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Source: *Journal of Economic Issues*, Jun., 1994, Vol. 28, No. 2 (Jun., 1994), pp. 477-488

Published by: Taylor & Francis, Ltd.

Stable URL: <https://www.jstor.org/stable/4226831>

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Long Waves, Long Cycles, and Long Swings

Andrew Tylecote

Have there been, since (say) 1800, "long wave" cycles of some 45-60 years in world rates of economic growth? If so, we are in a downswing. Some 60 years' data have accumulated since Kondratiev and Schumpeter's works, with much improvement in data for earlier periods and in econometric sophistication. Yet Solomou [1987] shows that what looks like a regular long wave in twentieth century growth rates can be "dismantled" into a number of *episodic traverses* without obvious cyclical character. Reijnders [1990], on the other hand, shows that for the nineteenth century, where no long wave is evident, one appears once allowance is made for *perspectivistic distortion*—the influence on the data of fluctuations of longer and shorter periods than the one looked for.¹ This controversy shows that empirical analysis cannot be conducted in isolation from theory. This paper emphasizes "low theory," which engages closely with empirical knowledge. It seeks to clarify what kind of long wave fluctuations we might expect to find in the data and how we might expect them to have altered over the period. It also asks what other cyclical movements we should look for and allow for to reduce "perspectivistic distortion" and when and how we should allow for "episodic traverses." Finally, and briefly, it considers implications for prediction and policy.

The author is Senior Lecturer in the Management School, University of Sheffield. This paper distills the author's book, "The Long Wave in the World Economy: The Present Crisis in Historical Perspective" [1993a], with a number of advances on the analysis of the book. This paper was presented at the annual meeting of the Association for Evolutionary Economics, Boston, Massachusetts, January 3-5, 1994.

Long Cycles

The only cycle of longer period than "long waves" that might be expected to affect economic growth is the "long cycle" in international relations [Wallerstein 1983; Modelski 1987]. This is a cycle of leadership or hegemony of some four generations—100-120 years. During the first generation, a *global war* takes place, ending with the victory of a new hegemon, or world power. This state thenceforth largely controls world trade and economic relations. In Modelski's scheme, the next generation is one of uncontested leadership, the third of *delegitimation*, and the fourth of *deconcentration*, with a serious challenger emerging; then global war returns. During our two centuries, the hegemons have been Britain (till 1914) and the United States (since 1945); the global wars have been the Revolutionary/Napoleonic (1792-1815) and the 1914-45 periods. Periods of global war presumably tend to slow growth. Maddison [1982] and Solomou [1987] show that the world economy did grow decidedly more slowly through 1914-45 than in the 30 years before, and grew far faster in the 30 years afterward. Likewise, we know that growth was slow from 1792 to 1815 in the United States and Britain, and for the decade afterward also in continental Europe [Tylecote 1993a]. This deceleration takes place not only because of the destruction, diversion of resources, and obstruction of trade that result from war, but also because of the vacuum of leadership that exists during such periods. Thus, in 1918-39, the United States behaved without any sense of the responsibilities that went with its new economic power. Maddison [1982] argues very reasonably that world growth was blighted by a surge of protectionism at this time, and clearly this was connected with the effects of the 1914-18 war and with U.S. irresponsibility—for example, the large tariff increases in 1931.

The 1914-45 deceleration was less pronounced for Britain, the ex-hegemon, than for any other major economy, as was the subsequent acceleration for the United States, the next hegemon. Hegemonic responsibilities seem a burden.² (One might also expect a state newly arriving at world power status to be enjoying a surge of economic dynamism at the time.) Moreover, neither the old nor the new hegemon suffered nearly as much physical destruction or social disruption as most other contestants in the global war. Much the same appears to be true for the previous global war, except for the oddity that the "retiring" and new hegemon were one and the same, Britain. This explains why Reijnders [1990], examining only

Britain, found no "long cycle" output fluctuation. For the world economy, we can assume a "long cycle" fluctuation of some 120 years, involving slower growth for some 30 years around the time of "global war." Thus, one of Solomou's "episodic traverses" is part of a cycle longer than any he was considering; so it may be with his next traverse, the 30 years after 1945, whose fast growth he very reasonably ascribes largely to Europe and Japan's technological "catch-up" of the United States after they had fallen far behind during 1914-45. That—and well-functioning international institutions—are bonuses to be expected during the generation after global war.

Long Swings

We now examine the period shorter than the long wave. The Juglar or fixed investment cycle (7-11 years) can be allowed for by calculating growth rates from Juglar "peak" to "peak." The only well-attested cycle longer than the Juglar is the Kuznets or long swing, which lasts some 15-25 years. This has strong econometric support [Solomou 1987]. It can be explained by the dynamics of investment in building and land and in those other long-lived assets—stocks and shares: Kuznets downswings were often triggered by stock market crashes like that on Wall Street in 1857. The United States had pronounced Kuznets swings in the nineteenth century [Solomou 1987], associated with immigration from Europe (fastest during upswings) [Abramovitz 1961; Thomas 1973]. A striking association has been found between these Kuznets swings and U.S. rainfall fluctuations governed by lunisolar tides of some 19 years; these exogenous cycles presumably act as pacemakers [Currie 1988; Tylecote 1993a]. Parallel to U.S. swings were weaker inverse movements in Western Europe [Solomou 1987] whose downswings may have been driven by the outflows of people and capital to fuel U.S. upswings. In the twentieth century, Solomou finds the U.S. Kuznets continuing, though briefly suppressed by World War II (the climatic pacemaker must have weakened as agriculture's importance and vulnerability declined). From 1920, such long swings as occurred elsewhere seem roughly synchronic rather than inverse with U.S. swings. This is explicable by the declining transatlantic migration and by the great expansion of trade. A U.S. boom would have an expansionary effect, through trade, on Europe. Likewise, since the end of the gold

standard, it has been unrealistic to think in terms of a limited world supply of financial capital that, if drawn by a U.S. boom toward New York, would leave Europe short. On the contrary, the expansion of credit across the world now depends on the same rather fragile structure of lending, depositing, and relending, and a collapse of confidence in one financial center would tend to spread to the others. But what are the conditions for a strong Kuznets swing? They appear to include the *deregulation* of property and financial markets, which can then be swept into the sort of speculative undershooting and overshooting described for land by Harrison [1983] and finance by Minsky [1982]. Clearly the Wall Street crash of 1929 and its aftermath fit the picture of recoil after a speculative overshoot—and so does the Tokyo crash of 1990-1991 [Tylecote 1993a]. In that case we would expect only a brief pause in the 1940s in U.S. Kuznets swings; the resumption of U.K. and Japanese swings in the 1980s, as their markets were deregulated; but no significant swings in the major economies of continental Europe, which remain to a large extent regulated. This fits Solomou's data to 1973 and that of Table 1 below.

Table 1. Growth Rates of GDP, Percent Per Annum, 1937-89*

Period	USA	Japan	Germany	France	Britain
1937-50	4.4	-2.2	1.0	1.4	1.7
1950-60	2.8	8.8	7.4	4.5	2.7
1960-69	4.3 ^a	11.1	4.4	5.4	2.9
1969-73	3.3 ^b	8.8	4.3	5.5	3.1
1973-79	2.7	4.1	2.4	3.0	1.6
1979-89	2.7	4.2	1.9	2.1	2.2
(1981-89)	2.9	4.1	2.0	2.5	3.3
(1989-92)	0.6	3.4	3.4	1.5	-0.8

Source: Tylecote [1993a]; *National Institute Economic Review* [1983 and 1993].

Notes: *United States, Japan, and Germany: GNP for 1980-89. Japan's dates and those in parenthesis are not peak-to-peak. Dates are noted where deviations > 2 years.

^a1959-66.

^b1966-73.

The Empirical Case for the Long Wave

At the world level, then, we have little evidence of Kuznets swings before 1914, national swings tending to cancel out. In the

interwar period, there is a pronounced swing, with the U.S. peak in 1928-9 (Table 2). Recently we have some evidence of a return to Kuznets swings, and current conditions particularly in Japan are indicative of a strong Kuznets downswing. This is helpful in identifying and phasing the Kondratieff wave, if any—for example, in the dating of the first peak in the wave during the twentieth century: 1914, 1920-1921, or 1929? If we allow for a strong Kuznets upswing during the 1920s, one of the earlier dates seems preferable. The second peak was presumably in 1973 or a little earlier. In the most recent period, the relatively good growth rates of the mid-to-late 1980s can be seen as a partial Kuznets upswing in a long wave downswing.

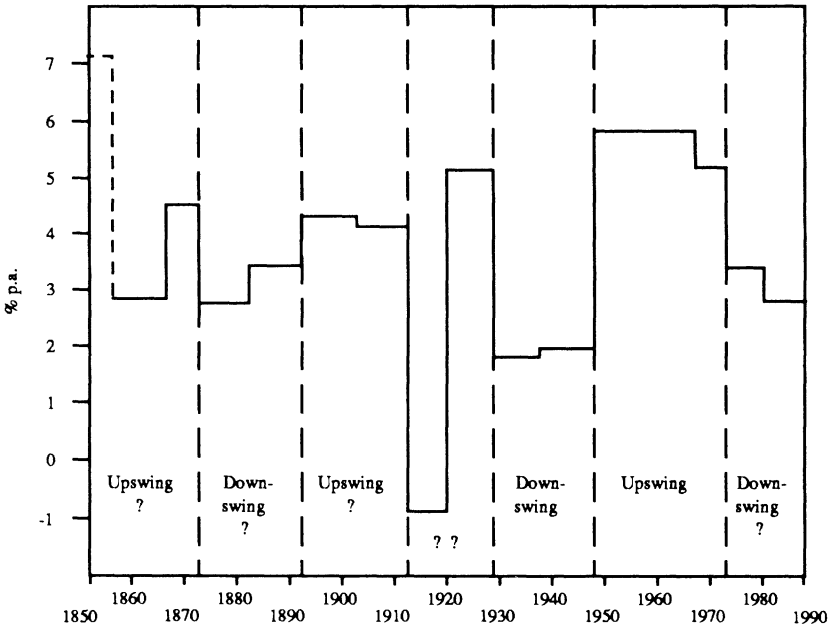
Table 2. Growth Rates of GDP, Per Annum, 1913-1951

Period	US	Britain	Germany	France	World
1913-24	3.0	0.3	0.3	0.7	0.8
1924-29	3.3	2.0	5.5	3.0	5.8
1929-37	-0.2	2.0	3.3	-0.5	1.5
1937-51	4.4	1.7	1.0	1.4	3.0

Source: Tylecote [1993a, Tables 10.1 to 10.5].

Doubts about the long wave remain. If 1914-45 is not an episodic traverse, it may instead be a global war phase in the long cycle, and 1945-1973 may be the next phase. At least it is easier to understand the period since 1973 as a long wave downswing than as the third phase of the long cycle (there is nothing particularly deflationary about "delegitimation") or yet another episodic traverse. What then of the period before 1914? Figure 1, which shows world growth rates for industrial production from one Juglar peak to the next, gives a mixed picture. From 1892 to 1913, there was indeed somewhat faster growth (4.1 percent p.a.) than during the previous 20 years (3.0 percent): this could be a long wave upswing following a long wave downswing, although the periods are rather short.³ However, the rather brief period before 1872, for which world data are available, shows a rate of growth little higher than the "downswing" afterward, if we limit ourselves to peak-to-peak data (1856-72, 3.4 percent p.a. against 3.0 percent). At this point, however, we can call a war to our aid: a war, which instead of explaining (away) an apparent long wave, like the 1914-45 "global war," can explain the apparent absence of one.

**Figure 1. World Economic Growth: A Long Wave Pattern?
Growth Rates in Industrial Production**



Source: Tylecote [1993a, Figure 1.2].

The U.S. Civil War of 1861-1865 was by far the most bloody and expensive war in the interval between the global wars and, besides devastating the U.S. economy, had wider effects, mainly through the drastic fall in the world supply of cotton. There is little obvious impact on British growth for the 1857-66 Juglar, probably because benefits to engineering balanced the disaster for Lancashire's cotton industry. The damage to the French economy—the second largest textile producer in Europe but far weaker in engineering—was all too apparent (see Table 3). Presumably, most of the growth lost in this period was "transferred" to the brief 1866-72 Juglar (4.5 percent world growth p.a.), but some went to later periods since the U.S. recovery was prolonged. In that case, but for war, growth in 1872-92 would have been even lower than occurred, and growth for the pre-1866 period decidedly higher. Now we know

Table 3. Growth Rates of Output, Percent Per Annum, 1845-1913*

Juglar	Britain	France	USA	Germany	World
1845-57	3.3	2.8			(7.6) ^a
1857-66	3.2	0.6		2.6	2.8
1866-73	2.3	2.1		2.3	4.5
1873-83	2.2	1.9	4.0	1.3	2.7
1883-90	1.6	0.4	5.3	2.8	3.4
1890-1903	1.8	1.6	3.1 ^b	3.4 ^c	4.3
1903-13	2.3	3.5	3.8 ^d	2.9 ^e	4.1

Source: Tylecote [1993a, Tables 9.1-9.5].

Notes: *Britain, France, and World: Industrial Production. United States: GDP. Germany: NDP. Dates are for Britain; deviations more than two years are noted.

^a1850-6; not peak-to-peak.

^b1892-99.

^c1890-1900.

^d1899-1912.

^e1900-13.

that for a number of major countries at least there had been fast growth of industrial production dating back to the early 1840s (Germany) or late 1830s (France) or before (United Kingdom, United States).⁴ Thus, the "war-adjusted" data could be taken to show a long wave upswing from about the early 1840s to about the late 1860s. The peak coming earlier, the downswing period to 1892 would be about the right length.⁵

An Explanation for the Long Wave

The argument so far shows that the data for output, when adjusted for ordinary and global wars and long swings, is consistent with an underlying long wave pattern. We now need a theory that would lead us to expect one. I find that the most plausible simple model is that of Perez [1983]. She starts from the assumption that there are major discontinuities in technological progress, such that every half-century or so there arises a new *technological style*, or "paradigm for the most efficient organisation of production, i.e. the main form and direction along which productivity growth takes place" [1983, 361]. This arises out of the drastic cheapening through a set of radical innovations of a number of

key factors of production.⁶ The new style would cause rapid change in the *techno-economic subsystem*. However this system coexists with the other main subsystem within capitalism, the *socio-institutional framework*. If the latter is mismatched to the former, problems ensue. The rapid diffusion of the new style that would otherwise occur is blocked; this causes a downswing, and a crisis, from which arise reforms that renew the "framework" so that it is well matched with the new style. Fast diffusion and an upswing follow.⁷

The Perez model may be elaborated to distinguish *types* of mismatch. Type 1 is *microeconomic* mismatch such that obstructs diffusion from the start (for example, if the organization of the firm is unsuited to the new style). Type 2 is *macroeconomic* mismatch such that as the new style diffuses, imbalances develop, resulting in macroeconomic crisis. (A typical element in these imbalances is growing income inequality as seen in the United States in the 1920s and generally in the 1980s; this prevents the required expansion of consumer demand and is ill-matched to the new style, which tends to demand more equality. There is a parallel international development [Tylecote 1993a, chaps. 6 and 7].) Type 3 is a *sociopolitical* mismatch such that a sociopolitical crisis arises out of the successful diffusion of the new style, as in Germany before 1914 [Tylecote 1993a, chaps. 9 and 10]. (Type 3 also has an international variant.) Type 1 necessarily has a rather quick decelerating effect; Type 3 may take a long time to have an economic impact.⁸

Did technology advance in the way described? Tylecote [1993a] found:

1. The "water" style, crystallized in Britain c.1785, based on water (and early steam) power and water transport.
2. The steam transport style, also in Britain, during the late 1820s; steam power and transport.
3. The steel-and-electricity style, United States, Germany, and Britain, late 1870s; cheap steel and electrical technologies.
4. The Fordist style, United States, c.1915; cheap oil and electric power and assembly line.

5. The microelectronics and biotechnology style, United States, Japan, and Western Europe, late 1970s; self-explanatory.

Note that the intervals between the crystallization of styles vary somewhat, between a little less than 40 years and more than 60 (the dating is tentative).

The interaction between new style and old framework changed over time. In the nineteenth century, the distribution of income was not so sensitive to the style nor did it so much affect the economy; as a result, Type 2 mismatch was not a problem. On the other hand, many of the socio-institutional frameworks designed for the pre-industrial period were extremely fragile politically. The *ancien regime* rapidly collapsed in the face of the advancing "water style"; the revolutions of the late 1840s can be related to the spread of the steam transport style through Europe in the previous decade or so. The long wars after 1792 prevented the Perez sequence of mismatch-crisis-reform from leading to fast diffusion, but it worked in the 1840s. The exception was the U.S. Civil War, which followed about 20 years of upswing. After this, political regimes had more elasticity, and the next style began to diffuse without such fractures, though not without crises or some reforms. This time Type 3 mismatch, interacting with a challenge to hegemony, caused a real international crisis—that of 1914—after 20 years of upswing: thus, a political crisis due to the fast diffusion of the old style began a long wave downswing before the new style could start diffusing. A little later (in Europe in the 1920s), a Type 1 mismatch developed, and finally a Type 2 "macro" mismatch, arising from diffusion in the United States, combined with a Kuznets downswing and the leadership vacuum to produce deep economic and political crisis. The result was radical reform, which gave powerful impetus to the postwar upswing and ensured that the Type 3 mismatch that arose would cause a relatively mild crisis (around 1968-74). Once again, a Type 3 mismatch began the downswing; with the crystallization of the new style, a developing Type 1 mismatch in the United States and Western Europe continued it. Finally, with the diffusion of the new style focused on Japan, a Type 2 macro-mismatch arose and combined with Kuznets downswings in some countries to cause the present depression.

The Outlook

While the Kuznets downswing can be relied upon to work itself out, the long wave downswing, being essentially a problem of socio-institutional mismatch, can be expected to continue and even intensify until the required reforms have been carried out.⁹ Those reforms must establish a set of relative prices that chart a path for the investments and product innovations of the new style: ever-cheapening machine intelligence, of course, but also abundant and reasonably priced skilled labor—and cheap less-skilled labor as long as it is abundant. Since we now have passed the point in the downswing at which real interest rates fall, investment in human and physical capital will then be seen as cheap. The one main factor of production that must be established as more and more expensive is natural capital, given the ecological situation. At the same time, to restore the level of demand and to improve the quality of labor, inequality must be reduced. This combination of requirements will need ingenious but feasible changes in government expenditure and taxation [Tylecote 1993c].

Notes

1. According to Reijnders, Kondratiev had tried to do the same but too crudely.
2. This implies no self-sacrifice or irrationality on the part of the hegemon. By the time hegemony is achieved, its citizens have acquired vast assets outside its borders and are acquiring more; these need to be looked after, even at the expense of the domestic economy.
3. Another objection is that of Solomou, who points out that the difference between periods is entirely accounted for by the higher weights given in the latter period to faster-growing countries rather than an acceleration of growth, on the average, in individual countries. For a full counterargument to this, see Tylecote [1993a, chap. 10].
4. The GNP figures for most European countries are depressed for the late 1840s by bad harvests and the potato blight.

5. Likewise, war in 1914 may have truncated the following upswing. Earlier, the global war of 1792-1815 must have totally obscured any "growth long wave," which would otherwise have had an upswing roughly in the war period and a downswing in the decades afterward.
6. For example, the Fordist technological style was based on innovations that made possible high-performance machine tools and cheap petroleum products, electricity, and electric motors. It involved the assembly line and mass production engineering.
7. Perez's model has similarities to the Regulationist School approach [see, e.g., Aglietta 1979].
8. Some oversimplification remains. Tylecote [1993a] shows that three *feedback effects*, through inequality, population, and money, contribute to an understanding of the changing dynamics of the long wave. For reasons of space, these are ignored here.
9. Not all countries need share in the reforms, but those that do not will lag behind.

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