4

"Long Waves" in the History of Capitalism

The cyclical course of the capitalist mode of production induced by competition takes the form of the successive expansion and contraction of commodity production and hence of the production of surplus-value. There corresponds to this a further cyclical movement of expansion and contraction in the realization of surplus-value and the accumulation of capital. In their timing, their volume and their proportions, the realization of surplus-value and the accumulation of capital are neither wholly identical with each other nor with the production of surplus-value itself. The discrepancy between the third and the first, and between the first and the second, provides the explanation of capitalist crises of over-production. The fact that these discrepancies cannot in anyway be ascribed to coincidence, but spring from the inner laws of the capitalist mode of production, is the reason for the inevitability of conjunctural oscillations in capitalism.[1]

The upward and downward movements of capital accumulation in the course of the industrial cycle can be characterized in the following manner. In a period of the upswing, there is an increase in the mass and the rate of profit, and a rise both in the volume and the rhythm of accumulation. Conversely, in a crisis and subsequent

[1]We have attempted to summarize the various academic and Marxist theories of the industrial cycle in the eleventh chapter of *Marxist Economic Theory*, in which we set out the reasons why this cycle is inevitable within the framework of the capitalist mode of production.

period of depression, both the mass and the rate of profit will decline, and both the volume and the rhythm of capital accumulation will decrease. The industrial cycle thus consists of the *successive acceleration and deceleration of accumulation.*

We shall leave out of our investigation at this point the extent to which the growth and decline of the *mass of profit* and of the *rate* of profit are identical with each other or merely congruent during the successive phases of the cycle. This question will be dealt with in the context of our treatment of the industrial cycle in late capitalism (see Chapter 14).

During the phase of upswing the accumulation of capital accelerates. But when this movement has reached a certain point it becomes difficult for the total mass of accumulated capital to achieve valorization. The fall of the rate of profit is the clearest sign of this watershed. The notion of over-accumulation indicates a situation in which a portion of the accumulated capital can only be invested at an inadequate *rate of profit* and increasingly only at a diminishing rate of interest.[2] The concept of over-accumulation is never absolute but always only relative: there is never 'absolutely' too much capital, but there is too much available to attain the expected social average rate of profit.[3]

Conversely, in the phase of the crisis and the ensuing depression, capital is devalorized and partially destroyed in value. Under-investment now occurs, or in other words, less capital is invested than could be expanded at the given level of production of surplus-value and the given (rising) average rate of profit. As we know, these periods when capital is devalorized and under-invested precisely have the function of once again raising the average rate of profit of the entire mass of accumulated capital, which in turn allows the intensification of production and capital accumulation. The entire capitalist industrial cycle thus appears to be the consequence of accelerated capital accumulation, over-accumulation, decelerated capital accumulation

[2]Henryk Grossmann, op. cit., p. 118ff., uses the notion of 'over-accumulation' in this sense, although not directly in connection with the industrial cycle. Marx uses it in this way in *Capital*, Vol.3, p. 251.

[3]'However, even under the extreme conditions assumed by us this absolute overproduction of capital is not absolute overproduction of means of production. It is overproduction of means of production only in so far as the latter *serve as capital*, and consequently include a self-expansion of value, must produce an additional value in proportion to the increased mass.' Marx, *Capital*, Vol.3, p. 255.

and under-investment.[4] The rise, fall and revitalization of the rate of profit both correspond to, and command, the successive movements of capital accumulation.

The question now poses itself: is this cyclical movement simply repeated every 10, 7 or even 5 years? Or is there a peculiar inner dynamic to the succession of industrial cycles over longer periods of time? Before we answer this question in the light of empirical data, we should examine it from a theoretical point of view.

Marx determined the length of the industrial cycle by the duration of the turnover-time necessary for the reconstruction of all fixed capital.[5] In each production cycle or in each year only a portion of the value of the fixed element of constant capital, i.e., principally of machines, is renewed. It takes several successive production cycles or years to complete this reconstruction of the value of fixed capital. In practice, machines are not renewed by 1/7 or 1/10 every year, which would mean that they would be completely reconstructed after 7 or 10 years. The actual process of the reproduction of fixed capital rather takes the form of mere repairs to these machines during the 7 or 10 years, after which they are replaced by new machines at a single stroke. [6]

In Marx's theory of cycles and crises, this renewal of fixed capital explains not only the length of the business cycle but also the decisive moment underlying *extended reproduction* as a whole, the upswing and acceleration of capital accumulation.[7] For it is the renewal of fixed capital that determines the feverish activity of the boom. In making this crucial point, incidentally, Marx anticipated the entire modern academic theory of cycles which, as we know, sees in the investment activity of the entrepreneurs the main stimulus for the upward movement of the cycle.

The characteristic element in the capitalist mode of production, however, is the fact that each new cycle of extended reproduction begins with different machines than the previous one. In capitalism,

[4] Cf. Paul Boccara, 'La crise du capitalisme monopoliste d'Etat et les luttes des travailleurs' in *Economie et Politique*, No. 185, December 1969, pp. 53-7, where he speaks of a cycle of over-accumulation and devalorization of capital.

[5] Marx, *Capital*, Vol.2, p. 185.

[6] Ibid., p. 170ff.

[7] Marx: 'But a crisis always forms the starting-point for large new investments. Therefore, from the point of view of society as a whole, it is more or less a new material basis for the next turnover cycle.' *Capital*, Vol.2, p. 186. See also *Capital*, Vol. 1, pp. 632-3.

under the whip of competition and the constant quest for surplus-profits, efforts are continually made to lower the costs of production and cheapen the value of commodities by means of technical improvements: 'Production for value and surplus-value implies, as has been shown in the course of our analysis, the constantly operating tendency to reduce the labour-time necessary for the production of a commodity, i.e., its value, below the actually prevailing social average. The pressure to reduce the cost price to its minimum becomes the strongest lever for raising the social productiveness of labour, which, however, appears here only as a continual increase in the productiveness of capital.'[8] The renewal of fixed capital thus implies *renewal at a higher level of technology*, and this in a triple sense.

Firstly, the value of the newer machines will form a greater component part of the total capital invested, i.e., the law of the increasing organic composition of capital will here prevail. Secondly, the newer machines will only be purchased if the cost of their acquisition and the values they will impart to ongoing output do not contradict the efforts of 'the capitalist to make a profit, i.e., if the saving on *paid* living labour exceeds the additional costs of the fixed capital, or more precisely, the total constant capital'.[9] Thirdly, the machines will only be bought if they not only save labour but also push down the total costs of production to a level below the social average, i.e., only if they constitute a source of surplus-profits for the entire period of transition—until these new machines determine the *average* productivity of labour in the given branch of production.

The problem of the increase in the organic composition of capital, i.e., the process of extended reproduction at a higher technical level, must not, however, be reduced merely to the problem of the value-composition of capital out of constant and variable capital. As Grossmann correctly explains with reference to Marx,[10] the notion of the organic composition of capital includes a technological element as well as a value element, and more particularly a correlation between these two elements (the value-composition is *determined* by the technological composition).[11] This means, therefore, that a certain *mass* of machinery requires a certain *mass* of raw and auxiliary materials, as well as a certain *mass* of labour-power, to set it in motion,

[8]K. Marx, *Capital*, Vol. 3, p. 859.
[9]Marx, *Capital*, Vol. 3, p. 262.
[10]Marx, *Capital*, Vol. 1, p. 612.
[11]Grossmann, op. cit., pp. 326-34.

independent of the immanent values of these masses.[12] These proportions depend not on the value of the machinery, but on its technical nature. On the other hand, however, the mass of the machinery employed depends on the basic technology which is used and not merely on the increased volume of fixed capital. For the purposes of a transition from a less productive to a more productive technical process, it is often sufficient to introduce minor improvements to the machinery, better labour organization, an accelerated work rhythm or better and cheaper raw materials. But in order *completely to reorganize* the technical process new machines are needed, which must previously have been designed; often new materials are needed, without which new branches of production cannot come into being; qualitative leaps forward are necessary in the organization of labour and forms of energy, such as the introduction of the conveyor belt, for example, or of automatic transfer machines. In other words, a distinction must be made between two different forms of the extended reproduction of fixed capital. There is the form in which there is certainly an extension of the scale of production, additional constant and variable capital is expended and the organic composition of capital indeed does increase, but in which all this occurs without a *revolution in technology* which affects the whole social apparatus of production; and the form in which there is not only an extension but a *fundamental renewal* of productive technology, or of fixed capital, which induces a qualitative change in the productivity of labour.[13]

Under normal conditions of the realization of surplus-value and the accumulation of capital, the extended reproduction of fixed capital every 7 or 10 years will be characterized by the fact that the capital set free in the course of the successive production cycles for the purchase or ordering of new machinery increases by a portion of value $M\beta$. If the total mass of surplus-value over the whole 10-year cycle is expressed as $M = M\alpha + M\beta + M\gamma$, then $M\alpha$ represents the surplus-value consumed unproductively by the capitalists and their clients, $M\gamma$ the additional circulating capital set free by the ten successive annual production cycles — which in turn divides into additional variable capital for the purchase of additional labour-power, and additional circulating constant capital for the continual

[12]Marx, *Capital*, Vol. 3, p. 243.

[13]Marx, *Capital*, Vol. 1, p. 629; 'The intermediate pauses are shortened, in which accumulation works as simple extension of production, on a given technical basis.'

injection of additional raw materials into production. The third component part of $M, M\beta$, is then the additional fixed capital which has progressively been set free and which can be used both for the purchase of *more*, and for the purchase of *more expensive*, more modern machines.

The relation of $M\beta$ to Cf, the additional to the existing fixed capital, forms the rate of increase of the fixed capital, $\triangle Cf$, or the rate *of increase in the value of the social stock of machinery.* The level of this rate of increase enables us to define periods of slow or rapid technological renewal.[14] These magnitudes must, of course, always be understood in *terms of value.* Obviously, the amortization fund of already existent fixed capital Cf can also be used for the purchase of machinery, but (at least in so far as we are dealing with a real amortization fund and not with concealed profits) never to a higher value than that of the machinery previously purchased.

Let us start from the fact that a basic change in productive technology determines a significant additional expenditure of fixed capital – among other things for the creation of new production sites and new instruments of production, besides the additional instruments of production which existing production processes can engender in cases of 'normal' accumulation. In other words, it determines a very high rate of $\frac{M\beta}{Cf}$. Every period of radical technical innovation thus appears as a period of *sudden acceleration of capital accumulation.*[15]

Against this background, the periodical under-investment of capital in the cyclical course of the capitalist mode of production henceforth embodies a double function. It not only serves to give expression to the inevitable periodical slump in the average rate of profit, but in doing so it also begins to brake the decline. It further

[14]Nonetheless, with a major acceleration of technological innovation, the *ongoing* improvement of productive technology through partial replacements of machinery may play an increasing role, diminishing the importance of $M\beta$ in raising the productivity of labour. Nick even regards this as one of the hallmarks of a 'technological-scientific revolution': Harry Nick, *Technische Revolution und Ökonomie der Produktionsfonds*, Berlin, 1967, pp. 17-18. We shall be returning to this complex of questions in Chapter 7.

[15]'A flow of new knowledge leads to continuous change in the production function for each commodity. This may take a variety of forms. Some advances, particularly those which originate in basic science, affect the whole nature of the production function as the basic processes of an industry undergo a radical change. Other advances lead to improvements in existing basic methods.' W.E.G. Salter, *Productivity and Technical Change*, Cambridge, 1960, p. 21.

creates a historical *reserve fund of capital*, from which can be drawn the means for *additional* accumulation needed over and above 'normal' extended reproduction to allow a fundamental renewal of productive technology. This can be expressed even more clearly: under 'normal' conditions of capitalist production the values set free at the end of *one* 7- or 10-year cycle are certainly sufficient for the acquisition of more and more expensive machines than were in use at the outset of this cycle. But they do not suffice for the acquisition of a fundamentally renewed productive technology, particularly in Department I, where such a renewal is generally linked to the creation of completely new productive installations. Only the values set free for the purchase of additional fixed capital in *several* successive cycles enable the accumulation process to make a qualitative forward leap of this kind. The cyclical recurrence of periods of under-investment fulfils the objective function of setting free the necessary capital for this kind of technological revolution. But this in itself does not explain the reasons for the occurrence of radical technological revolutions in some periods and not in others. The existence of a long period of under-investment is precisely the expression of the fact that additional capital was certainly available, but was not in fact invested or expended. The real problem is hence to explain why at a particular point in time this additional capital is expended on a massive scale, after lying idle for a long period. The answer is obvious: only a *sudden increase in the rate of profit* can explain the massive investment of surplus capitals — just as a prolonged fall in the rate of profit (or the fear that it will decline even more precipitously) can explain the idleness of the same capital over many years.[16] On the eve of a new spring tide of capital accumulation we should be able to record the appearance of the following factors, which render possible a sudden increase in the average rate of profit *beyond the periodic results of the devalorization of capital occurring in the course of the crisis.*

[16]Kondratieff also enumerated the preconditions which he thought were necessary for a sudden extension of capital accumulation. They were: '1. High intensity of savings activity; 2. A relatively abundant and cheap supply of loan capital; 3. Its accumulation in the hands of powerful enterprises and centres of finance; 4. A low level of commodity prices, stimulating savings activity and longterm capital investment.' *(Die Preisdynamik,* p. 37). The weakness of this explanation is obvious: all these phenomena occur, precisely in phases of under-investment (e.g., between 1933 and 1938 in the USA) without this leading to rapid technological renewal. Kondratieff completely overlooked the strategically crucial role of the rate of profit.

The relevant factors are these:

1. A sudden fall in the average organic composition of capital, for example as a result of the massive penetration of capital into spheres (or countries) with a very low organic composition.

2. A sudden increase in the rate of surplus-value, as a result, for example, of a rise in the intensity of labour due to a radical defeat and atomization of the working class which disables it from using advantageous conditions on the labour market to raise the price of the commodity of labour-power and forces it to sell this commodity below its value even in a period of economic prosperity.

3. A sudden fall in the price of elements of constant capital, especially of raw materials, which is comparable in effect to a sudden decline of the organic composition of capital, or a sudden fall in the price of fixed capital due to a revolutionary advance in the productivity of labour in Department I.

4. A sudden abbreviation of the turnover-time of circulating capital due to perfection of new systems of transport and communications, improved methods of distribution, accelerated rotation of stock, and so on.

Two processes must here be separated out temporally and conceptually. On the one hand, there is the process which permits the average rate of profit to rise and as it were sets this rise in motion, leading to a massive investment of previously idle capital; on the other, there is the process that springs from this massive investment of previously idle capital.

If the triggering factors are by their nature and volume such that their effect can quickly be neutralized by the increase in the mass of accumulated capital, then the average rate of profit will rise only briefly. In this case the quickening of the rhythm of capital accumulation will be braked abruptly and give way, after a short interruption, to renewed under-investment. This occurred, for example, in various imperialist countries during and immediately following the First World War. If, on the contrary, the triggering factors are by their nature and volume such that their effect cannot be neutralized by the immediate consequences of the sudden increase in the accumulation of capital, then the whole mass of capital previously not invested will progressively be drawn into the maelstrom of accumulation. It then becomes possible to achieve not only a partial and moderate, but a massive and universal revolution in production technology. This will ensue particularly if *several factors are simultaneously*

and cumulatively contributing to a rise in the average rate of profit.

In the preceding chapters we have already briefly emphasized the causes which led to such a persistent increase in the average rate of profit in the 90s of the last century: the sudden massive investment in the colonies of excess capital exported from the metropolitan countries, leading simultaneously to a considerable fall in the organic composition of world capital and a sudden decrease in the price of circulating constant capital, which combined to affect the average rate of profit.[17]

At least two other periods in the history of capitalism can be recorded, in which a comparably abrupt rise in the rate of profit also occurred. The first took place in the middle of the 19th century, immediately following the outbreak of the 1848 Revolution. The decisive triggering factor seems to have been, in this case, a radical increase in the rate of surplus-profit due to a radical rise in the average productivity of labour in the consumer goods industry, i.e., due to a radical increase in the production of relative surplus-value. The second occurred on the eve or at the start of the Second World War; it was likewise determined by a radical rise in the rate of surplus-value, which was rendered possible on this occasion, however, by a radical change in the relationship of class forces, prolonged by a radical increase in the intensity of labour and combined with a fall in the price, first of circulating constant capital due to the penetration of the most modern technology into spheres producing raw materials, then also of fixed constant capital due to a sudden rise in the productivity of labour in the machine-building industry. We shall return to the concrete causes and effects of this increase in the rate of surplus-value immediately preceding and during the Second World War in the next chapter.

What, then, are these 'revolutions in technology as a whole' which we have described as phases of the re-entry of idle capital into the process of valorization, determined by a sudden rise in the average rate of profit? In Chapter 15 of the first volume of *Capital*, Marx distinguishes three essentially different parts of all developed machinery: motive machinery, transmission machinery and tool or labour machines.[18] The evolution and transformation of the latter

[17] See, among other things, Footnote 13 of Chapter 3.

[18] Usher criticizes this definition of machines, which Marx took from Ure and Babbage. He claims that such a characterization omits the crucial criterion of progress in machinery, which is the creation of ever 'more elegant' (presumably

two, of course depend after a certain point on the development of the motive machines, which embody the decisively dynamic element of the whole: 'Increase in the size of the machine, and in the number of the working tools, calls for a more massive mechanism to drive it, and this mechanism requires, in order to overcome its resistance, a mightier moving power than that of man, apart from the fact that man is a very imperfect instrument for producing uniform, continued motion.'[19] Further: 'A system of machinery, whether it reposes on the mere cooperation of similar machines, as in weaving, or on a combination of different machines, as in spinning, constitutes in itself a huge automaton, whenever it is driven by a self-acting prime mover.'[20] The production of 'motive machines', i.e., the mechanical producers of energy, by machinery instead of by handicrafts, is the determinant movement in the formation of an 'organized system of machines', as Marx puts it. This production of machines, and first and foremost of motive machines, by other machines is the historical precondition for a radical change in technology: 'At a certain stage of its development, Modern Industry became technologically incompatible with the basis furnished for it by handicraft and Manufacture', i.e., with the production by handicraft or manufacture of the machines themselves. 'Modern Industry had therefore itself to take in hand the machine, its characteristic instrument of production, and to construct machines by machines. It was not till it did this, that it built up for itself a fitting technical foundation, and stood on its own feet. Machinery, simultaneously with the growing use of it, in the first decades of this century, appropriated, by degrees, the fabrication of machines proper. But it was only during the decade preceding 1866, that the construction of railways and ocean steamers on a

meaning 'more labour-saving') *combinations* of different elements into a unitary self-moving 'train': A. P. Usher, *A History of Mechanical Inventions,* Harvard, 1954, pp. 116-17. Usher here seems to have overlooked that Marx first described the historical genesis and development of the machine (*Capital,* Vol. 1, p. 378f.), so that he could then quite definitely place the emphasis on the mutual *combination* of machine parts or of different machines: 'An organized system of machines, to which motion is communicated by the transmitting mechanism from a central automaton, is the most developed form of production by machinery.' (ibid., p. 381). Babbage himself was no less aware of this, for his brilliant mind was engaged, a hundred years before the real beginnings of automation, in the design of an automatic calculating machine which was to take this notion of the articulated combination of all component parts to its highest level of development.

[19]K. Marx, *Capital,* Vol. 1, p. 376.

[20]Ibid., p. 381.

stupendous scale *called into existence the cyclopean machines* now employed in the construction of prime movers.'[21]

The fundamental revolutions in power technology — the technology of the production of motive machines by machines — thus appears as the determinant moment in revolutions of technology as a whole. Machine production of steam-driven motors since 1848; machine production of electric and combustion motors since the 90's of the 19th century; machine production of electronic and nuclear-powered apparatuses since the 40's of the 20th century — these are the three general revolutions in technology engendered by the capitalist mode of production since the 'original' industrial revolution of the later 18th century.

Once a revolution in the technology of productive motive machines by machinery has occurred, the whole system of machines is progressively transformed. For as Marx explains: 'A radical change in the mode of production in one sphere of industry involves a similar change in other spheres. This happens at first in such branches of industry as are connected together by being separate phases of a process, and yet are isolated by the social division of labour, in such a way that each of them produces an independent commodity. Thus spinning by machinery made weaving by machinery a necessity, and both together made the mechanical and chemical revolution that took place in bleaching, printing and dyeing, imperative. So too, on the other hand, the revolution in cotton spinning called forth the invention of the gin, for separating the seeds from the cotton fibre; it was only by means of this invention, that the production of cotton became possible on the enormous scale at present required. But more especially, the revolution in the modes of production of industry and agriculture made necessary a revolution in the general conditions of the social process of production, i.e., in the means of communication and of transport. In a society whose pivot, to use an expression of Fourier, was agriculture on a small scale, with its subsidiary domestic industries, and the urban handicrafts, the means of communication and transport were so utterly inadequate to the productive requirements of the manufacturing period, with its extended division of social labour, its concentration of the instruments of labour, and of the workmen, and its colonial markets, that they became in fact revolutionized. In the same way, the means of communication and transport handed down from the manufacturing

[21]Ibid., pp. 384-5 (Our italics).

period soon became unbearable trammels on Modern Industry, with its feverish haste of production, its enormous extent, its constant flinging of capital and labour from one sphere of production into another, and its newly-created connexions with the markets of the whole world. Hence, apart from the radical changes introduced in the construction of sailing vessels, the means of communication and transport became gradually adapted to the modes of production of mechanical industry, by the creation of a system of river steamers, railways, ocean steamers, and telegraphs.'[22]

It is not difficult to provide evidence to show that each of the three fundamental revolutions in the machine production of energy sources and motive machines progressively transformed the whole productive technology of the entire economy, including the technology of the communications and transport systems.[23] Think, for example, of the ocean steamers and diesel locomotives, automobiles and radio communications in the epoch of the electric and combustion engines; and the jet transport planes, television, telex, radar and satellite communication networks, and atom-powered container freighters of the electronic and nuclear age.[24] The technological transformation arising from the revolution of the basic productive technology of motive machines and sources of energy thus leads to a new valorization of the excess capitals which have gradually been piling up from cycle to cycle within the capitalist mode of production. By exactly the same process, however, the gradual generalization of the new sources of energy and new motive machines must lead, after a longish phase of accelerated accumulation, to a longish phase of decelerating accumulation, i.e., renewed under-investment and reappearance of idle capital.

The production sites of the new motive machines imply long-term possibilities for the expansion of *newly* accumulated capitals. As long as the capitals invested over successive periods in the industries making steam-driven or electric motors or electronic apparatuses continue to dominate the market, only small and adventurous capitals condemned to experiment — in other words, to fall short of full valorization, will dare to venture into 'new realms' of energy and motive machinery. As the application of the new motors becomes more and more general, the growth rate of the industries making these motors gradually declines further and further, and it becomes

[22]Ibid., pp. 383-4.
[23]David Landes, op. cit., pp. 153-4, 423f.
[24]See an essay by Wolfgang Pfeifer in the *Neue Zürcher Zeitung*, 24.8.1972.

increasingly difficult for the capitals feverishly accumulated in the first phase of growth to continue their valorization.

A general transformation of productive technology also generates a significant rise in the organic composition of capital and, depending on concrete conditions, this will lead sooner or later to a fall in the average rate of profit. The decline of the average rate of profit in turn becomes the greatest impediment to the next technological revolution. The increasing difficulties of valorization in the second phase of the introduction of any new basic technology lead to growing under-investment and increasing creation of idle capital. Only if a combination of specific conditions generates a sudden rise in the average rate of profit will this idle capital, which has slowly gathered over several decades, be drawn on a massive scale into the new spheres of production capable of developing the new basic technology.

The history of capitalism on the international plane thus appears not only as a succession of cyclical movements every 7 or 10 years, but also as a succession of longer periods, of approximately 50 years, of which we have experienced four up till now:

— the long period from the end of the 18th century up to the crisis of 1847, characterized basically by the gradual spread of the *handicraft-made or manufacture-made steam engine* to all the most important branches of industry and industrial countries; this was the long wave of the industrial revolution itself.

— the long period, lasting from the crisis of 1847 until the beginning of the 1890s, characterized by the generalization of the *machine-made steam engine* as the principal motive machine. This was the long wave of the first technological revolution.[25]

— the long period, lasting from the 1890s to the Second World War, characterized by the generalized application of electric and

[25] In our opinion Oskar Lange is right to object to the use of the term 'industrial revolution' for great technological upheavals such as the automation of production processes since the Second World War. 'This usage obscures the historical specificity of the industrial revolution which formed the basis of industrialization. It must also be emphasized that the original industrial revolution which led to the rise of large-scale industry was closely connected with the genesis of the capitalist mode of production and hence with a new social formation.' Oskar Lange, *Entwicklungstendenzen der modernen Wirtschaft und Gesellschaft,* Vienna, 1964, p. 160. Accordingly, we here use the terms 'first, second and third technological revolutions' (instead of the widely-used formula 'second and third industrial revolution'). In doing so, we are correcting an error which we have ourselves committed in the past.

combustion engines in all branches of industry. This was the long wave of the second technological revolution.[26]

– the long period, beginning in North America in 1940 and in the other imperialist countries in 1945-48, characterized by the generalized control of machines by means of *electronic apparatuses* (as well as by the gradual introduction of nuclear energy). This is the long wave of the third technological revolution.

Each of these long periods can be subdivided into two parts: an initial phase, in which the technology actually undergoes a revolution, and when such things as the production sites for the new means of production have first to be created. This phase is distinguished by an increased rate of profit, *accelerated accumulation,* accelerated growth, accelerated self-expansion of previously idle capital and the accelerated devalorization of capital previously invested in Department I but now technically obsolescent. This first phase is followed by a second, in which the actual transformation in productive technology has already taken place, i.e., the new production sites for new means of production are for the most part already in existence and can only be further extended or improved in a quantitative sense. It is now a matter of getting the means of production made in these new production sites generally adopted in all branches of industry and economy. The force that determined the sudden extension by leaps and bounds of capital accumulation in Department I thus falls away, and accordingly this phase becomes one of retreating profits, *gradually decelerating accumulation,* decelerating economic growth, gradually increasing difficulties in the valorization of the total accumulated capital, and particularly of new additionally accumulated capital, and the gradual, self-reproducing increase in capital being laid idle.[27]

[26]Friedmann speaks in this connection of the 'second industrial revolution': George Friedmann, *'Sociologie du Travail et Science sociales,'* in G. Friedmann and Pierre Naville, *Traité de Sociologie du Travail,* Paris, 1961, p. 68.

[27]Between 1900 and 1912 the value of fixed capital in American non-agricultural enterprises doubled; it rose, at fixed prices (1947-49 dollars), from $16.8 billion to $31.4 billion. Between 1912 and 1929 it increased again, although at a slower rhythm, from $31.4 billion to $53.6 billion. It then remained almost constant for 18 years, after the Great Depression the figure $53 billion was not reached again until 1945, followed by a slight fall in 1946. In 1947 the figure was still only $54.9 billion and the peak of 1929 was finally surpassed only in 1948, with $63.3 billion. In the same period, however, bank assets increased from $72 billion in 1929 to $162 billion in 1945, and the assets of life insurance companies went up

According to this scheme, which covers the successive phases of accelerated growth until 1823, of decelerated growth 1824-47, of accelerated growth 1848-73, of decelerated growth 1874-93, of accelerated growth 1894-1913, of decelerated growth 1914-39,[28] of accelerated growth 1940-45 and 1948-66, we should today have entered into the second phase of the 'long wave' which began with the Second World War, characterized by decelerated capital accumulation. The more rapid succession of recessions in the most important imperialist economies (France 1962; Italy 1963; Japan 1964; West Germany 1966-67; USA 1969-71; Great Britain 1970-71; Italy 1971 and the world-wide recession of 1974-75) seems to confirm this hypothesis.

Obviously these 'long waves' do not assert themselves in a mechanical fashion, but function through the articulation of the 'classical cycles'.[29] In a phase of expansion the cyclical periods of boom will be longer and more intensive, the cyclical crises of over-production shorter and more superficial. Conversely, in those phases of the long wave where a tendency to stagnation is prevalent the periods of boom will prove less feverish and more transitory, while the periods of cyclical crisis of over-production will, by contrast, be longer and profounder. The 'long wave' is conceivable only as the result of these cyclical fluctuations and never as some kind of metaphysical superimposition upon them.

The first writer who seems to have discerned these 'long waves' in the history of capitalism was the Russian Marxist, Alexander Helphand (Parvus).[30] Through a study of agricultural crises he came to the conclusion, in the mid-1890s, that the long depression

---

from $17.5 billion to nearly $45 billion, i.e., with a dollar devaluation of approximately 30%, the increase was still 70% in the case of bank assets, and 100% in that of the insurance companies. US Department of Commerce, *Long-Term Economic Growth 1860-1965,* Washington, 1966, pp. 186, 200-2, 209.

[28] In principle we start every long period with the year after the crisis which has just ended a 'classical cycle', and end the long period with a crisis-year. Since crisis-years are not completely identical in all the capitalist countries, we have chosen those of the most important capitalist country, which sets the tone for the world market, i.e., Great Britain up to the First World War and thenceforth the USA.

[29] The Russian Marxist Bogdanov tried to call the possibility of this into question. Many opponents of 'long waves' have followed in his path. See our reply further below.

[30] This may be incorrect in the strict sense. Schumpeter reports that Jevons quotes an article by Hyde Clark entitled 'Political Economy', which allegedly records the existence of 'long waves' in cyclical economic development. The article appeared in the periodical *Railway Register*, 1874, but it had no influence on the further discussion of the problem: Joseph Schumpeter, *History of Economic Analysis*, New York, 1954.

which began in 1873 and to which Friedrich Engels had attached such great importance[31] ought soon to be replaced by a new long-term upswing. He expressed this idea for the first time in an article which appeared in the *Sächsische Arbeiterzeitung* in 1896, and then further elaborated it in his 1901 brochure, *Die Handelskrise und die Gewerkschaften.*[32] Basing himself on a well-known passage from Marx,[33] Parvus used the notion of a *Sturm und Drang* period of capital to provide a conceptual framework for 'long waves' of expansion followed by long waves of 'economic depression'. The determinant of this long-term wave-movement was for Parvus the extension of the world market by changes which were 'under way in all areas of the capitalist economy – in technology, the money market, trade, the colonies' – and were lifting 'the whole of world production onto a new and much more comprehensive basis'.[34] He did not give statistical data in support of his thesis; and he committed grave errors in his periodization.[35] Despite this, however, his sketch remains the brilliant attempt of a Marxist thinker possessed of a mind which was uncommonly acute, even if also undisciplined and inconsequent.[36]

More than ten years were to pass before this fertile idea of Parvus – which had won the immediate praise of Kautsky[37] – was taken up once more, this time by the Dutch Marxist J. Van Gelderen.[38] In 1913, under the pseudonym of J. Fedder, Van Gelderen published a series of three articles in the periodical of the Dutch 'left', *De Nieuwe Tijd,* in which, taking as his starting

[31]See, among other things, Engel's footnote in *Capital*, Vol.3, p. 489.

[32]Parvus, *Die Handelskrise und die Gewerkschaften,* Munich, 1901, pp. 26-7.

[33]We quote it in Chapter 3 of this book. See footnote 32 of the third chapter.

[34]Parvus, op. cit., p. 26.

[35]Thus he says that the *Sturm und Drang* period began in the 1860's and ended at the start of the 1870's, while it is now generally accepted that there was a 'long wave' of expansion from the 1847 crisis until 1873.

[36]Parvus was, among other things, together with Trotsky the originator of the theory of permanent revolution applied to Russia which, in contrast to the views of all other Russian Marxists, foresaw a workers' government as the outcome of the coming Russian revolution. But while Parvus envisaged a social-democratic government on the Australian pattern (i.e., a government which would remain within the framework of the capitalist mode of production), Trotsky was of the opinion as early as 1906 that the Russian revolution would lead to the dictatorship of the proletariat based on the support of the poor peasants.

[37]Karl Kautsky, 'Krisentheorien', in *Die Neue Zeit*, Vol.XX, 1901-1902, p. 137.

[38]Simultaneously with Van Gelderen – and independently of him – Albert Aftalion (*Les Crises Périodiques de Surproduction*), M. Tugan–Baranovsky (in the French edition of his *Studien zur Theorie und Geschichte der Handelskrisen in England*), J. Lescure, (*Des Crises Générales et Périodiques de Surproduction*), and

point the price rises everywhere discernible in the capitalist countries, he constructed a hypothesis of 'long waves' for the history of capitalism since the middle of the 19th century. These articles, which have received far too little attention in Marxist literature up till now, raised the whole problem onto a level which was qualitatively much higher than that on which it had been placed by Parvus or Kautsky. Van Gelderen not only attempted to assemble empirical evidence for his thesis and to follow in detail the movement of prices, foreign trade, output and productive capacity in many spheres, as well as movements of the bank rate, capital accumulation and the foundation of businesses, and so on.[39] He also tried to *explain* the long-term wave-movement of the capitalist mode of production, and in so doing he started out, in contrast to Parvus, not from the extension of the market, but from the extension of production: 'The precondition for the genesis of a spring tide in the capitalist economy[40] is an extension of production, whether spontaneous or gradual. This creates a demand for other products, indirectly always products of the industry making means of production, and raw materials. The nature of the demand generated by the extension of production . . . can take the following two main forms:

1. Through the reclamation of sparsely inhabited regions. In these areas agriculture or animal husbandry provide the population with export products with which to pay for the wares it needs. The latter are of two kinds: mass-consumption goods, mostly manufactures, and materials for production: machines, elements for railways and other types of communication, building materials. The rise in prices which is the consequence of this demand spreads from one branch of production to another.

2. Through the quite sudden rise of a branch of production which is in a stronger position than was the case previously to satisfy a particular human need (automobile and electric industry). The effect

---

W. Pareto (in 1913) marginally noted the problem of 'long waves'. but only in a fragmentary way and without coming anywhere near the scope of Van Gelderen's analysis. See in this connection, Ulrich Weinstock, *Das Problem der Kondratieff-Zyklen,* Berlin and Munich, 1964, pp. 20-2. It is therefore not necessary to consider them here.

[39]J. Fedder, 'Springvloed-Beschouwingen over industrieele ontwikkeling en prijsbeweging', in *De Nieuwe Tijd,* Nos. 4, 5, 6, April, May, June, Vol.18, 1913.

[40]Van Gelderen calls the expansive 'long wave' the *springvloed* (spring tide) and the recessive 'long wave' the ebb.

of this is the same, on a smaller scale, as that of the first form.[41]

The conclusion that Van Gelderen drew from this analysis – independently of Kautsky, who formulated something similar at this time[42] – was that an expanding 'long wave' is typically preceded by a major increase in gold production.[43] Admittedly, his explanation suffered from a pronounced dualism, for 'spring-tides' were attributed either to the extension of the world market or to the development of new branches of production. Moreover, he failed to realize that the question of additional capital investments cannot be reduced to the production of money *material* (i.e., gold production) but constitutes a problem of the additional production and accumulation of *surplus-value.* One cannot demand of a pioneer, however, that he should straightaway provide satisfactory answers to all the aspects of a newly discovered complex of problems. For there can be no doubt that Van Gelderen's work was of a pioneering kind. Of the further elaborations of the theory of 'long waves' in the 1920s and 1930s—from Kondratieff to Schumpeter and Dupriez – hardly one went beyond the ideas developed by Van Gelderen. The inadequacy of the statistical material at his disposal does not detract from the pioneering quality of his contribution. Ulrich Weinstock is wrong to accuse him of arriving at 'the establishment of a peculiar change of tempo in all spheres of economic activity' on the basis of evidence embracing a mere 60 years, and to state that this should be 'rejected out of hand'.[44] What is at stake is not the formal question of the adequacy or inadequacy of Van Gelderen's evidence. The real point is the correctness or otherwise of Van Gelderen's working hypothesis in the light of the data at our disposal today. Weinstock omits to apply this test and cannot therefore appreciate the anticipatory quality of Van Gelderen's work.

The First World War was barely over when thinkers in the young Soviet State began to concern themselves in depth with the question

[41]J. Fedder, op. cit., pp. 447-8.

[42]Karl Kautsky, 'Die Wandlungen der Goldproduktion und der wechselnde Charakter der Teuerung', Supplement to *Die Neue Zeit,* No. 16, 1912-1913, Stuttgart, 24 January 1913. On page 20 of this essay, Kautsky explains the long-term downswing and upswing of prices, in the periods 1818-49, 1850-73, 1874-96 and 1897-1910, by the long-term fluctuations of gold production.

[43]J. Fedder, op. cit., pp. 448-9. This is also at least partially the explanation for 'long waves' advanced today by the Belgian professor Léon Dupriez (see further below).

[44]Weinstock, op. cit., p. 28.

of 'long waves'. N. D. Kondratieff, a former Deputy Minister of Food in Kerensky's Provisional Government, had been interested in the problem since 1919, and in 1920 he founded the Moscow Institute for Conjunctural Research (*Koniunkturny Institut*), which proceeded to collect material for his own 'theory of long waves'.[45] Leon Trotsky, who was working on the question of the post-war development of capitalism as compared to its development before 1914, also explored this complex of problems – although probably without an acquaintance with Van Gelderen's work,[46] which suffered the disadvantage of being written in a language accessible to few Marxists or economists. In his famous report on the world situation at the Third Congress of the Communist International, Trotsky declared on the question of long waves: 'In January of this year, the London *Times* published a table covering a period of 138 years – from the war of the thirteen American colonies for independence to our own day. In this interval there have been 16 cycles, i.e., 16 crises and 16 phases of prosperity .... If we analyze the curve of development more closely, we shall find that it falls into five segments, five different and distinct periods. From 1781 to 1851 the development is "very slow", there is scarcely any movement observable. We find that in the course of 70 years foreign trade rises only from £2 to £5 per capita. After the Revolution of 1848 which acted to extend the framework of the European market, there comes a breaking point. From 1851 to 1873, the curve of development rises steeply. In 22 years foreign trade climbs from £5 to £21 while the quantity of iron rises in the same period from 4.5 kg. to 13 kg. per capita. Then from 1873 on there follows an epoch of depression. From 1873 till approximately 1894 we notice stagnation in English trade... there is a drop from £21 to £17.4 – in the course of 22 years. Then comes another boom, lasting till the year 1913 – foreign trade rises from £17 to £30. Then finally with the year 1914, the fifth period begins – the period of the destruction of capitalist economy. How are the cyclical fluctuations blended with the primary movement of the capitalist curve of development? Very simply. In periods of capitalist development the crises are brief

[45] See the article on N. D. Kondratieff written by George Garvy for the Sixth Volume of the *International Encyclopedia of Social Sciences*, London, 1968.

[46] Kondratieff says, at any rate, that he was unacquainted with Van Gelderen's work when he wrote his Russian articles in 1922-25 and his famous 1926 German essay, 'Die langen Wellen der Konjunktur', in *Archiv für Sozialwissenschaft und Socialpolitik*, Vol. 56, No. 3, December 1926, p. 599ff. There is no reason to doubt the truth of this statement.

and superficial in character, while the booms are long-lasting and far-reaching. In periods of capitalist decline, the crises are of a prolonged character while the booms are fleeting, superficial and speculative.'[47]

Trotsky went on to speak of the *Sturm und Drang* period of capital after 1850 – in obvious reference to his former associate Parvus[48] – and concluded with two predictions: first, that in the short term a certain upswing of capitalism was not only economically possible but inevitable, although this upswing would be short and in no way precluded the historical chance of a socialist revolution in Europe. Second, that in the long term, 'after two or three decades', if the revolutionary activity of the European working class were to suffer a lasting sebtack, there was the possibility of a new expansion of capitalism.[49] In the following months Trotsky returned to the same problem in passing on several occasions,[50] but upon the appearance of Kondratieff's first work he dealt with the subject once more in the context of a letter to the editorial board of *Viestnik Sotsialisticheskoi Akademii.* In this letter he reaffirmed his conviction that besides the 'normal' industrial cycles there were longer periods in the history of capitalism which were of great importance for the understanding of the long-term development of the capitalist mode of production: 'This is the schema in the rough. We observe in history that homogeneous cycles are grouped in series. Entire epochs of capitalist development exist when a number of cycles is characterized by sharply delineated booms and weak, short-lived crises. As a result, we have a sharply rising movement of the basic curve of capitalist development. There obtain epochs of stagnation when this curve, while passing through partial cyclical oscillations, remains on approximately the same level for decades. Finally, during certain historical periods the basic curve, while passing as always through cyclical oscillations, dips downward as a whole, signalizing the decline of the productive

[47]Trotsky, 'Report on the World Economic Crisis and the New Tasks of the Communist International', Second Session, June 23, 1921, of the Third Congress of the Communist International, in Leon Trotsky, *The First Five Years of the Communist International,* Vol. 1, New York, 1945, p. 201.

[48]Ibid., p. 207.

[49]Ibid., p. 211.

[50]Trotsky: 'Flood-tide – the Economic Conjuncture and the World Labour Movement', *Pravda,* 25 December 1921, republished in Trotsky, *The First Five Years of the Comintern,* New York, 1953, pp. 79-84; Trotsky, 'Report on the Fifth Anniversary of the October Revolution and the Fourth World Congress of the Communist International', (20 October 1922), ibid., pp. 198-200.

forces.'[51] Trotsky even gave concrete specifications as to how a study of the 'long-term curve of capitalist development' should be undertaken, emphasizing that empirical investigations along these lines would be of exceptional importance in the enrichment of the theory of historical materialism.[52] What is most striking in this context is Trotsky's emphasis on the need to go beyond the limitations of 'purely' economic data and to integrate into any serious investigation a whole series of social and political developments. This was in the tenor of his sharp criticism of Kondratieff's first study,[53] whose proof of the existence of 'long cycles' was based on purely statistical evidence: 'Following the Third World Congress of the Comintern, Professor Kondratieff approached this problem—as usual painstakingly evading the formulation of the question adopted by the Congress itself—and attempted to set up alongside of the "minor cycle", covering a period of ten years, the concept of a "major cycle", embracing approximately fifty years. According to this symmetrically stylized construction a major economic cycle consists of some five minor cycles, and furthermore, half of them have the character of boom, while the other half is that of crises, with all the necessary transitional stages. The statistical determinations of major cycles compiled by Kondratieff should be subjected to careful and not overcredulous verification, both in respect to individual countries as well as the world market as a whole. It is already possible to refute in advance Professor Kondratieff's attempt to invest epochs labelled by him "major cycles" with the selfsame "rigidly lawful rhythm" that is observable in minor cycles; it is an obviously false generalization from a formal analogy. The periodic recurrence of minor cycles is conditioned by the internal dynamics of capitalist forces, and manifests itself always and everywhere, once the market comes into existence. As regards the large segments of the capitalist curve of development (50 years) which Professor Kondratieff incautiously proposes to designate also as cycles, their character and duration is determined not by the internal interplay of capitalist forces but by those external conditions through whose channel

[51] Trotsky, 'The Curve of Capitalist Development', first published as a letter to the editorial board of *Viestnik Sotsialisticheskoi Akademii* dated 21 April 1923, and published in the fourth number of this periodical, April-July 1923. We cite here the English translation, which appeared in *Fourth International,* May 1941, p. 112.

[52] Ibid., p. 114.

[53] The work in question is N. D. Kondratieff, *Die Weltwirtschaft und ihre Bedingungen während und nach dem Krieg,* Moscow, 1922.

capitalist development flows. The acquisition by capitalism of new countries and continents, the discovery of new natural resources, and, in the wake of these, such major facts of a "superstructural" order as wars and revolutions, determine the character and the replacement of ascending, stagnating or declining epoch of capitalist development.'[54]

George Garvy has interpreted this text to mean that although Trotsky accepted the existence of long-term fluctuations, he denied that they had a cyclical character.[55] This view is not quite accurate, unless we are to reduce the whole pattern to a pointless dispute as to the semantic differences between cycles, 'long waves', 'long periods' and 'large segments of the capitalist curve of development'. Trotsky put forward two central arguments against Kondratieff's thesis: first, that the *analogy* between 'long waves' and classical 'cycles' is false, i.e., that long waves are not possessed of the same 'natural necessity' as classical cycles. Second, that while classical cycles can be explained exclusively in terms of the internal dynamics of the capitalist mode of production, the explanation of long waves demands 'a more concrete study of the capitalist curve and the interrelationship between the latter and all the aspects of social life'.[56] In other words, Trotsky objected to a monocausal theory of 'long waves' constructed by analogy with Marx's explanation of classical cycles by the renewal of fixed capital.

These two criticisms—which were shared by many Soviet economists in the 1920s[57]—can be fully endorsed. If we have defined the 'long waves' as long waves of accelerated and decelerated accumulation determined by long waves in the rise and decline of the rate of profit, then it is plain that this ascent and decline is not determined by one single factor but must be explained by a series of social changes, in which the factors listed by Trotsky play a major role. The following table will help to make this clear:

[54]Trotsky, op. cit., pp. 112-14.

[55]Garvy, 'Kondratieff's Theory of Long Cycles', in *The Review of Economic Statistics*, Vol. XXV, No. 4, November 1943, pp. 203-20.

[56]Trotsky, op. cit., p. 114.

[57]Garvy quotes in this context the views of Bogdanov, Oparin, Studensky, Novozhilov, Granovsky and Guberman. See also Herzenstein. 'Gibt es grosse Konjunkturzyklen?', *Unter dem Banner des Marxismus*, 1929, Nos. 1-2: 'Basing himself on the deceptively cyclical appearance of long-term price waves, (Kondratieff explains) the uneven dynamic of the material forces of production by a rhythmical mechanism of conjunctural changes' (p. 123).

Long Wave	Main Tonality	Movement of the Value Components of Industrial Commodities	Origins of this Movement
1 1793-1825	expansive, rising rate of profit	Cf : rising steeply Cc : rising steeply, then falling v : falling s/v: rising	Artisan-produced machines, agriculture lags behind industry – rising prices for raw materials. Fall in real wages with a slow expansion of the industrial proletariat and mass unemployment. Vigorous expansion of the world market (South America).
2 1826-1847	slackening, stagnant rate of profit	Cf : rising Cc : falling s/v: stabilizes	Dwindling of profits made from competition with pre-capitalist production in England and Western Europe. Growing value of C neutralizes the higher rate of surplus-value. Expansion of the world market decelerates.
3 1848-1873	expansive, rising rate of profit	Cf : falling Cc : stable, then rising v : falling s/v: rising	Transition to machine-made machines lowers the value of Cf. Cc rises; but rise cannot keep pace with fall of Cf. Massive expansion of the world market following the growing industrialization and extension of railway construction in the whole of Europe and North America, as a result of the 1848 Revolution.
4 1874-1893	slackening, rate of profit falls, then stagnates, then rises slightly	Cf : rising Cc : falling v : slowly rising s/v: first falling then rising again	Machine-made machines are generalized. The commodities produced with them no longer produce a surplus-profit. The increased organic composition of capital leads to a decline in the average rate of profit. In Western Europe real wages rise. The results of the growing export of capital and the fall in the prices of raw materials only gradually permit an increase in capital accumulation. Relative stagnation of the world market.

Long Wave	Main Tonality	Movement of the Value Components of Industrial Commodities	Origins of this Movement
5 1894-1913	expansive, rate of profit rising, then stagnant	Cf : falling Cc : rising, but slowly v : slowly rising, then stable s/v: rising steeply, then stable	The capital investments in the colonies, the breakthrough of imperialism, the generalization of monopolies, profiting even further from the notably slow rise in the price of raw materials, and promoted by the second technological revolution with its accompanying steep rise in the productivity of labour and the rate of surplus-value, permit a general increase in the rate of profit, which explains the rapid growth of capital accumulation. Vigorous expansion of the world market (Asia, Africa, Oceania).
6 1914-1939	regressive, rate of profit falling sharply	Cf : stable Cc : falling v : falling, then stable, then falling s/v: falling, then stable (in Germany, rising from 1934)	The outbreak of the War, the disruption of world trade, the regression of material production, determine growing difficulties in the valorization of capital, reinforced by the victory of the Russian Revolution and the narrowing of the world market which it provoked.
7 1940/45-1966	expansive, rate of profit first rising, then slowly starting to fall	Cf : rising Cc : falls v : first stable or falling, then slowly rising s/v: steeply rising, then stable	The weakening (and partial atomization) of the working class determined by fascism and the Second World War permit a massive rise in the rate of profit, which promotes the accumulation of capital. This is first thrown into armaments production, then into the innovations of the third technological revolution, which significantly cheapens constant capital and thus promotes a long-term rise in the rate of profit. The world market shrinks through autarky, world war and the extension of non-capitalist zones (Eastern Europe, China, North Korea, North Vietnam, Cuba), but

Long Wave	*Main Tonality*	*Movement of the Value Components of Industrial Commodities*	*Origins of this Movement*
			is then significantly extended by the intensification of the international division of labour in the imperialist countries and the beginnings of industrialization in the semi-colonies.
8 1967- . . .	slackening, rate of profit falling	Cf : stable and rising Cc : falling, then abruptly rising v : slowly rising, then stable s/v: stabilized	The slow absorption of the 'industrial reserve army' in the imperialist countries acts as a block to a further rise in the rate of surplus-value despite increasing automation. The class struggle attacks the rate of profit. The intensification of international competition and the world currency crisis work in the same direction. Slow-down in the expansion of world trade.

Once it has been established that the upward and downward curves of a 'long wave' are determined by the criss-crossing of very different factors, and it is emphasized that these 'long waves' do not possess the same built-in periodicity as the classical cycles in the capitalist mode of production, then there is no reason to deny their close connection with the central mechanism, which is by its very nature a synthetic expression of *all* the changes to which capital is permanently subject: the fluctuations in the rate of profit.[58]

At the same time as Kondratieff, but independently of him, the Dutch Marxist Sam De Wolff attempted to refine Van Gelderen's thesis statistically, among other things by working out 'decycled' figure-series. In the process, however, he carried Kondratieff's error of a formal analogy with the classical cycles, already pointed out by Trotsky, to an even greater extreme by postulating an 'absolute regularity' for the 'long cycles' — 2½ 'classical cycles per long cycle'. De Wolff attributed a rigid length to the one and the other, although he thought that the duration of the 'classical cycle' would gradually decrease from 10 to 9, then to 8 and even to 7 years.[59] De Wolff's analysis of 1924 was dominated by the development of prices and gold production and in this sense provided no explanation for the 'long waves', thus regressing behind Van Gelderen's account. In a work which appeared in 1929,[60] he did admittedly offer such an explanation, which was very similar to that of Kondratieff and was based on the reconstitution of very durable fixed capital such as buildings, gas factories, rolling-stock, pipes, cables, and so on. A rigid analogy with Marx's explanation of 'classical cycles' was postulated once again; its validity has never been verified empirically.[61]

[58] See in this context the importance that Tinbergen and Kalecki attribute to profit and the rate of profit — although obviously not defined in the Marxist sense of the terms — in the industrial cycle. Tinbergen and Polak, *The Dynamics of Business Cycles,* London, 1950, p. 167, 170f. etc. Michael Kalecki, *Theory of Economic Dynamics.*

[59] Sam de Wolff:-'Prosperitats- und Depressionsperioden', in Otto Jenssen (ed.), *Der Lebendige Marxismus,* Jena, 1924, pp. 30, 38-9.

[60] Samde Wolff: *Het Economisch getij,* Amsterdam, 1929, pp. 416-19.

[61] Thus the building or building-and-transport cycles discerned by Isard, Riggleman, Alvin Hansen and others in the USA have an average length of only 17-18 years, and not 38 as de Wolff assumed. See Walter Isard, 'A neglected cycle: the transport-building cycle', in *Review of Economic Statistics,* Vol. 34, 1942, republished in Hansen and Clemence, *Readings in Business Cycles and National Income,* London, 1953, p. 467, 479. For the building cycle — often called the 'Kuznets cycle' — in the USA, see Simon Kuznets, *Long Term Changes in National Income of the United States*

Kondratieff's famous attempt to isolate and define 'long waves'[62] was later elevated into 'the' explanation of long periods *par excellence* by Schumpeter. In its first mature form,[63] however, Kondratieff still wavered to and fro between different types of the explanation. He retained the notion that the 'ebb-periods' of long waves were characterized by severe agricultural depressions, while typical features of 'long periods of upswing' included the application of many discoveries and inventions dating from the previous phase, an acceleration of gold extraction, and great social upheavals, including wars. In direct (but unacknowledged) reference to Trotsky's criticism, Kondratieff polemicized against the 'essential' but not 'watertight' consideration that 'long waves', in contrast to those of medium length, were 'determined by contingent circumstances and external events', 'for example by changes in technology, wars and revolutions, the integration of new countries into the world economy and fluctuations in the extraction of gold'.[64] These factors, which he himself emphasized, were said to be *effects* and not *causes*; the rhythmic movement of these factors, whose influence he did not deny in the least, were said to be explicable only by the long-term fluctuations of economic development. Thus, for example, he argued that it is 'not the incorporation of new regions (which gives) impetus to the ascent of long waves in the economy, but on the contrary, a new upswing which, by accelerating the tempo of the economic dynamic of the capitalist countries, makes it possible and necessary to exploit new countries and new markets for sales and raw materials.'[65]

This in itself did not yet provide an explanation of the 'long waves', which was to follow two years later in Kondratieff's second German essay.[66] His explanation was mainly based on the longevity of 'large investments', the fluctuations of savings activity, the idleness of money capital (loan capital) and the consequences of a low

since 1869, Cambridge, USA, 1952. For both the connection and (in part) contrary course of the American and English building cycles, see the essays collected in Derek Aldcroft and Peter Fearon (eds.), *British Economic Fluctuations 1790-1939*, London, 1972.

[62] N. D. Kondratieff, 'Die langen Wellen der Konjunktur'.

[63] Probably influenced by the criticisms of Trotsky and other Russian Marxists, Kondratieff replaced the notion of 'long cycles' with that of 'long waves' in 1926. But in substance his 'waves' are identical with cycles.

[64] Kondratieff, op. cit., p. 593. [65] Ibid., p. 593.

[66] Kondratieff, *Die Preisdynamik der industriellen und landwirtschaftlichen Waren (Zum Problem der relativen Dynamik und Konjunktur)*, referred to earlier.

price level continuing over a long period: 'These goods (large investments, ameliorations, cadres of qualified labour, and so on) have a capacity for long-term use. Their construction or production requires longish periods, extending beyond the span of the ordinary commercial and industrial cycles. The process of extending the fund of such capital goods is neither continuous nor regular. The existence of long economic waves is connected precisely with the mechanism of the extension of this fund; the period of its accelerated expansion coincides with the ascending wave, while the period in which the production of these capital goods slackens or stagnates coincides with the descending wave of the large cycle. The production of the kind of capital goods in question necessitates a vast outlay of capital, over a relatively long time-span. The occurrence of such periods of increased production of capital goods, i.e., periods of long ascending waves, is hence dependent on a series of preconditions. These preconditions are: 1. A high intensity of saving activity. 2. A relatively abundant and cheap supply of loan capital. 3. Its accumulation in the hands of powerful enterprises and centres of finance. 4. A low level of commodity prices, which acts as a stimulant to savings activity and long-term capital investments. The presence of these preconditions creates a situation which will lead sooner or later to an increase in the production of the kind of basic capital goods mentioned above and hence to the emergence of a long ascendant economic wave.'[67] After he seems to have given a closed explanation of 'long waves' in this way, Kondratieff shifts to an investigation of the different rhythms with which the average productivity of labour develops in agriculture and in industry, coming to the conclusion that the 'increase in the purchasing power of agricultural goods' determined by the retardation of the productivity of agrarian labour ultimately sets in motion the 'long waves', because thereby the demand for all commodities is quickened.[68]

[67] Ibid., p. 37.

[68] Ibid., p. 58-59. Probably without having read Kondratieff's article, De Wolff formulated a not dissimilar explanation for classical cycles, which he related to sun spot cycles. Years with minimum sunspots would determine bad harvests, hence advantageous exchange relations for agriculture, and years with maximum sun spots a rich harvest and hence good exchange relations for industry, hence increased profits and increased investment of fixed capital. De Wolff however expressly restricted this argument, which relied on Jevons, to the launching period of industrial capitalism. Sam de Wolff, *Het economisch getij*, pp. 286-7.

Kondratieff's own retort to his critics applies equally well to the five causal relations listed by him: he has by no means proved that these are causes and not effects. The increased gap between supply and demand for agricultural goods in the expansive 'long waves' up to the First World War might well be regarded more as an effect than as a cause of general expansion: growing employment and increasing industrial output in fact create a demand of this kind, while agrarian production is less elastic than industrial.[69] If there is a rise in the prices of agricultural raw materials and foodstuffs, however, then the effects not only on the demand for industrial goods but also on the rate of profit ought to be investigated, and this Kondratieff failed to do. He was thus unable to answer the question as to why the 'falling purchasing power of industrial commodities' does not rapidly stifle expansion.

Idle money capital (loan-capital) is a characteristic of every crisis; why does this capital remain idle for long periods – despite the low rate of interest – instead of being invested productively? The same question applies to an increase in savings activity and growing concentration of capital, which could rather be described as constants of capitalist development (with brief interruptions at the peak of successive 'booms') than as variables.[70] Moreover, as far as 'long-lived capital goods' are concerned,[71] the same objection applies as to the similar thesis of De Wolff: 'capital goods' with a productive life of forty to fifty years play only a marginal role in capitalism. If the means of production in question have a shorter life-span than this, then no 'echo effect' can evoke a forty to fifty year cycle. The upward and downward movements of capital laid idle and capital productively invested would then be restricted largely to the ten year cycle. By excluding from his argument two crucial determinants – long-term fluctuations in the average rate of profit and the influence of technological revolutions on the volume and value of renewed fixed capital – Kondratieff himself barred the way to the solution of the question he had raised. The methodological basis of the errors made by Kondratieff in working out an

[69] Kondratieff himself emphasized this, op. cit., p. 60.

[70] It is true that periods of accelerated capital accumulation are also characterized by an increased mobilization of capital. The period 1849-73 witnessed the expansion of stock exchanges and joint-stock companies; the period 1893-1913 that of trusts, investment banks and holding companies; the period 1945-67 that of common investment funds, convertible bonds, eurocheques, and so on.

[71] In his reflections on this subject, Kondratieff was clearly influenced by Professor Spiethoff's article, 'Krisen', in *Handwörterbuch der Staatswissenschaften*, Vol. 4,

explanation of 'long waves' can be attributed to his exaggerated *fixation on price fluctuations* and *insufficient analysis of fluctuations in industrial production and the growth of productivity.* In the final resort this can be traced back to his rejection, or revision, of Marx's theory of value and money.

Joseph Schumpeter, who was responsible for the most thorough treatment of 'long waves in the economy',[72] tried to avoid these mistakes. Starting from his general theory of capitalist development, which he had already completed[73] when Kondratieff drew his attention to 'long waves', he worked out a concept of 'long waves' which was based on the 'innovatory activity of entrepreneurs', i.e., remained in harmony with his overall theory of capitalism. He also sought to give greater importance to production-series than to price-series, although he appears to have failed empirically in this respect.[74] Moreover, the problem as to why innovation is introduced on a massive scale ('in clusters') in certain periods cannot be satisfactorily resolved without a more thorough treatment of 1) the role of productive technology; and 2) the long-term fluctuations in the *rate of profit.* Precisely these two factors are inadequately explored in Schumpeter's *magnum opus.* This is all the more astonishing in that Schumpeter fully acknowledged the central importance of the problem of profit.[75]

The most systematic critiques so far of Schumpeter's and Kondratieff's theories of 'long waves' have been made by Herzenstein and Garvy (for Kondratieff), Kuznets (for Schumpeter) and Weinstock.[76] They are not very convincing. The technical inadequacies of Kondratieff's statistical methods, the arbitrary selection of starting and finishing points for the 'long waves' and the unconvincing nature of Schumpeter's series except as regards price levels, can all be granted. The fact still remains that economic historians are practically unanimous in distinguishing major expansion in the years 1848-73, pronounced long-term depression in the years 1873-93,

1923. A revised edition of this article can be found in Arthur Spiethoff, *Die wirtschaftlichen Wechsellagen,* Tubingen, 1955.

[72]Joseph Schumpeter, *Business Cycles,* 2 Vols., New York, 1939.

[73]Joseph Schumpeter, *Die Theorie der wirtschaftlichen Entwicklung,* 1911. (English: *The Theory of Economic Development,* New York, 1961).

[74]Weinstock, op, cit., pp. 87-90.

[75]For example, Schumpeter, *Business Cycles,* pp. 15-17, 105-6, etc.

[76]Garvy, op. cit., Weinstock, op. cit.; Kuznets, 'Schumpeter's Business Cycles', in *Economic Change,* New York, 1953, pp. 105-24. Weinstock relies heavily on Garvy's critique of Kondratieff and Kuznets's critique of Schumpeter.

a tempestuous increase in economic activity in the years 1893-1913, strongly decelerated, if not stagnant and regressive development between the two World Wars, and a renewed major increase in growth after the Second World War.[77] Only with regard to the 'first Kondratieff' – i.e., the alleged alternation of faster growth 1793-1823 and of slower growth 1824-47 – is there any, partly justified, doubt.[78] Such a succession of at least five 'long waves' cannot be attributed either to pure accident or to various exogenous factors.

Herzenstein's critique of Kondratieff exposed most of the errors in his theoretical explanation. But he bent the stick too far in the other direction, when he sought to refute the very existence of 'long waves' empirically. He improperly extrapolated trends from the economic development of the USA and thereby tried to confine the long upswing of 1849-73, as well as the protracted depression of 1873-93, to Great Britain alone. The statistical material assembled at the end of this chapter, however, proves beyond any doubt that these two long waves manifestly swept the entire *world* production and *world* market of 19th-century capitalism. Herzenstein,

[77] It would extend too far to list bibliographical references for the feverish expansion of the world economy from 1848-73, in the period between the 1890's and the First World War, and the period following the Second World War, or for the major world depressions. There is an extensive bibliography on the 'long depression' of the period 1873-1896 in Hans Rosenberg, 'Political and Social Consequences of the Great Depression of 1873-1896', in *The Economic History Review*, Nos. 1-2, 1943, pp. 58-61.

[78] The reason for this was already explained by Marx a century ago, in a passage added to the French translation of the First Volume of *Capital:* 'But only when mechanical industry had struck its roots so deep that it exercised an overwhelming influence over the whole of national production; when the world market had successively mastered widespread areas of the New World, Asia and Australia; and when, finally, a sufficient number of industrial nations had entered the arena – only from this time on do there occur those constantly self-generating cycles, embracing years in their successive phases, which always end in a general crisis, constituting the conclusion of one cycle and the starting point of the next'. (This passage is not included in the English edition of *Capital*; it should appear before the last sentence on p. 633 – *translator.*) The fact that many historians and economists nevertheless assert the existence of a long wave 1793-1847 is due, not only to successive price movements, but to the feverish expansion of world trade (especially British commerce) from the outbreak of the industrial revolution to the aftermath of the Napoleonic Wars, which was then followed by the stagnation or even contraction of international trade. English exports, which had reached an annual average value of £43.5 million in 1815-19, declined to £36.8 million in 1820-24, then to £36 million in 1825-29 and £38-7 million in 1830-34. The 1815-19 level was not attained again in absolute figures until 1835-39, and in per capita terms until the end of the 1840's.

in fact, went so far as to reject even the increased growth of the 1893-1913 period, on the basis of one insubstantial article in a single journal. His theoretical arguments against Kondratieff were more interesting. He objected to the latter's attempt to 'classify historical epochs as periodic cycles', because – he wrote – Kondratieff's series of 'unique historical constellations . . . leading to fundamental changes in the general conditions of the world market and the inter-relations between the territorial sectors of this market', was logically incapable of explaining 'repeated fluctuations of fixed regularity'.[79] But he overlooked the fact that 'unique historical constellations' on the capitalist world market can indeed be classified into two basic categories; those which cause the average rate of profit to rise, and those which cause it to decline over the long-run. Herzenstein fails to establish that these constellations will have only random and irrelevant effects on the rate of profit. In the absence of such a proof (one that in our view is theoretically and empirically impossible to furnish), there is no reason why 'unique constellations' cannot indeed be regarded as successively promoting long-term upswings and downswings of the average rate of profit – in other words, of capital accumulation and rates of economic growth.

The attempt to interpret 'long waves' out of existence as simple expressions of 'stronger' or 'weaker' classical cycles is equally unconvincing.[80] The fact that long-term economic development is influenced, in rhythmical alternation, more strongly by phases of economic prosperity at one time and phases of crisis and stagnation at another, ought at least to present a problem. As soon as it is acknowledged as such and not as a self-evident fact, an explanation for it must be sought, and we thus come back once more to the problematic of the 'long waves'. Following Kuznets it has become fashionable to replace 'long waves' by 'trends' and arbitrary 'decennial averages'. But here too, a genuine problem is conjured away by its dissolution into very long periods of time. Even the Great Depression of 1929-32 disappears in some of these 'trend calculations'.[81] No one can doubt the existence of that particular crisis, however.

[79]Herzenstein, op. cit., p. 125.

[80]Bogdanov appears to have been the first to make such an attempt. 'The long waves are not independent of the conjunctural cycles, but simply (!) the result of the summation of individual conjunctural cycles of different lengths which happen to (!) fall within each phase of the long cycles.' Garvy quotes this passage with approval, and Weinstock repeats it. (op. cit., p. 50).

[81]Thus Kuznets operates with 'averages' of the 10-year growth of world trade in the

Weinstock argues that the theory of long waves is Marxist in inspiration and therefore unutilizable,[82] basing himself on Popper's polemic against 'historicism'; it is he, of course, and not any Marxist, who thereby reveals unscientific bias. The real issue is ultimately whether or not the existence of 'long waves' has been established, and if so, how they are to be explained. Weinstock further objects that: 'The time-series for output and income, which would be needed for a proof of long waves, cannot be reconstructed for a sufficient number of relatively advanced countries with the necessary reliability for the period since the French Revolution.'[83] In other words, the 'long waves' are not demonstrable statistically. We, on the contrary, regard the main problem *not* as one of statistical verification, but of theoretical explanation,[84] although it goes without saying that, if the theory of 'long waves' could not be confirmed empirically, it would be an unfounded working hypothesis, and ultimately a mystification. Methods of empirical verification must themselves, however, be appropriate to the specific problem to be explained. Price movements, which may be provoked by inflationary development — including, in the context of a gold standard, a greater reduction in the commodity value of precious metals than in the

---

period 1928-63 or even 1913-63 which completely obliterate the specific fact of a marked contraction of world trade in the period 1929-39: Simon Kuznets, 'Quantitative Aspects of the Economic Growth of Nations, M-X Level and Structure of Foreign Trade: Long Term Trends', in *Economic Development and Cultural Change*, Vol.XV, Part II, No. 2, January 1967. This is reminiscent of those notorious 'statistical averages' which would calculate the 'per capita income' of a backward country as $1,000 and use this to determine its 'relative standard of living', without taking into account that this average is the result, say, of a situation in which 75% of the population receive only $100, 24% receive $2,000 and 1% receives $45,000.

[82] Weinstock, op. cit., pp. 62-6. Weinstock comes to the conclusion that long waves must be regarded more as 'historical epochs' than as 'true cycles' (ibid. p. 201), apparently without realizing that the same idea had been formulated forty years before by the Marxist Trotsky. (For the relevant sources, see above, footnotes 51 and 54.)

[83] Weinstock, op. cit., p. 101.

[84] In a posthumous work Lange commented: 'Even though the historical facts cited above (the alternating phases of capitalist production since the year 1825) are not subject to any serious reservations, they are not sufficient proof of the existence of long-range cycles. To prove this theory it would be necessary to show that there exists a causal relation between two consecutive phases of the cycle and nobody has succeeded in showing this.' (Oskar Lange, *Theory of Reproduction and Accumulation*, Warsaw, 1969, pp. 76-7). Although we likewise reject the concept of the 'long cycle' and do not, therefore, accept the mechanical determination of the 'ebb' by the 'flow' and vice versa, we have nevertheless attempted to show that the inner logic of the long wave is determined by long-term oscillations in the rate of profit.

average value of other commodities – are definitely not a reliable indicator.[85] Output figures for individual commodities, which may be heavily influenced in certain periods by the role of particular branches of production as 'growth sectors', should likewise be treated with caution. Income curves, which may be co-determined by inflationary price movements, are also derivative indices and can only be used after fundamental historical analysis. The most convincing indicators consequently appear to be those of industrial output as a whole and the development of the volume of world trade (or of per capita world trade); the former will express the long-term tendency of capitalist *production* and the latter the rhythm of expansion of the *world market*. Precisely where these two indicators are concerned, it is quite possible to provide empirical verification for 'long waves' after the crisis of the year 1847:

Annual cumulative rate of growth of the industrial output of Great Britain[86]

Deane and Cole, *British Economic Growth 1688-1959*, p. 170 (includes the building trade).

1827-1847 : 3.2%[87]
1848-1875 : 4.55%
1876-1893 : 1.2%
1894-1913 : 2.2%
1914-1938 : 2%
1939-1967 : 3%

Annual cumulative rate of growth of the industrial output of Germany[88]
(after 1945: Federal Republic of Germany)

1850 – 1874 : 4.5%
1875 – 1892 : 2.5%
1893 – 1913 : 4.3%
1914 – 1938 : 2.2%
1939 – 1967 : 3.9%

[85]The theses of Gaston Imbert, which are based exclusively on price movements, must therefore be rejected. Gaston Imbert, *Des Mouvements de Longue Durée Kondratieff*, Aix-en-Provence, 1959. David Landes refuses the notion of 'long waves' for the evolution of prices; but he has not thereby in any way refuted their existence. Landes, op. cit., pp. 233-4.

[86]B. R. Mitchell and Phyllis Deane, *Abstract of British Historical Statistics*; the Hoffmann index until 1913; the Lomax index 1914-38 (both without the building trade). Calculations for the period after the Second World War are taken from EEC Office of Statistics and include the building trade.

[87]Average 1801-1811 until average 1831-1841: 4.7%

[88]For the figures until 1938, Walther G. Hoffmann, *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*, Berlin, 1965. The figures after the Second World War come from the *Statistisches Jahrbuch für die Bundesrepublik*.

Annual cumulative rate of growth of the industrial output of the USA[89]

1849 – 1873	5.4%
1874 – 1893	4.9%[90]
1894 – 1913	5.9%
1914 – 1938	2%
1939 – 1967	5.2%

Annual cumulative rate of growth of physical per capita output on a world scale[91]

1865 – 1882	2.58%
1880 – 1894	0.89%
1895 – 1913	1.75%
1913 – 1938	0.66%

Annual cumulative rate of growth in the volume of world trade[92]

1820 – 1840	2.7%
1840 – 1870	5.5%
1870 – 1890	2.2%
1891 – 1913	3.7%
1913 – 1937	0.4%
1938 – 1967	4.8%

The switch since 1967 from a long wave of expansion to a long wage of much slower growth is statistically confirmed by the respective trends of world industrial production for each period:

Annual Compound Percentage Growth of Industrial Output [93]

	1947-1966	1966-1975
USA	5.0%*	1.9%
Original EEC 'Six'	8.9%	4.6%
Japan	9.6%	7.9%
UK	2.9%	2.0%

* For the USA, 1940-1966

[89] For the figures 1849-1873, Robert E. Gallmann, 'Commodity-Output 1839-1899, in *Trends in the American Economy in the 19th Century*, Vol. XXIV of *Studies in Income and Wealth*, Princeton, 1960. The later figures are from *Long-Term Economic Growth 1860-1965*, Bureau of the Census, US Department of Commerce.

[90] This figure is much higher than average, because a certain postponement of the 'long wave' was brought about by the Civil War, so that production increased more steeply in the USA than in Europe in the 1880's.

[91] Léon H. Dupriez, *Des Mouvements Economiques Généraux*, Vol. II, Louvain, 1947, p. 567.

[92] Calculated by us from Mulhall, *Dictionary of Statistics*, London 1889; Mulhall and Harper, *Comparative Statistical Tables and Charts of the World*, Philadelphia, 1899; Simon Kuznets, 'Quantitative Growth of the Economic Wealth of Nations'; Ingvar Svennilson, *Growth and Stagnation in the European Economy*, Geneva, 1954; *Statistisches Jahrbuch für die Bundesrepublik Deutschland*, 1969.

[93] Calculations based upon United Nations and OECD statistics. We assume the following rates of decline during the present recession: for 1974: USA -3%, Japan

Dupriez, for his part, published his theory of long waves in economic development in its final form after the Second World War.[94] This theory attributed the decisive role in the explanation of Kondratieff's waves to the deviations of the value of money index from the value of goods index: 'The fundamental connection between the bundle of essential economic processes and contingent historical facts must be sought in the deviation of the value of money index: failing any stabilization of the relation between money and goods, such deviations are virtually inevitable. This is the basic economic reality governing the Kondratieff waves, which determines all the processes linked to price changes. It is the new fact we introduce into the explanation of the secular progress which extends beneath the Kondratieff waves, where it proves to be a much more decisive and straightforward determinant than in business cycles themselves.'[95] The basis of Dupriez's argument rests on the great variability in the demand for capital (Marxists would say: the demand of the industrial capitalists for additional money capital). In the ascendant phase of the long wave, the rising prices which result from a fall in the value of money index, stimulate this demand for capital. Then there occurs a turning point, mostly after wars or revolutions, at which 'the desire for a reorganization of public finances' becomes predominant, the money-value index rises because of the diminished volume of money for credit, and the corresponding deflation and fall in prices act as a damper on the growth of the economy.[96]

The decisive turning point in this whole schema is thus occasioned by a purely psychological factor — which, in exactly the same way as Schumpeter's outstanding entrepreneurial personalities with a proclivity for epoch-making innovations, performs the role of an arbitrary *deus ex machina* in it.[97] Quite apart from this weakness,

-3%, EEC -1%, UK -2%; for 1975: USA -2%, Japan -1%, EEC -2%. UK -1%. These assessments probably underestimate the scale of the general recession of 1974-75. Since the rate of growth during the rest of the 70's will certainly be below that of the 60's, especially in Japan, the long-term trend will tend to accentuate rather than to reduce the contrast between the growth rates of the 1947-66 period and the 1967-198? period.

[94]Dupriez, op. cit., and *Konjunkturphilosophie,* Berlin,1963.

[95]Ibid, pp. 201-2.

[96]Dupriez, *Des Mouvements Economiques Généraux,* pp. 92, 96.

[97]Schumpeter had already worked out this thesis in his *Theory of Economic Development,* where he expressly stated that the appearance of a few 'innovatory personalities' would inevitably provoke a whole wave of innovations. In his *Business Cycles* he further clung to this theory. Kuznets is therefore right to accuse him of having worked out a thesis of the cycle of entrepreneurial *capability.* Simon Kuznets, 'Schumpeter's Business Cycles', p. 112.

however, Dupriez's argument represents a peculiar new version of that dualism of commodities and money which Marx had already criticized so severely in Ricardo, and which fails to understand that money can only perform its role as a medium of exchange because it is itself a commodity. Once, however, the commodity value (production price) of the money material, i.e., of precious metal, as determined by its own conditions of production, is eliminated from the argument, then the factor declared by Dupriez to be the crucial motor behind long waves is reduced to fluctuations in paper money, i.e., the inflation of paper money. Since, however, the initial impetus of long waves was attributed to demand for capital – real capital capable of valorization and not paper money – the argument collapses of its own accord. It is not clear why a lack of circulating paper money should in certain periods throttle the *demand* for money capital and hence be accompanied by a *falling* rate of interest, while in other periods, precisely when there is an expansion of credit, the demand for money rises even more steeply and thus boosts the rate of interest. Indeed Dupriez himself has published a table showing cyclical fluctuations in the long-term rate of interest in Great Britain, which demonstrates the opposite of what he sets out to prove. For precisely in phases of 'reorganization of money' and 'money scarcity', the interest rate is lower than in phases of 'money inflation':

Average long-term rate of interest in Great Britain [98]

1825 – 1847	3.99%
1852 – 1870	4.24%
1874 – 1896	3.11%
1897 – 1913	3.25%

As in the case of Kondratieff and Schumpeter, so in that of Dupriez, what should be the crucial connecting link in the whole argument is missing – the rate of profit. The ebb and flow of long waves of economic development are not the result of the 'scarcity' or 'super-abundance' of money, depending on whether there is an 'inflationary' generation at the helm or one which is inspired by the 'desire for a reorganization of public finances'. On the contrary: the demand for money capital and hence the rate of interest undergo a relative decline when the falling average rate of profit puts a brake on the investment activity of the capitalists. Only when specific

[98] Dupriez, *Des Mouvements Economiques Généraux*, Vol. II, p. 54.

conditions permit a steep rise in the average rate of profit and a significant extension of the market will this investment activity take possession of the technical discoveries capable of revolutionizing the whole of industry and thus bring about a long-term expansionary tendency in the accumulation of capital and the demand for money capital (at a relatively high rate of interest).

The specific contribution of our own analysis to a solution of the problem of 'long waves' has been to relate the diverse combinations of factors that may influence the rate of profit (such as a radical fall in the cost of raw materials; a sudden expansion of the world market or of new fields for investment for capital; a rapid increase or decline in the rate of surplus-value; wars and revolutions) to the inner logic of the process of long-term accumulation and valorization of capital, based upon spurts of radical renewal or reproduction of fundamental productive technology. It explains these movements by the inner logic of the process of accumulation and self-expansion of capital itself. Even if we assume that the activity of invention and discovery is continuous, the long-term development of capital accumulation must still remain discontinuous, for conditions promoting the valorization of capital (and resulting in a rise or stabilization at a high level of the rate of profit) must in time turn into conditions determining a deterioration in this valorization (in other words, a fall in the average rate of profit). The concrete mechanisms of this conversion must be analysed by reference to the concrete historical conditions of the development of the capitalist mode of production at the time of these major turning points (i.e., the start of the 20's and the 70's of the 19th century; immediately preceding the First World War; the mid-60's of the 20th century). That is what we have tried to demonstrate in this chapter. We have shown that a *different* combination of triggering factors was responsible for the successive and sudden increases in the average rate of profit after 1848, after 1893, and after 1940 (USA) and 1948 (Western Europe and Japan). After the Revolutions of 1848, the rise in the rate of profit was essentially due to the rapid expansion of the world market, itself partially a result of these revolutions, and to the sudden expansion of gold production in California and Australia, which created propitious conditions for the first technological revolution. This in turn led to a radical cheapening of fixed constant capital and a steep upswing in the rate of surplus-value — with a massive increase in the productivity of labour in Department II, and thereby a massive increase in

the production of relative surplus-value. All these determinants released a sharp upward shift of both the average rate of profit and therefore of capital accumulation as such.

In the early 90's of the last century, the triggering factors of the new long wave of expansion were the momentous drive of capital exports to the colonies and semi-colonies, and resultant cheapening of raw materials and foodstuffs, which similarly led to a sharp increase in the rate of profit in the imperialist countries. This permitted the second technological revolution, a fall in the costs of fixed capital and a pronounced acceleration of the turnover-time of industrial capital in general – in other words, to another major increase in the mass and rate of surplus-value and of profit. The central problem posed by the most recent past is why, after the long recession or stagnation of capital accumulation after 1913, which was intensified by the Great Depression of 1929-32, it was possible for a new rise in the average rate of profit and a new acceleration of capital accumulation to take place immediately before, during and after the Second World War (depending on the particular imperialist country in question). This raises the further question of whether a new long wave can be predicted from the second half of the 1960's onwards – the ebb after the flow. We shall try to answer these questions in the following chapters.