Is there a Long Cycle?

Is there a long cycle? This question is of the greatest importance, not only in economic history, but in the interpretation of the current situation. Is the slowing down of world production and trade in the past decade just the consequence of a series of temporary mishaps, whose effects can be rectified — or is the world under the influence of a long cycle, whose effects will still be with us for many years into the future?

The world had been enjoying increases in production and in international trade, in nearly every case at rates higher than ever previously known, with a fairly good demand for primary products. These increases prevailed from 1945 to 1973 — a few years more than the 25 years expected for the upward phase of the long cycle — if there is a long cycle — but this extension of time was to be expected from the additional time required to replace war time capital losses.

Since 1973 these trends have been sharply checked. If indeed we conclude that we are now in the downward phase of a world long cycle, we shall have to review a great many of our ideas and policies.

It was as long ago as 1922 that Kondratiev gave his name to the concept that, superimposed upon the familiar business cycle movements, there was a long cycle, with amplitude of some 50 years.

This original formulation related solely to index numbers of prices, without any mention of terms of trade, volume of international trade, manufacturing production, capital investment, and other variables with which the concept of the long cycle is now associated.

We must bear in mind however that, until comparatively recently, most published price index numbers related only to primary products. The preparation of price index numbers for manufactured goods was found to be too difficult an exercise. It is well known that the prices of manufactures fluctuate less than the prices of primary products; so any apparent long cycle which we find in the prices of primary products relates, in effect, to changes in the terms of trade.

In my book *The Economics of 1960* (written in 1940), attempting (with little success) to foresee long-run world trading conditions,

I suggested a simple formulation of a long cycle of 50 years duration, coinciding conveniently with the quarter centuries, with upward phases 1850-1875 and 1900-1925, followed by downward phases. The underlying cause, I suggested, might be alternating periods of world capital-hunger and capital-satiation. After a long period of high investment, a point would be reached where the stock of past investments was large enough significantly to slow down the rate of new investment. Periods of capital-hunger showed, besides heavy investment, an increase in the rate of growth of the volume of international trade, and terms of trade favourable to primary products. As the situation appeared in 1940, although on the face of it the downward phase had several years further to run, wartime destruction of capital, as well as extensive neglect of maintenance and replacement, should be expected after the war to lead to a longer than usual phase of high capital investment, expanding international trade, and terms of trade favourable to primary products. I did not quite venture to predict that this phase would come to an end in the mid-1970s, though in 1940 this would have been a permissible deduction from the capital-hunger hypothesis.

Professor Sir Arthur Lewis established a firm connection between the volumes of international trade in primary products, and of world manufacture, both in short-period fluctuations and in long-period movements. In 1883-1913 world trade in primary products grew at .86 of the rate of world manufacture; between 1951 and 1970 the corresponding figure was .87.[1] Lewis's exceptionally thorough study of this period 1870-1913 leaves no doubt that there was a long-cycle turning point in prices about 1895, with the terms of trade for primary products improving after that date. He has no hesitation in stating the cause, namely a slowing down in the world rate of growth of output of primary products. But he adds the enigmatic statement (p. 66) that "in denying that the Kondratiev upswing of prices caused further industrial growth of the advanced countries, we are not also denying that the faster growth up to 1907 may have contributed to causing the Kondratiev upswing".

Schumpeter, as is well known, saw a long cycle, due however to changes in the leading technologies; in the mid-19th century coal, iron, railways, steamships and textiles; at the turn of the century electricity, steel, chemicals, internal combustion engine vehicles. That these

[1] *Growth and Fluctuations 1870-1913*, p. 175.

changes in technology took place cannot be denied; they may have been related to sociological and historical causes which we have not been able to analyse. But these new technological opportunities led to increased investment, which (apparently through a multiplier effect) increased industrial output, which in turn caused the terms of trade to move in favour of primary products.

Lewis made the comment that Schumpeter's conclusions are "not obvious".

Those however who have at any rate some belief in Schumpeter's doctrine may well ask themselves what has been happening in the modern world. The 1950s appear to have been a time of considerable new technical development of chemicals (particularly petrochemicals) and engineering. How many important new technical developments are taking place now, apart from computers, whose effect seems to have been exaggerated?

Kuznets (in a private conversation) considers that "the evidence is not adequate" for a long cycle.

W.W. Rostow[2] had no doubt about the existence of Kondratiev cycles. But he makes their timing less regular; and adds the unexpected point that a large proportion of the whole upward phase price increase of primary products occurs in the initial years of the cycle.

Years of upward phase of cycle	Initial period	Price rise in initial period as proportion of whole upward phase
1793-1813	1798-1801	.59
1850-1873	1852-1854	.73
1897-1913	1897-1900	.48
1934-	1934-1937	#

Cyclical movement lost in general world price inflation.

A study of this pattern leads him to the affirmation, as he goes to press in 1977, that "I am even more confident that the world economy now confronts a protracted period of relative high energy, food, and raw material prices", heralded by the sharp price rise of 1972-77.

One wishes that one could be so confident. The situation in the 1970's was confused by the sudden large arbitrary rise in the price of oil.

[2] *The World Economy: History and Prospect*, p. 287.

But when we look at the other elements in the situation, capital investment, world industrial production, and the volume of international trade, all seemed to be heading for a climax about 1973, a point which we might have expected to be followed by a prolonged downward phase.

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As a key to world long cycles — if they exist — as a consequence of alternate periods of capital-hunger and capital-satiation, it is proposed that we look more closely at the information about the supposed underlying cause of the long cycle, namely changes in the rate of capital investment in leading countries. The available information is mostly about the volume of gross investment. What we should wish to examine, it would seem, would be figures of net capital stock, after making the required substantial deductions for depreciation and replacement requirements. Net capital stock should be expected to show a slow but steady increase, subject possibly however to long-period changes in its rate of growth. We then look for points of inflexion demarcating periods of rapid growth and of slower growth, to be determined by the inspection of diagrams. To detect such points of inflexion we must have annual data — decadal or quinquennial averages will not suffice.

Net capital stock is estimated by the "perpetual inventory" method, adding each year's gross investment, and deducting depreciation. Money gross investment has to be expressed in real terms. To obtain continuous series it is necessary to "link" price bases many years apart, a procedure not generally permissible, but unavoidable in this case.

The opening stock, accumulated before current information on gross investment first becomes available, sometimes has to be estimated arbitrarily. Errors at this point will do little harm; the amount involved is small in relation to the figures for subsequent years; and all the time the effect of any initial errors is being swept away by depreciation.

The principal factor in depreciation is obsolescence — difficulty in competing with more up-to-date equipment and structures. The rate at which an asset depreciates must always be a matter of arbitrary judgement; and varies greatly among different types of assets.

Estimates of depreciation can be "straight line" (equal annual deductions from original value) or "diminishing balance" (equal annual proportionate deductions). There is no strong case for preferring either

method. But for cumulative calculations of net capital stock the diminishing balance method is more convenient.

Fixed capital (inventories are not considered here) is classified into "structures" (comparatively long-lived) and "equipment" (comparatively short-lived). "Equipment" includes all forms of machinery and vehicles used for business purposes, but not private cars, household equipment etc. "Structures" includes, besides buildings, roads, water supply, mines and the like. Public as well as private investment is included. Residential construction is excluded — there are indications that this may move differently from business investment.

In his monumental work *A Study of Saving in the United States* Goldsmith estimated appropriate rates of depreciation for a great many sub-categories of structures and equipment. Expressed in diminishing balance rates (the straight-line rates would of course be much lower) the weighted averages came out at 4.2% per year for structures and 11.8% for equipment.

Conventional depreciation rates, though approximate, are based on the collective experience of accountants and taxation officials of the rate at which structures are likely to be converted to inferior uses, or the tendencies for the productivity of equipment to fall behind that of its more newly installed rivals, and for maintenance costs to rise. While these are better than nothing, the only satisfactory method of measuring depreciation, for the purpose of national accounts, is to collect sufficient information about the actual market prices of used assets of varying age. Though details are not given, this method has been used in preparing a fully articulated set of accounts of both national product and net capital stock for a period of 100 years in Norway.[3]

Japan took a Wealth Census in 1970, which classifies assets by age. Comparing census valuations in 1970 with real (i.e. restated at 1970 price) gross investment in past years, the results indicate a diminishing balance form of depreciation, i.e. the logarithm of surviving/original value is an approximate linear function of the age of the asset. The Japanese rates of depreciation are exceptionally high, about 9% per year diminishing balance for structures, and 22% for equipment. If we were to continue applying these rates we would have to come to the conclusion that capital stock measured net failed to increase in the 1970's, which does not appear probable.

Calculations from the *Norwegian* data give the following results.

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[3] *Langtidslinjer i Norsk Økonomi 1865-1960* (Central Statistical Office, Oslo, 1966).

DIMINISHING BALANCE RATES OF DEPRECIATION % PER YEAR

	Structures, not housing	Ships and boats	Other equipment
1865	2.06	12.1	9.7
1870	2.04	13.5	8.8
1875	2.15	12.4	9.3
1880	2.52	14.0	9.1
1885	2.65	13.4	9.2
1890	2.72	13.6	9.1
1895	2.80	12.1	9.4
1900	2.98	11.4	9.1
1910	3.15	10.7	9.1
1920	3.15	11.3	9.2
1930	2.07	11.3	10.3
1940	2.58	12.9	9.9
1955	3.08	13.9	11.8
1960	3.11	14.9	12.0

In the calculations of net capital stock for other countries which follow, standardised diminishing balance rates are used of 3% for structures and 10% for equipment, for all countries.

As for the *United Kingdom* information going back a long way (but needing qualification) is available in Feinstein's *National Income Expenditure and Output of the UK 1855-1965*, brought up to date by the current official annual *National Income and Expenditure*. A not entirely arbitrary estimate for the opening stock can be prepared from the same author's *Capital Accumulation and Economic Growth in Great Britain 1760-1860* (contributed to *The Cambridge Economic History of Europe*, Vol. VII). Feinstein points out however that some of the results in the more recent (*Cambridge Economic History)* publication, e.g. £ 47.7 million per year excluding dwellings in 1855-60, are markedly different from those (£ 78.8 million per year in 1856-60) at current prices in *National Income Expenditure and Output of the UK 1956-1965*, which sets out to give continuous series comparable with present day data. A reconciliation of this discrepancy is made in the Appendix. A small adjustment is made for the inclusion of Southern Ireland before 1920.

The values for single years are shown only in diagram form, for reasons of space: but values are tabulated at the points of inflexion. These points of transition between higher and lower rates of growth stand out fairly clearly.

NET CAPITAL STOCK (END OF YEAR)
£ billion at 1958 prices

Structures		Equipment	
1861	(6.02)	1861	(.76)
1880	7.67	1878	1.67
1896	8.13	1895	2.27
1904	9.90	1906	3.80
1936	11.24	1920	3.83
1948	11.36	1934	5.73
1972	30.48	1948	7.63
1982	40.34	1970	23.67
		1982	35.08

Summarising the points of inflexion (abstracting, so far as we can, for war periods):

Periods of rapid expansion		Periods of slower expansion	
Structures	Equipment	Structures	Equipment
1861-1880	1861-1878	1880-1896	1878-1895
1896-1904	1895-1906	1904-1936	1906-1920
	1920-1940		
1948-1972	1948-1972	1972-1982	

The case seems clear for recording an upward phase from the 1860's (when the data commenced) to 1880, and a downward phase from 1880 to 1895. The next upward phase however only lasted until 1905 — a great diversion of British investible funds abroad was beginning about then. The two series then diverge — capital stock in structures rising only very slowly till 1936, but with a rapid rise in equipment. It is difficult to say, in the lack of further evidence after 1940, whether we should (as Rostow does) regard a new cycle as beginning in 1936. But there is no doubt about strongly marked upward phases in both structures and equipment beginning in 1948, and slowing down in 1972.

For *Sweden* a continuous series of gross investment since 1861, distinguishing structures and equipment, is given by Östen Johansson (*The Gross Domestic Product of Sweden and its composition 1861-1955*, Table 48) which can be brought up to date (excluding residential).

The points of inflexion appear to be:

(billions of krone of 1913 purchasing power)

Structures		Equipment	
1861	.10	1861	.05
1880	1.73	1878	.25
1900	2.18	1896	.55
1923	3.66	1906	1.03
1946	5.86	1920	1.56
1970	20.15	1979	51.28
1979	26.66		

Periods of rapid expansion		Periods of slower expansion	
Structures	Equipment	Structures	Equipment
1861-1880	1861-1878	1880-1900	1878-1896
1900-1923	1896-1906	1923-1946	1906-1920
1946-1970	1920-1979	1970-1979	

As for the *USA*, annual data (R.W. Goldsmith, *A Study of Saving in the United States*) are only available back to 1896. Earlier data, compiled by Kuznets, are available only in the form of quinquennial averages, which will not suffice for our purpose of detecting points of inflexion.

Goldsmith's estimates of net capital stock are used from 1896 to 1929, after which the net capital stock is computed as elsewhere, on 10% and 3% diminishing balance rates of depreciation for producers' durables and structures respectively.

NET CAPITAL STOCK
$ billion of 1972 purchasing power

Non residential structures		Equipment and machines	
1896	130.1	1896	35.0
1920	243.2	1898	36.4
1923	325.6	1907	63.2
1930	429.0	1945	126.4
1950	570.3	1955	251.1
1970	1245	1965	363.6
1982	1603	1982	884.8

Periods of rapid expansion		Periods of slower expansion	
Structures	Equipment	Structures	Equipment
1896-1910	1898-1907	1910-1923	1896-1898
1923-1930	1945-1955	1930-1950	1907-1945
1950-1970	1965-1982	1970-1982	1955-1965

As for *Japan*, annual investment and price data back to the 1880's are available in Emi and Rosovsky *Capital Formation in Japan, Long Term Economic Statistics of Japan*, Vol. 3, p. 191-197, and *Hundred Year Statistics of the Japanese Economy* (Bank of Japan). This latter contains information from which estimates can be made of the loss of capital stock due to the war, and to the earthquake of 1923.

More recent information is from *Annual Report on National Income Statistics*.

The points of inflexion appear to be:

Rapid growth	Less rapid growth
1890-1914	1914-1955
1955-1971	1971-1981

The following are the data for net capital stock at the points of inflexion.

NET CAPITAL STOCK

Trillions (10^{12}) yen of 1975 purchasing power

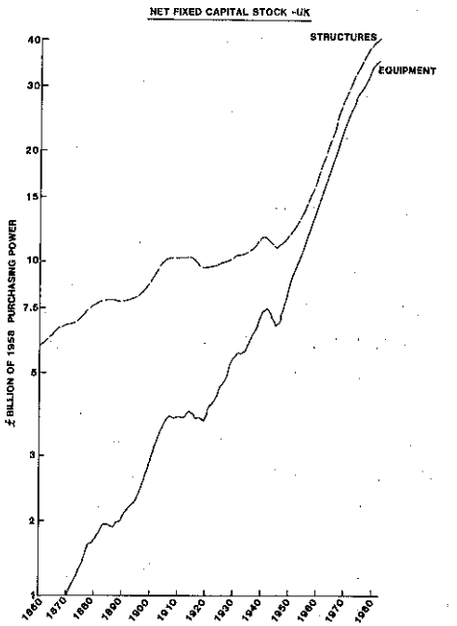
	Structures	Equipment
1890	.748	.148
1914	5.07	1.52
1955	21.22	9.91
1971	110.6	92.0
1981	266.7	165.2

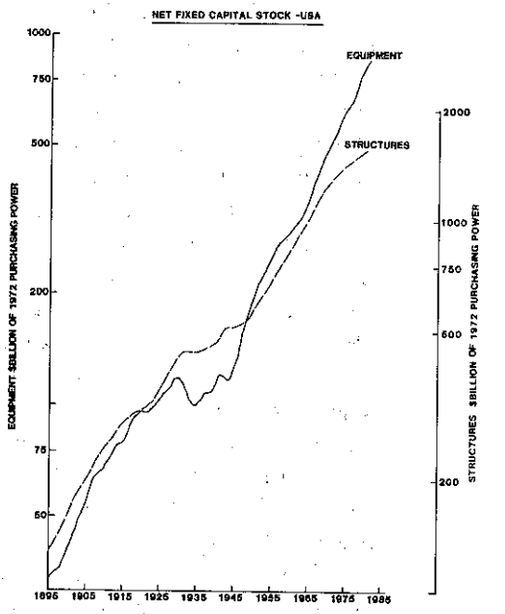
* * *

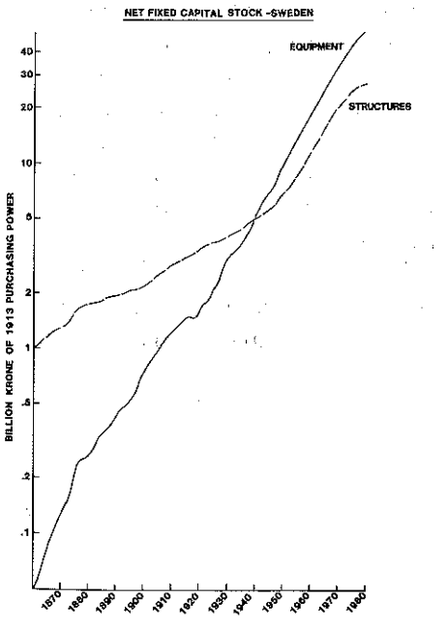
We can now assemble the information on apparent points of inflexion in the long cycle.

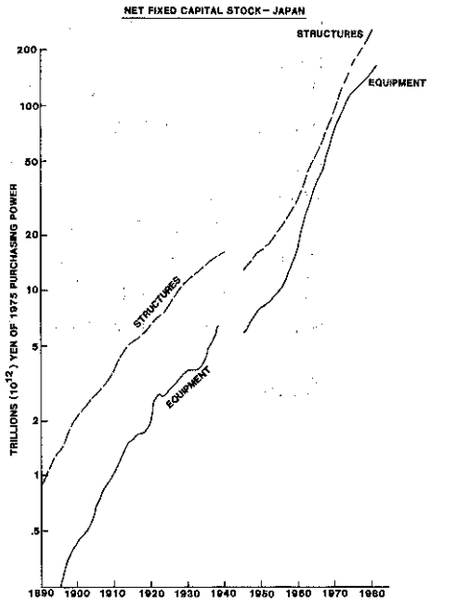
	End of upward phase	End of downward phase	End of upward phase	End of downward phase	End of upward phase
UK:					
Structures	1880	1896	1904	1936	1972
Equipment	1878	1895	1906	1948	1972
USA:					
Structures	—	—	1910	1950	1970
Equipment	—	—	1907	1945	1970
Sweden:					
Structures	1880	1900	1923	1948	1970
Equipment	1878	1896	1906	1920	1979
Japan:					
Structures	—	1894	1914	1955	1971
Equipment	—	1894	1914	1955	1971

We reach the conclusion that for the four countries studied, and probably for the whole industrial world, there have been approximately simultaneous changes in the rate of investment; but not with a uniform 50 year cyclical timing.









It appears that the industrial world, since 1970, has entered a period of slowing down of the rate of investment, with consequent effects on international trade, industrial production and employment, and the terms of trade for primary products. Private investment is slowing down because of the stock of past investment, and this situation cannot be significantly altered, by low interest rates or in any other way. But public investment should be increased, within reasonable limits.

The recent marked slowing down of fixed investment in USA has been accompanied by an also marked slowing down of the rate of increase of man hour productivity. Here the check came as early as 1968, which fact raises the question of whether some technical frontiers had been reached, not to be crossed in the near future. (Schumpeter might have reasoned thus.) We cannot accept the explanation frequently given, namely that this was due solely to the increasing relative importance of the service industries, where productivity gains are much slower. Productivities in both the goods and services sectors began slowing down at the same time.

US national accounts show real domestic product, excluding government (it is almost impossible to measure the real product of government), households and institutions, farms and housing i.e. business real gross product; and figures of aggregate annual man-hours works are available on the same basis. Real gross product (defined as above) per man-hour was expanding at a remarkable steady rate of 2.2% per year — very much the same as its average long-run rate of growth over the past hundred years. The rate of increase since 1968 is hard to measure, because of succeeding strong recessions; but the average appears to be of the order of magnitude of 0.7% per year.

In Japan after a unprecedented boom in every respect in 1973, including fixed investment and productivity growth, the subsequent check to productivity growth has been dramatic. But with the Japanese system of life time employment such a situation was unavoidable.

Brisbane

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APPENDIX

Reconciliation of discrepancy in Feinstein's results

On analysing the *Cambridge Economic History* data (Table 6) into "equipment" and "structures" the difference is found to be in the "structures". ("Equipment" has been defined as the sum of the headings "Industrial Machinery and Equipment", "Ships", "Carrings and Coaches", 40% of "Railways", 25% of "Mining and Quarrying" and "Gas and Water" and 5% of "Agriculture"; all the remainder (except Dwellings) is defined as "structures").

"Equipment" so measured is in reasonable agreement with the *National Income Expenditure and Output of the UK 1856-1965* (Table 39) results under the summed headings "Ships", "Vehicles", and "Plant and Machinery".

The discrepancy appears mainly to arise in the *Cambridge Economic History* valuation of "Industrial and Commercial Buildings", which is based on rental value assessed for tax under the Inhabited House Duty, capitalised 18 years' purchase to give a capital stock of £ 460 million in 1860. But the figure of 18 years' purchase includes the value of land. Feinstein later in the same text, under the heading "Other Land", estimates the value of land underlying industrial and commercial buildings at £ 150 million in 1860, or annual value of £ 7.5 million out of a total annual value for industrial and commercial buildings of £ 25.5 million. To the remaining £ 18 million may be applied a multiplier of 14 (for annual values are gross of maintenance and depreciation) giving an 1860 stock of £ 252 million instead of £ 460 million. The capital formation estimates for the decades before 1860 in *Cambridge Economic History* are all based on this supposed terminal figure of £ 460 million, and have been reduced in the ratio 252/460. For the 1851-60 period this reduces the total by £ 5 million per year.

Another substantial source of discrepancy appears to be investment in agricultural buildings and land improvements, for which *Cambridge Economic History* gives the high figure of £ 6.6 million per year (excluding a supposed small component for farm machinery), in 1851-60, based on slight evidence.

This item apparently was not covered at all in *National Income Expenditure and Output*.

These two items account for £ 11.6 million out of the total discrepancy of £ 18.9 million, we must assume that the more recent *(Cambridge Economic History)* are more correct, and that the *National Income Expenditure and Output* data for 1856-60 (averaging £ 14.8 million per year) for "other buildings and works" (excluding dwellings) are defective to the extent of £ 7.3 million, in addition to their omission of £ 6.6 million agricultural improvements.

The sum of these two values, £ 13.9 million for 1860, is phased out linearly over the period 1860-1890 – net expenditure on agricultural improvements assumed to be declining, together with measurement discrepancy between the two series.

At prices of 1900 (the base used in *National Income Expenditure and Outlay*) this amount rises 25% to £ 17.4 million.

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