY OF THE 5TH WAVE – IS THE EARTH TOO SMALL FOR IT?

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Abstract

Long waves are the longest economic cycle with an approximate length of 50-60 years. Most of the exponents of the long wave theory are convinced about their relation to innovations of the highest level. The most important theoreticians of long waves are N.D.Kondratiev and J.A.Schumpeter. It is generally accepted that there have been 4 whole cycles, so called K-waves, since the beginning of the industrial revolution. However, economists differ in the opinion, whether we are witnessing the beginning of the 5th wave now, or the 5th wave has not started yet. This 5th wave should be initiated by information technologies, respectively by the so-called economy 4.0. However, if the 5th K-wave is already going on, then its course is significantly different from the upswing phase of the previous four waves and there is a question, what caused this. As the previous four K-waves always led to a significant territorial growth in markets, there is a provocative question, whether the Earth is not already too small for the awaited 5th wave and if this wave is not connected with expansion into the space. The first efforts in this direction can be seen already these days.

Key words: K-wave, Innovation, Business Cycles

JEL Code: B15, E14, E44

Introduction

It is not common to think about economic issues in the scale crossing the borders of the Earth. Nevertheless, it is obvious that if K.E.Ciolkovsky's visionary words about the Earth as the cradle of mankind and impossibility to stay in the cradle for ever, are true, then earlier or later this scale will have to be taken into consideration. In fact, it is the same logic, as the one when in the past, economic theory started to cross borders of national markets and pay attention to international or global markets. It is possible that the first phase of this process is in progress already now, but is also possible, that this untraditional approach will help us explain the issue of imperceptible Fifth Kondratiev wave, which, if the theory of long cycles is correct, should have started already sometimes in 1990-2000.

The theory of long Kondratiev cycles (also known as K-waves) is not a part of mainstream economics. Based on this theory, the hypothesis about approximately 50-year periods can be constructed. These periods can be seen not only in the economic field but also in the presence and type of war conflicts, revolutionary unrests etc. The main authors of long wave concept are N.D.Kondratjiev and J.A.Schumpeter, the economists who can hardly be categorized into any traditional economic school.

1 The longest economic cycle

Although the first explicit mentions on long-term fluctuations of economic indicators appeared already in the middle of the 19th century (H.Clarke), a really fundamental approach connected with exact formulating of a long wave theory dates back to the period between the World Wars and is connected with the names of Kondratiev (in 1920) and Schumpeter about one decade later. He is also the author of a hypothesis according to which the cause of these waves (Schumpeter called them by the name of his predecessor –Kondratiev waves) are technological innovations of the highest level (so-called basic innovations). According to Schumpeter, innovations are spread irregularly over time and come out in waves as adequate conditions must be created before these innovations can be practically applied. As soon as this happens, innovations catch on like a snowball, cluster and lead to technical revolutions. Based on the mentioned innovation clusters, Schumpeter characterizes long waves as the longest economic cycles in capitalism.

Kondratiev wrote an empirical paper on the development of prices of goods, capital interests, raw material extraction, international trade return, production of metals and so on in the period of 140 years. In relation to this paper, he concluded that there were three “big boom cycles” in 1920.

Tab. 1: Kondratiev’s dating of so-called „long boom cycles“

First wave	Upswing phase from 1787-92 to 1810-17 Recession from 1810-17 to 1844-51
Second wave	Upswing from 1844-51 to 1870-75 Recession from 1870-75 to 1890-96
Third wave	Upswing phase from 1890-96 to 1914-1920

Source: Kondratiev, 1989. Own adjustments.

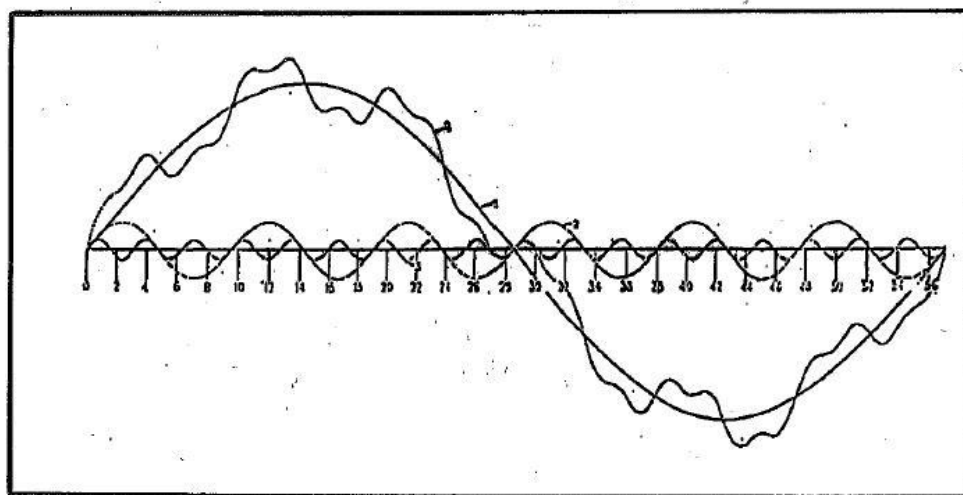
Important Schumpeter’s contribution is time differentiation of economic cycles. He carried out a statistical analysis and then set the length of three basic types of cyclical fluctuation accordingly. He called these cycles after their inventors. According to Schumpeter, there are

short-term Kitchin cycles lasting 3-5 years, mid-term Juglar cycles lasting 7-11 years and long cycles (Kondratiev long waves) lasting 45-60 years (Schumpeter, 1987, p. 86-87).

Schumpeter emphasizes the unity of all economic cycles - individual cycles interfere with each other, similarly as physical waves do. If all these three cycles get into the same phase, especially in case of a crisis, “movement with extraordinary force” can be expected (Schumpeter, 1989, p. 433). Schumpeter claims that in historical development he found three whole Kitchin cycles per each completed Juglar cycles and six completed Juglar cycles per each Kondratiev long cycle.

Fig. 1 shows all 3 types of economic cycles in attested resonance (Kondratiev-Juglar-Kitchin) 1:6:18 and the final curve of “interference” of these cycles, showing the real course of economic processes during one long wave. It can be seen on the interference curve at the first sight that if a long wave is in its upswing phase, periods of GDP growth last long and show high year-to-year increases whereas periods of GDP decline are very short. This is just the opposite in the decline phase of a long wave, declines or stagnations last long, in contrast to periods of significant growth which are short. This exactly describes the economic situation in developed countries over the last few decades.

Fig. 1: Multicyclicity of economic development by Schumpeter



Source: Schumpeter, 1989, p. 175.

Kondratiev and Schumpeter described only 3 long waves, the following fourth one whose beginning relates to the World War II, was on after their death. Its course was described only by their most important successor G. O. Mensch, who dates the K-cycles as follows: 1785-1842 (67 years), 1842-97 (55 years), 1897-1940 (43 years), 1940-95 (55 years). Each cycle is characterised by both a leading or dominant industry (coal and iron in the first cycle, steam and

steel in the second cycle, electricity, chemistry and automobiles in the third cycle and astronautics, nuclear weapons and computers in the fourth cycle) and leading countries (Great Britain, Great Britain and Germany, the USA and Germany, the USA and Japan). Table 2 sums up opinions of major authorities in the field of long waves:

Tab. 2: Chronology of long waves according to some authors

	1. long wave		2. long wave		3. long wave		4. long wave	
	Trough of decline	Peak of growth	Trough of decline	Peak of growth	Trough of decline	Peak of growth	Trough of decline	Peak of growth
1. Kondratiev (1926)	1790	1810/17	1844/51	1870/75	1890/96	1914/20		
2. Schumpeter (1939)	1787	1813/14	1842/43	1869/70	1897/98	1924/25		
3. Dupriez (1978)	1789/92	1808/14	1846/51	1872/73	1895/96	1920	1939/46	1974
4. Rostow (1978)	1790	1815	1848	1873	1896	1920	1939/48	1967
5. Mensch (1979)	1785	1818	1842	1870	1897	1920	1940	1967
6. Van Duijn (1983)	–	–	1845	1872	1892	1929	1948	1973

Source: Van Duijn, 1983, p. 163. Own adjustments

According to Mensch, the 5th cycle started around 1995. It is said to have been preceded by a wave of innovations starting in 1984. The most important is supposed to be production of microprocessors, genetic engineering, new materials and changes in the energy industry. Mensch is not alone who is convinced that the 5th wave is already in progress now. For example, according to Rostov, mentioned in the table 2, the 5th wave started already in 1972. Similarly, even some other authors are also convinced that at least the most developed economies have already entered the 5th wave, even though Rostov's dating is an exception in this respect. There are generally prevailing opinions that if the world (or at least its economically most developed part) is already in the 5th wave, it is in its initial phase. However, there is at least the same number of authors with an opposite opinion who claim that the commencement of the 5th wave is from unknown reasons delayed and the current epoch is a sluggish continuing of the decline phase of the 4th wave.

2 Is the 5th wave delayed?

As stated in the 1st chapter, some economists think the present world economy should be somewhere in the upswing phase of the 5th K-wave of the so far history. However, in that case, the

5th wave would significantly differ from all four previous waves. It is true that the end of the 4th long K-wave or commencement of the 5th K-wave (especially at the global level), often connected with e.g. information revolution still remains an open question.

The main problem is that the upswing phase should be accompanied with huge pace of GDP growth, often in 2-digit figures. On the contrary, the current economy has been showing only a very little growth, on average only 2.9% since 1995 - a hypothetical begin of the 5th wave (Cihelkova, p. 14-16).

This by far more corresponds with a decline phase of a wave where economically “bad years” usually prevail and productivity of capital falls in a long-term view due to obsolete technique and technology. Such development describes the situation of the current developed world much better than optimistic prognosis about a new upswing phase of the 5th cycle. In that case, however, the enormous length of the decline phase of the 4th cycle remains to be an unsolved issue. How can this be explained? Currently, explanations are mostly concentrated in the four following possibilities:

1. Theoretical conclusions made by Mensch, Rostow, Van Duijn and others are wrong, there is no 5th K-wave currently on and the so-called “information revolution” is only a late part of the exceptionally long 4th wave.
2. The 5th K-wave is really in progress, but as well as in the past four waves, even this 5th one primarily concerns countries and regions representing economic avant-garde. In the previous waves, this was Euro-American West, while the rest of the world stagnated to some extent. In the current 5th wave countries like China, India, South Korea etc. represent economic vanguard while the post-industrial West has already passed its peak and is experiencing sluggish decline.
3. The 5th wave is really in progress, however, its course differs from the previous four as it is not connected with any big war or their series. The 1st wave relates to Napoleon’s Wars, the 2nd wave with a series of 1847-1849 revolutions immediately followed by Crimean War, the 3rd wave with colonial wars and large armament leading in its consequences to the outbreak of World War I and the 4th wave with World War II. These wars always lead to massive destruction, but that was exactly the reason why they became the cause of subsequent massive recovery at the same time. The current 5th wave has not been accompanied by any world-wide war (at least yet) and therefore the current pace of growth does not correspond to those typical for previous long-term cycles.

4. Changes in all previous four waves were always initiated by the need for increase in the productivity of factors of production for expanding markets backed up by preconditions in the form of achieved level of scientific findings. Of course, the same can be expected even in case of the 5th wave, but the difference is that industrialisation in developing countries allowed staying with current technologies much longer than in the past. New “outcries” of technology are always very costly and complicated at the beginning and so it takes them some time to break into the obsoleting ones. However, if the older, already well-established technologies get suddenly more space worldwide, companies in most developed countries are not pushed to fast innovations either. This is even more likely if the production is relocated to poorer countries with cheaper labour, which has become a rule.

3 Or is it all different?

Points 1-4 in the previous chapter represent so-called “standard” attempts to explain an unusual phenomenon. Other possible explanation for the delayed commencement of the 5th wave may relate to the types of economic activities which should become main driving forces of new economic expansion. This brings us back to the idea presented in the Introduction of this paper. State-of-the-art technical industries using digitalization and robotics are supposed to be the base of the so-called industry 4.0. Of course, this is very probable, the only question is whether the Earth will not be too tight for such development of production forces and whether, in connection with industry 4.0, there won't arise an economy exceeding the global market frame. This may still seem like a sci-fi now, but it is a fact that, space exploration which was one of the driving activities already in case of the 4th wave might be upgraded to a qualitatively new level in historically short time. And it is crucial in this connection, that the current development in this field is starting not to be a domain of present main players, state-owned agencies like NASA, Roskosmos, ESA, JAXA etc. any more. These have been losing their positions which are taken over by private capital pushing forward. And it was just the private capital which was the decisive factor in the commencement of previous long waves.

Private companies active in astronautics and related fields are becoming more and more self-confident stakeholders aiming to change at first close and later further surrounding of the Earth into a sphere of private economic activity. Activities of billionaires Elon Musk (SpaceX), Jeff Bezos (Blue Origin), Richard Branson (Virgin Galactic) and many others are good examples, but at the same time more and more private non-American stakeholders such as Rocket

Lab from New Zealand or Chinese OneSpace or Spice Transportation are also winning recognition in this field.

Currently, even a network of “space internet” is being created (Starlink, which should start to operate with help of thousands of private satellites already this year), projects of bases and habitats in the space or on other bodies are being prepared (module Beam of a private company Bigelow Aerospace has already been operating at the International Space Station) and activities focused on extraction of raw materials in the space are at a high level of planning, e.g. companies Planetary Resources or Deep Space Industries, backed also by US dollar billionaires.

The cause of slow commencement of the 5th wave might be simply in the fact that development of space equipment (booster rockets and other space infrastructure/architecture) is technically, economically and organizationally too demanding for private capital. It is definitely much more demanding than introduction of steam or electricity in the past. However, as soon as these initial difficulties are over, there will be extremely large-scale expansion.

Not very far future will undoubtedly show us which of these explanations is closest to the truth. At the same time opportunities for further research will open. Anyway, questions about the end of the 4th and beginning of the 5th K-waves remain still open.

Conclusion

Regardless whether the 5th wave is currently in progress or it is supposed to start at some time in future and regarding to existing chronology of long waves, most authors agree that there have been four whole long-term cycles since the first industrial revolution up to now. Most exponents of the long wave theory are convinced about cyclical character of these waves and their connection with innovations.

Identification of individual long waves faces a crucial problem of empirical testing of various hypotheses related to innovation cycles or waves. A lack of satisfactory innovation statistics and other reliable comparable data for a longer horizon makes scientific research more difficult from this view. The present sample contains only a short period of four identified long waves since the end of the 18th century. Considering existing differences between courses of individual waves and discrepancies between individual approaches and attempts for scientific explanation, such a small sample cannot be solved by application of mathematical and statistical methods. Therefore, many long-wave concepts did not undergo empirical testing at all. This is also one of the reasons, why the idea of long waves hasn't found its position in mainstream economics utilising high-level mathematical and statistical apparatus.

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