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Working Paper

The Finnish Economy in the Long Cycles

ETLA Discussion Papers, No. 278

Provided in Cooperation with:
The Research Institute of the Finnish Economy (ETLA), Helsinki

Suggested Citation: Ray, George F. (1988) : The Finnish Economy in the Long Cycles, ETLA Discussion Papers, No. 278, The Research Institute of the Finnish Economy (ETLA), Helsinki

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https://hdl.handle.net/10419/187004

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Keskusteluaiheita
Discussion papers

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THE FINNISH ECONOMY IN THE LONG CYCLES

No 278 20.12.1988

ISSN 0781-6847

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RAY, George F., THE FINNISH ECONOMY IN THE LONG CYCLES. Helsinki : ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 1988. 104 p. (Keskusteluaiheita, Discussion Papers, ISSN 0781-6847 ; 278).

ABSTRACT: How did the long cycles in the world economy affect Finland? This is the question the paper attempts to answer. Its first section is about long cycles in general and Kondratiev's cycles in particular, together with Schumpeter's view that attributed the generation of cyclical upturns to the widespread diffusion of major innovations. The second part deals with the geography of the long cycles: the first and second cycles started in Britain, the economic leader of the world in the 19th century, facing serious challenges towards the end of the turn of the century from Germany and smaller countries. The third cycle around the century saw the emergence of the USA and the postwar upturn the ascent of Japan. National characteristics are important: the third chapter discusses them for eleven countries. The fourth and longest chapter analyses Finnish developments. The first Kondratiev cycle (1790-1813) did not have much effect on Finnish life; the second (1844-74), which was characterised by the railway boom in more developed Europe, did already have some impact on the Finnish economy and triggered off a course of development that, albeit from low level, continued during the downturn phase of the long cycle into the third upturn until the 1914-18 war. Finland could not escape the world crisis around 1930, nevertheless her economy went on progressing in the interwar years although the world in general was in a 'down' phase. The 1939-45 World War and its consequences were traumatic; the reparation obligations forced Finland into accelerated industrialisation, creating the basis for further rapid progress in the postwar cycle that turned the previously agricultural and rural country into a highly developed economy.

KEY WORDS: Long cycles, Kondratiev, Finnish economic development, industrialisation, Finland

THE FINNISH ECONOMY IN THE LONG CYCLES

George F. Ray

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November 1988

THE FINNISH ECONOMY IN THE LONG CYCLES

George F. Ray

Introduction

With the benefit of hindsight, it is legitimate to consider the quarter of a century following the 1939-45 World War and its aftermath as a 'belle epoque' in the world economy. Economic growth in this period was rapid in practically all countries; its rate was historically very high. The turn-round into the deepest postwar recession, in 1975, was sharp. It was followed by a modest recovery into another period, characterised by slow progress, interspersed with stagnation; average growth was hardly more than half of that in the preceding long postwar boom.

While the going was good, few people paid much attention to long cycles in economic activity. The worsening economic atmosphere in general, and some of the symptoms in particular - those which indicate the delicate health of the world economy, such as unemployment, inflation, international debts, trade imbalances, etc. - redirected attention in a painful manner to the potential possibility of the existence of long cycles, or long waves, in the world economy.

The phrase, 'possibility of the existence' is used deliberately here: there are probably as many advocates of the theory of long cycles as there are opponents. It is not the purpose of this paper to take sides: we start with the assumption that long cycles did (and do) exist. If so, how have they affected Finnish economic developments? An attempt will be made to approach the answer to this question.

To begin with, somewhat more will be said on the theory of long cycles; a complete survey of the rich literature on this subject would fill a thick volume - obviously exceeding the scope of this paper and also duplicating works already in existence[1] - hence this section is kept brief. A geographical excursion into economic history follows, crudely covering the past two hundred years. Next comes a discussion of some of the national characteristics of development.

World economic history usually deals with the main actors, the major economic powers of the time. Smaller countries, such as Finland, are not among these powers. It is in the fourth section that we turn to developments in Finland - to what extent, if at all, were these influenced by the long cycles?

A fairly voluminous statistical compendium supports the text and provides an appropriate basis for international and Nordic comparisons, apart from purely Finnish historical data.

I. LONG CYCLES IN THE WORLD ECONOMY

Economic development is characterised by cycles. The shortest cycles, named after Kitchin,[2] embrace a period of three to four years. Very crudely, these are supposed to have been caused by stock movements. The medium-term (Juglar[3]) cycle takes seven to nine years. It has considerable impact on business life and its various phases - from revival through recovery to stagnation and crisis - can be followed with a fair amount of accuracy through economic history. The crisis years between the beginning of the 19th century and the outbreak of the 1939-45 World War clearly indicate the 7-9 year pattern: 1810, 1818, 1825, 1837, 1847, 1857,

1866, 1873, 1882, 1890, 1900, 1907, 1913, 1920, 1929 and 1937. The postwar period was one of rapid long term progress, yet it was not uninterrupted; minor growth recessions occurred in 1958 and 1967 until the deepest crisis followed in 1975. After that, the pattern is blurred; longer historical perspective is needed for assessing the 1980s, but again, 1982 stands out as the weakest year.

Our interest, however, is in the long cycles - also called long waves - in the world economy. From the beginning of industrialisation, several statistical time series have shown rising and declining movements; such movements being clearly noticeable in wheat prices and wholesale prices and also, though perhaps less clearly, in interest rates and in some production series. Precise identification is not easy, partly because of the gaps in early and reliable statistical information, and also in view of major disturbances, among which the most important were of course the various wars, such as the Napoleonic Wars (1802-15), the Great War in 1914-18, and the 1939-45 World War.

The concept of long cycles has become associated with Kondratiev,[4] who analysed the development of long-term trends in selected economic indicators. In 1925, he published his findings that there exist half-century long waves and made an attempt to explain them theoretically. His study, originally in Russian, was translated into German in 1926 and into English in 1935.

Kondratiev was not the first. A Dutch economist, van Gelderen, is credited with having drawn attention to 'large cycles' as early as 1913;[5] Pareto[6] also wrote of the existence of 'long waves' in the same year. Mitchell, writing in America in 1927, included in his work on business cycles a brief account of the theory of long cycles.[7]

Spiethoff in Germany also published his thesis in 1925;[8] his view, in its simplest form, was that over-investment in prosperous periods results in excessive and obsolescent capacity, reduced profits and downturns; some indeed consider him the discoverer of epochs of prosperity followed by epochs of depression. In France, Simiand developed the idea of alternating inflationary and deflationary trends, the former being characterised by rapid growth on a stable technological basis (that is, capital widening) and the latter by qualitative improvement (capital deepening) and the elimination of inefficient enterprises.[9]

The next two major works to be mentioned here are those of Schumpeter[10] and Dupriez.[11] It was probably Schumpeter who first called the long cycles the 'Kondratiev movement' (or cycle) - and the name stuck. Schumpeter's original thought was to put the emphasis on innovation and on the subsequent burst of entrepreneurial investment activity. Dupriez developed a structural, real and monetary explanation for the long cycles 'embedded in general economic history as an integral part of economic theory as it is used in business cycle analysis'. Both Schumpeter and Dupriez considered Kondratiev's analysis 'too simplified, mechanistic and deterministic' - but both used his work, in a sense, as a starting point. Indeed, Dupriez went as far as to write in 1978 that, 'the commodious reference to the Kondratiev movement ... should be construed as an homage to the pioneer, but should not be understood as an acceptance of his theories, nay even his approach'. So, there were Doubting Thomases even among the converted.

Yet, it is under 'Kondratiev' that an exposition of the long waves in economic development can be found in the International Encyclopaedia of Social Sciences.[12]

In Kondratiev's time - the early 1920s - indicators of real output, as we know them now, did not exist; the statistical information available to him was more primitive. He made use of 25 long-time series but only two of them were production series, all the others concerned prices and interest rates. His 'world' was also limited: of his 25 series, ten concerned France, eight Britain, four the USA, one Germany, and only the two production series, for coal and pig iron, were meant to represent the output of the world, as it was then statistically covered.

In recent times, there was no lack of followers, scholars studying the problem of long cycles from various angles, coming forward with new theories, often based on much better and wider empirical information. Some of them, such as Mensch[13] and Kleinknecht[14] more or less agree with Schumpeter in assigning technological innovation an outstanding role as the engine of economic development. Others take different or supplementary views, such as Mandel,[15] Forrester,[16] Freeman[17] and Rostow.[18] Mandel's cycle consists of the successive acceleration and deceleration of capital accumulation; the capital goods sector is in the centre of Forrester's theory; Freeman discusses the employment-generating effect of a particular wave of innovation, turning at a later stage into employment displacement; Rostow argues on the basis of the scarcity and abundance of food and raw materials and hence their different price development, as well as shifts of investment among uses of a different nature, gestation, etc. These oversimplified characterisations (described in more detail and commented on elsewhere[1]) directly or indirectly take us back to the cornerstone of Schumpeter's thesis: technological progress as embodied in innovations. Freeman openly discusses the employment-creating impact of major innovations and it is easy to construct not only theoretical but also

empirical relationships between entrepreneurial activity, generated by some major innovations, and many of the phenomena mentioned above.

Schumpeter's thesis was accepted by Kuznets,[19] although critically and with some hesitation. He expressed the view that if the Schumpeterian investment boom generates the long period of upswing, it must stem from major innovations that have a very far reaching impact across the whole economic system.

Kondratiev's cycles

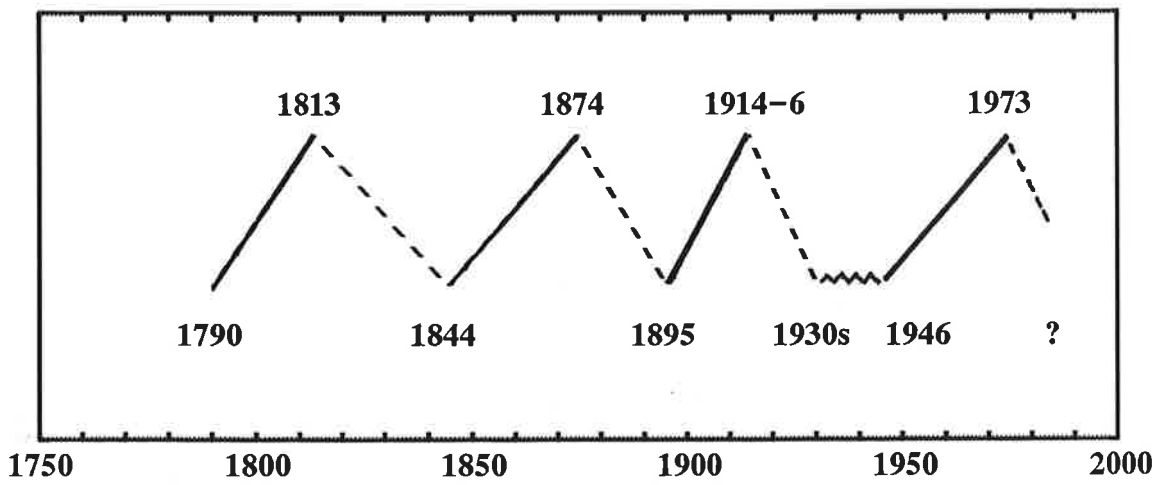
Kondratiev identified - rightly or wrongly - three major waves. The upturn periods of these waves were in 1790-1813, 1844-74 and 1895-1914/6. Having reached the peak in the upturn period, the world economy started a recession/depression path until it began to recover again. The table below very crudely repeats the turning points of Kondratiev's three cycles as well as the number of years between them (table I). Rather arbitrarily, a fourth cycle has been added, which Kondratiev did not live to see; this was the postwar long boom, suddenly ending around 1973. It certainly fits the rhythm of the long waves very well, as is shown clearly in a sketchy diagram (figure I).

Apart from this addition, all other data originate in Kondratiev's work. It was Schumpeter, the Austrian/American economist, who took Kondratiev most seriously. There has never been any great doubt that scientific and technological advance, incorporated in innovation and investment, play some part, and possibly an important part (whether explicitly or implicitly), in any cycle, and particularly in the long cycle. But Schumpeter made technological progress, especially innovation, a cornerstone of his business cycle theory to the extent that he attempted

Table I. Kondratiev's cycles

Period of upturn	Trough	Peak	Number of years				Main driving force (according to Schumpeter)
			trough to trough	peak to peak	trough to peak	peak to trough	
(1) 179-1813	1790	1813	-	-	23	-	steam power
(2) 1844-1874	1844	1874	54	61	30	31	railways
(3) 1895-1914/6	1895	1916	51	42	21	21	electricity motor car
(4) (1946-1973	(1946)	(1973)	(51)	(57)	(27)	(30)	..
Source: refs 4 and 9; postwar cycle added.							

LONG CYCLES IN THE WORLD ECONOMY SINCE 1790



to identify, however tentatively, Kondratiev's cycle with major innovations, each with 'an all-pervasive influence on all or many sectors of the economy' (to quote Kuznets' words from his review of Schumpeter's work in the American Economic Review).[19]

Schumpeter's thesis was that the first long cycle was largely due to the dissemination of steam power, the second to the railway boom, and the third to the combined effects of electricity and the automobile. These are of course oversimplifications. In the first cycle, the cotton industry, with its advent and rapid advance, was a senior partner to steam power; the railway boom developed in parallel with a powerfully emerging iron and steel industry; and the growth of the engineering and chemical industries contributed to the third cycle in a major way.

Oil, chemicals, road and air transport and some other new technologies could be candidates for the fourth, postwar cycle, but changes of a non-technical nature have probably also contributed to the lasting rapid growth of economic activity - such as trade liberalisation and regional (not only European) integration.

Invention - innovation - diffusion

Since innovation is such a centrepiece in the Schumpeterian interpretation of Kondratiev's long cycles, some observations may not be out of place. They concern chiefly the long chain of previous inventions that help the eventual 'basic inventor' (whoever he is) and the long time that may follow before the invention becomes an innovation.

The first Kondratiev upturn started around 1790 and was 'largely' attributed to the steam engine. This, in turn, is generally attributed to Watt, although well before his time (in 1698) Savery constructed a simpler

steam engine which was later developed by Newcomen (1712), both making use of the recognition of Heron of Alexandria, the first scientist who understood the power of steam and invented a sort of reaction turbine - in the 1st Century AD! Thus, Watt did not have to discover the steam engine, but he did develop it significantly in 1769 (separate condenser) and again in 1781 (rotative engine).

The third cycle is attributed to electricity and the motor car. Electricity perhaps illustrates some problems best: many consider Faraday the inventor, but he could not have presented his theory to the Royal Society in London in the year 1831 without the outstanding achievements of scientists such as Benjamin Franklin (1749), Galvani (1791), Volta (1800) and Ampere (1822), among others. And then, it was a very long way from Faraday's time to the birth of the electricity supply industry, towards the turn of the century.

The automobile is also supposed to have contributed to the third cycle. Daimler produced his first car in 1887; in 1893, two years before Kondratiev's upturn, the largest European producer, France, built altogether 500 automobiles. This is not to belittle the importance of the motor car, just to point out that its contribution to the third cycle, which ended in the Great War, must have been rather limited.

One of the outstanding innovations in the fourth (post-Kondratiev) cycle was nuclear power. It is almost futile to speculate about its 'basic' inventor. Was it Marie Curie, who discovered radium (1898, Paris); Rutherford, who first smashed the atom (1911-9, Cambridge); Cockcroft and Walton, who first split it (1932, Cambridge); Hahn and Strassman, who worked out the more elaborate fission process (1938, Berlin); Frisch, who experimented in energy release (1938, Copenhagen); or Fermi, who built the

first reactor (1942, Chicago)? Or does it all go back to Einstein's theoretical work? Eventually, the first commercial power-generating station came on stream at Calder Hall in the UK in 1956.

The purpose of the above questions was not to search for an answer. It was to make the point that whoever is or was the 'basic' (or the most important) inventor, his result is usually based on a long chain of previous inventions. Furthermore, usually it takes a long time before 'inventions' become 'innovations'; the latter - that is, practical application - may follow the former by several decades.

Without invention there is no progress; Faraday's 1831 lecture and demonstration were an enormous step forward in the academic sense. The immediate economic impact was nil, however. From the point of view of its influence on the economy, it is not invention that matters, and even the pioneering innovation makes little impact (albeit its importance as a 'base' should be acknowledged). What really counts is the diffusion of that innovation across the economy - and the speed of this diffusion. And, in agreement with Kuznets: only the widely-based rapid diffusion of some major innovation can be assumed to play any part in helping to trigger off a longer term upswing.

Such rapid and widespread diffusion cannot start without a favourable economic climate: when the demand is there (or is likely to emerge), when the investors' recognition and expectation induces them to take the risk of investing in the novelty, and when the investment capital required by any major change becomes available.

Further requirements, apart from capital, are support from other industries, in the form of supplies, and services (for example, transport), and the supply of skilled labour (for example, machinists) and unskilled

labour (such as the labourers required for the building of railways). All in all, since no major technology can be introduced in an isolated manner, a certain general level of advance is a pre-requisite.

Freeman(17) pointed to another aspect which might be particularly interesting and important from the point of view of Finland: developments of a long cyclical nature can occur at different times in different parts of the world because of the varying conditions and endowments. (He used the example of the different times involved in the development of the automobile industry in America, Europe and Japan.)

II. THE GEOGRAPHY OF THE CYCLES

The Kondratiev cycles developed first in certain areas (and these were different in the three or four cycles); then they spread to others. It was the difference in the general conditions - the political scene, the economic, social and other conditions - that determined the timing, although the international nature of the cycles can be fairly well established.

For a variety of reasons industrialisation started in Britain. The impact of the first Kondratiev upturn was the strongest there. In the first upswing, 1790 to 1815, industrial production in Britain rose by about 200 per cent. In the same period, industrial production in France, the only comparable country in those days, rose by only about 60 per cent. By 1840, almost at the end of the down-phase of the cycle, the total capacity of all steam engines installed in Britain was equivalent to 620,000 horsepower, three times as much as those operating in France, Austria, Belgium, Sweden and the lands that later became Germany and Italy, taken together.

The most vigorous industry in that period was cotton spinning and weaving. The consumption of its base material, raw cotton, rose in Britain from 8,000 tons a year in the 1780s to 106,000 tons around 1830, whilst in the six countries mentioned above the aggregate cotton consumption around 1830 was about 45,000 tons - less than half that in Britain alone.

Britain had little competition from the other countries: the USA was too young, France had been set back by the Napoleonic Wars, Germany and Italy were not even geographical and national entities, and Sweden was purely an agricultural country. Genuine competition emerged only from two small but already advanced countries: Belgium and Switzerland.

In the period 1820-50, which roughly corresponds with the downphase of the first long cycle, Britain definitely dominated the still narrow 'world' economy, producing two thirds of the world's coal, half of iron and steel, half of commercially-produced cotton cloth, and more than one third of metal-based hardware.

Given Britain's industrial leadership, it was almost natural that the 30 year long upturn of the second cycle also started there. This cycle was characterised by the railway boom. At the beginning of the cycle, Britain had perhaps 3,000 kilometres of railway lines open; by its end, around 1880, there were 25,000 kilometres, virtually the final rail network. The only other country where a comparable stage of the national rail network had been built by then was Belgium. If the length of railways in 1939 is taken as their final shape, these two countries had built about 80 per cent of their eventual network by 1880; that indicator applied to France and Germany would be just above 50 per cent, the same for Austria-Hungary, the Netherlands and Switzerland; about 40 per cent in Italy, Spain and Sweden, and less in all other countries.

The creation of a substantial part of the rail network in all these countries (as elsewhere) indicates vigorous activity, having started from practically zero. This shows that the cycle had become international and its timing was much more in harmony than in the first cycle. Railway building required steel: in 1870-4, just about the peak of this cycle, Britain produced ½ million tons of steel a year and the aggregate steel output of the six countries mentioned above was about the same.

Industrial production rose rapidly in Britain until about 1860, faster than elsewhere. But in the 1860s and 1870s, towards the end of the upswing, the British growth rate started to lag behind that of Germany,

Italy, and some of the smaller countries such as Belgium, Switzerland and Sweden. The great innovation, the railway, had spent its initial driving force earlier in the pioneer country, Britain, than in the 'followers'. At the end of this upswing, Britain was still in the lead in many respects (for example, steel, coal, cotton) but it was becoming clear that in other areas her leadership was being subjected to serious international challenge. This was partly because of the enormous structural changes that took place in the last decades of the 19th and the beginning of the 20th Century, changes that found Britain lagging.

This was no longer the age of cotton. The metalworking and chemical industries expanded spectacularly and Germany took the lead in both of them, mainly relying on fundamental technological innovations. By 1914, Germany's steel output exceeded 16 million tons; British production was only half of this quantity, 7 million tons. Between 1895 and 1914, the beginning and the end of Kondratiev's third upswing, German steel output rose fivefold; British production doubled. Belgian steel output in 1914 was eight times that of the average in 1890-4; the same indicator for France was 5½, for Austria-Hungary and Italy 4½, and for Sweden 3.

The third Kondratiev upswing has been associated with the combined effect of electricity and the motor car; whilst their importance is beyond doubt, the third cycle is not as dominated by them as the previous one was by the railways. Steel, however, retained its role as a pre-requisite for both. The third cycle saw a significant geographical shift: a new industrial power had emerged which was soon to overtake all other countries - the United States. In all the 'old' areas as well as in the new ones - and also in the rapidly spreading novelty, the telephone - the advance of the USA was extremely rapid. Even before the 1914-18 War, the USA was far

ahead of Britain (and also of Germany and other European countries), much further ahead than differences in population could justify. Some examples: electricity generation in 1907 in the USA was five times the British production figure; in 1914, there were 13 times as many automobiles on the road in the USA as in Britain.

Thus, whilst during the third cycle it was still politically true that 'Britannia ruled the waves' as the centre of her enormous worldwide Empire, economically and industrially she was already declining from her peak.

The fourth and most recent upswing, in the Kondratiev sense, lasted from the end of the postwar reconstruction around 1950 to 1973. Already in the third cycle it was somewhat dubious to 'appoint' electricity and the motor car as the generators of the uptrend, but in the last cycle it is even more difficult to find the most likely candidates. Oil, chemicals, road and air transport and also some 'new' technologies (new in the postwar sense) are all possible candidates. Other - political and institutional - changes obviously played important parts in the past (such as the abolition of the guild system, the unification of the German or Italian states, and so on); major changes of a non-technical nature, such as the liberalisation of trade (the Kennedy, Dillon and Tokyo 'rounds') and regional integration are likely to have contributed to the rapid and lasting growth of economic activity in the fourth long wave.

There have been quite a few other characteristics of the postwar cyclical upswing that lasted about quarter of a century, namely:

- this postwar 'boom' was more all-embracing, in the geographical sense, than in the earlier cycles; furthermore,
- its timing was also more coincidental than had been the case earlier;
- it saw the advent of Japan as a new industrial power;

- and the rapid development of Soviet Russia;
- American leadership was consolidated in the first half of the upturn phase;
- the latter part of that phase (and the years after) was characterised by the Japanese challenge;
- and the partly successful endeavour of Western Europe to close the technological and productivity gap that had developed between them and the USA, in the latter's favour.

III. NATIONAL CHARACTERISTICS

Although much has already been said concerning Britain, the pioneer of industrialisation and for a long time the leader of the then still narrow world economy, a few further aspects will help to explain her rise and decline.

For a wide industrial base, it was necessary that a large part of the active labour force be available for the then new kind of activity. The British industrial revolution was preceded by similarly important developments in agriculture. In the second half of the 18th Century and the first decades of the 19th, the technological development of British agriculture was exceptionally rapid; it 'freed' labour from agricultural work and made it available for industry. According to the 1841 census of population, no more than 22 per cent of the working population was engaged in agriculture (including fisheries and forestry). Some forty years later, the same proportion of agricultural labour was still around 50 per cent in France, Germany and Italy; the 1841 British share of around 22 per cent was

not reached before the end of the 1939-45 War in many countries, among them all the Nordic countries.

Another chief reason why Britain became the leading economic power in the late 18th and 19th Century was her political stability, coupled with the fact that she was far and away the first to throw off most of the old strangleholds - serfdom, guilds, internal customs barriers - which were still paramount in most of Europe in that period; by the later decades of the last century, stability was not unique to Britain, restrictions had been lifted elsewhere too, and in some respects legal and institutional arrangements on the Continent and in America had become more progressive than in Britain.

Historians have studied the British decline in a host of books; some of them summed up their findings in the 'pioneer's path': the unchallenged leadership of Britain - in the age of steam power and the railways - was simply not tenable for ever, a relative decline was unavoidable. The highly advanced state of 'old' industries, and particularly 'old' technologies, led to the development of vested interests unfavourable to progress.

Some examples: new steelmaking processes were introduced in the 1880s; however, their large-scale adoption in Britain would have meant the wholesale scrapping of the (then) greatest iron industry in the world,[20] based (of course) on earlier technology. The British chemical industry, still prominent around 1860-70, was left behind; one of the reasons was probably the concentration on the Leblanc process for making alkali at a time when its competitors abroad were adopting the Solvay process, which was more efficient and offered more scope for further development. The gas industry was probably most highly developed in Britain; its entrenched

position for lighting - for which electricity was first used - might have been a much stronger force in Britain than elsewhere in hindering the spread of electricity. Similarly, it was probably Britain's coal lobby that was delaying the adoption of the motor ship.

These and other explanations are easy to find with the benefit of hindsight; they appear apologetic, but they provide a rationale for the past - even though they do not change the historical facts.

There are then other cases with no such obvious explanations. Take office machinery: this industry took off around 1900, with the manufacture of typewriters. British backwardness is amply documented and analysts have summed up the main reasons for it as follows: "a ledger-minded, undemanding public, lack of incentive for mechanisation in view of abundant and cheap labour, delay in the recognition of the future expansion of demand, lack of entrepreneurship and under-capitalisation".[21] These statements are not peculiar to the office machinery industry alone.

Electrical engineering, the great new industry that sprang up with the spread of electricity, was dominated in Britain by German and American companies - Siemens, Westinghouse and General Electric. The case of the new transport medium, the automobile, was similar. Britain was not particularly far behind other European countries in the beginning - that came later - but it did lag a long way behind the USA; around 1910, the most important car-maker in Britain was - Henry Ford, producing more cars there than the next two largest firms combined. British entrepreneurs have lagged in that major industry too; this is likely to have had a considerable impact on general industrial developments in view of the requirements of the mass production of motor vehicles in terms of machine tools, transfer lines, other metal goods, instruments and rubber products.

Institutional arrangements also served industrial advance much better elsewhere than in Britain. Technical education was significantly behind the continental system and even the level of general education was low, affecting the shopfloor in particular. This is not to deny that the British educational system was very good at the upper level, producing outstanding scientists as well as an elite to rule and administer the Empire, but it did not favour industrial development.

Although the fundamental importance of innovation as the generator of long upswings was most firmly established by Schumpeter, its significance was recognised well before him by other leading economists. Marshall, for example, wrote in 1903 as follows:[22]

> "Sixty years ago England led the world in most branches of industry. The finished commodities and, still more, the implements of production to which her manufacturers were giving their chief attention in any one year, were those which would be occupying the attention of the more progressive Western nations 2 or 3 years later, and the rest from 5 to 20 years later. It was inevitable that she should cede <u>much</u> of that leadership to the great land which attracts alert minds of all nations to sharpen their inventive and resourceful faculties by impact on one another. It was inevitable that she should yield a little of it to that land of great industrial traditions which yoked science in the service of man with unrivalled energy. <u>It was not inevitable that she should lose so much of it as she has done</u>".

Of course, the loss - to America and Germany - would not have been inevitable if the innovatory entrepreneurial spirit had not ceased to operate as vigorously as '60 years ago' - that is, in the first half and around the middle of the 19th Century. It was the lagging in new departures - new industries, new activities based on innovation - which made it inevitable.

It has already been mentioned that Britain had only two small but serious competitors in the heyday of her industrial supremacy: Switzerland and Belgium. We turn now to <u>Switzerland</u>, a country in terms of population

more comparable with Finland than the large countries, concentrating on the early part of the 19th Century, and on the industry which was in those days the pioneer of industrial advance and international trade: cotton. Well before the great cotton age, that industry was already in existence in both Britain and Switzerland, on a small and rather primitive scale. Switzerland might have been more advanced then in the technical sense, as indicated by a few technical terms of Swiss origin (for example, Swiss checks, and so on). The real take-off, however, occurred in Britain and from 1780 onwards, Switzerland was a good market for British cotton textiles.

It was soon after the Napoleonic Wars that the Swiss cotton industry became a more serious competitor for British exporters, not only in Switzerland itself, but also in third markets in Europe and overseas. The sharp competition induced the British Parliament in 1835 to send John Bowring on an official mission of inquiry to Switzerland to study that country's commerce and industry, with the objective of investigating the reasons the British were encountering the Swiss as serious competitors "in all markets of the world". In his detailed report,[23] Bowring emphasised some of the Swiss attitudes that had led to their success: freedom of trade, flexibility and readiness to adapt to new situations, willingness to accept quickly social, industrial and economic change.

If the start of the industrial revolution in Britain is put at 1780, the same development in Switzerland started some twenty years later, around 1800 (one historian mentions 1798). Conditions were given: feudal landed rights abolished, liberty for trades and crafts declared, and so on. The location of Swiss industry was greatly different from that in Britain: whilst British industry was concentrated in urban areas, cities and towns,

the Swiss urban population around the end of the 18th Century was mainly employed in what came to be called tertiary activities; industrial operations mostly took place in rural districts. Even in mountainous areas, such as the Jura or Glarus, two thirds of the population was occupied mainly in industry, with only one third depending on agriculture.

In some periods of a cotton age, when the industrial revolution was already in full swing, England alone absorbed some 60 per cent of the world cotton production; at about the same time, Switzerland took over another 20 per cent (the Swiss population at the time was about two million). In 1780, the Swiss cotton industry employed 150,000; it was not a 'monoculture': other important Swiss industries of the day were silk and watchmaking (both exporters), as well as wool and linen manufacture (for domestic use). It was Goethe who described in detail (in his 'Wilhelm Meister's Wanderjahre) the structure and position of the Swiss textile industry in rural areas on the eve of industrial change, including the threat of mechanisation and the resigned readiness to accept it.

When the British lead became too strong for them, the Swiss took a bold step, a major organisational innovation: they abandoned old-type spinning almost completely in order to develop the weaving side and the export of woven textiles. Mechanised spinning mills started up. Then weaving became mechanised in England: the Swiss concentrated on those fine and superfine woven fabrics which had not yet been displaced by machine weaving. Their policy was clear and realistic: to introduce innovation as quickly as possible and counter British competition with better performance (such as greater speed in weaving) and lower prices.

Moreover, they diversified. One of their leading businessmen, Escher, got hold of English machinery in 1823. He set this up in his mill but soon

moved over to the construction of textile machinery. This was the beginning of the Swiss engineering industry in the modern sense. By 1835 his machine factory employed 400 and exported its machines to all the neighbouring countries. We can note the passage from the primitive to the mechanised textile industry, from textiles to machinery, and later on from textiles to dyes - the beginnings of the self-sustained advance of industry based on industrial and organisational innovation, great flexibility, and that special agility and managerial talent which often seems to be a characteristic of the industries of some smaller countries. These were the properties that continued to stimulate the Swiss economy later on as well, for example from the 1880s onwards, when it was boosted by the rapid growth of the industries making power generating machinery and other electrical equipment, as well as pharmaceuticals and other chemicals.

Britain's other major competitor in the early days was Belgium. The woollen industry there (that is, in the area of the Low Countries which by 1830 had become Belgium) could look back on a long period of success in the pre-industrial age. The area was richly endowed: coal and iron ore were locally available, water power had been used much earlier, but the existence of other well-entrenched industries - mainly woollen and metals - made cotton a relatively late starter. The adoption of steam power was also rather slow. Coming over from England, Cockerill started making spinning machines in Verviers as early as 1799 and a number of outstanding innovators helped the Ghent textile industry to reach prominence, as well as the metal industries in Charleroi and elsewhere. In 1807, Huart-Chapel invented a reverbatory furnace for melting down scrap iron, introduced several major changes - such as puddling furnaces to convert pig iron into wrought iron (1821) - and built the first coke-blast furnace in the

Charleroi area; new type rolling mills were also added at about the same time. Having thus rejuvenated the country's old established industrial base, by 1840 Belgium was highly industrialised, comparable only to Britain; she soon had relatively the densest railway network in Europe.

By contrast, Holland - the other part of the area known earlier as the 'Low Countries' - had hardly any noteworthy industries. In the second half of the 1840s, 32 per cent of the Belgian working population was engaged in manufacturing; in the Netherlands the same proportion was 19 per cent. The rise of the Dutch metal industries parallelled that of the great maritime innovation: the steamship, the first of which appeared in Rotterdam in 1823.

The first major country to overtake Britain was Germany. The first Kondratiev cycle found the area that later became Germany a politically dismembered, customs-ridden territory, with vastly different interests between the larger units such as Prussia and Bavaria, the commercial and trade centres such as the Hansa cities (Hamburg, Bremen, etc.) and Frankfurt, and smaller industrial 'pockets'. Still, in 1850, steam engine capacity was one fifth of that in Britain. The 'cotton age' was missed out completely. Railway building started ten years after it did in Britain, though by about 1880 the length of railway lines open to traffic was somewhat longer (in an area twice the size of Britain). Germany's real take-off came with the unification of the German lands by Bismarck in 1871. Industrial development was wide-spread, based on an abundant supply of coal and huge labour reserves (in 1882, 48 per cent of the labour force was still in agriculture). The German advance was outstanding on three fronts. The steel industry was thriving on the then new open hearth (Siemens) and Thomas processes; from 1880 to 1900 its output rose tenfold, leaving

Britain far behind; in the years preceding the 1914 War German steel output was comparable to that of all the European countries combined. As the combined result of technological change and scale economies, the cost of steelmaking in Germany dropped to a tenth of its 1860 level.

Another pillar of German industrial progress was the chemical industry. As early as 1900, Germany supplied 90 per cent of the world production of dyes and German firms were among the leaders in almost all branches of the expanding chemical industry. The leading German chemical companies were the first to 'institutionalise' research development in their laboratories; this organisational novelty contributed to their success in no small measure. Finally, Germany was quick - perhaps the quickest in Europe - to introduce electricity; the electrical engineering industry was also developed early, owing much to the systematic concentration on invention and to the early large-scale adoption of American innovations.

In the 18th Century, France was the leading country in Europe. Industrial development also started, partly helped by new techniques imported from England, but later, in the 19th Century, France was not among the pioneers. At the time of the revolution and the Napoleonic Wars, France was cut off from the outside world and lost contact with the technical and scientific progress there. Until the middle of the 19th Century, she remained a largely agricultural country. Industry picked up in the second Kondratiev cycle - characterised by the railway boom - but even then French growth was relatively slow. Nevertheless, the contribution of a few major industrial innovations was important to French (and also to general) industrial progress, such as the Jacquard loom, among many others.

Austria-Hungary was among the major European powers in the 19th Century but was lagging far behind the above countries. Austrian industry was slow to introduce steam power and was also not among the leaders in cotton production. Although some industrial centres of the multi-national Habsburg Empire were quite successful in their own area (such as the Czech Skoda works) it is perhaps not an unfair characterisation to mention that the majority of pig iron production was still exclusively charcoal-smelted until about 1870.

Because of certain similarities with Finland, we are dealing separately here with one part of the Austria-Hungarian Monarchy - Hungary. Neither Finland nor Hungary were entirely independent until the end of the 1914-18 War: the first was a part of the empire of the Romanovs, the second of the Habsburgs. In both countries industrialisation started very late. The first Kondratiev cycle left Hungary unaffected. It was a feudal country, kept backward partly deliberately by Vienna, partly by its own ruling class and partly by the legacy of history. Primitive agriculture was dominant. The first textile factories were built in the 1830s; in the second half of the 1840s there were only two plants employing 1,000: a shipyard and a large brick factory, both at the peripheries of the later capital. The first railway was opened in 1846. Some development started in 1867, when (after the 1848-9 revolution) the House of the Habsburgs and the Hungarian nation 'reconciled'. The length of railways then was 2,300 kilometers, growing to 11,000 km by 1890 and 22,000 km by 1913. Thus, the railway building was delayed, as was that of the whole infrastructure. Industrialisation in the third cycle, 1895-1913, was founded on agriculture. Budapest became a centre of grain milling, probably housing the largest concentration of this industry in Europe. Other factories

based on agriculture followed: breweries, sugar and spirit factories, leather works.

Coal and lignite mines were opened, iron and steel works founded and an engineering industry started; the light industries and the chemical industry, however, were latecomers, their major development did not start before around 1900 - in view of the dominant position of Austrian and Czech products within the free trade area of the Habsburg Monarchy. From 1860 to 1913 manufacturing production rose at a rate of about 5 per cent a year, fairly rapidly but not as fast as in some countries when at a similar phase in development, for example Sweden. It was only after the Second World War that industry became the largest sector.

This background makes the spectacular development of a few isolated cases even more striking (and this is another reason why Hungary has been included here). Probably the most marked among these cases were those two particular electrical engineering firms which acquired international reputations (Ganz and 'Tungsram') and developed very rapidly indeed, thanks to the significant innovations of a few highly gifted and successful scientists and engineers in various areas of the then fast-growing electrical engineering industry. This example is of some significance: it underlines the importance of innovations even in a situation where the whole economic climate is not particularly favourable, external economies hardly exist, and the domestic market does not provide any great stimulus to innovatory activity.

Single major innovations can often be seen to have created the basis for whole national industries. This was the case in Spain: the Bessemer steelmaking process offered the opportunity for the large-scale use of Spanish iron ores and the development of the iron and steel industry (and,

somewhat later, the engineering industry) in a country where as late as 1940 no more than 19 per cent of the labour force was engaged in manufacturing.

During the first half of the 19th Century, Sweden was one of the poorest countries in Western Europe. The first Kondratiev cycle hardly touched Sweden at all. Even in the second half of the century, only about 12 per cent of the Swedish population was engaged in industrial activities. Thus, apart from the rather small iron industry working local ores, and workshops serving agriculture and the forestry industries, proper industrialisation in Sweden started rather late, but then its advance was rapid and widely based. During the third upturn of the long wave, in the twenty years from about 1895, industrial production grew at an annual rate of some 7½ per cent, doubling every 9-10 years, making the Swedish industry the fastest moving in Europe. Thanks to this rapid growth, Sweden was already in the forefront towards the end of the third cycle, especially in the area of electricity, with the development of the country's hydropower potential and also with the pioneering work in long-distance power transmission. One of the bases of the expansion of Swedish engineering industry was the provision of the forestry industry with machinery, another was an early invention, the milk separator (in 1870), which greatly contributed to the creation of the dairy industry, not only in Sweden but also in other Nordic countries. Both these things played an important role in helping engineering to become established in Sweden - branching out later on, with assistance from other Swedish innovations in such varied areas as turbines, electrical machinery, and ball bearings. This rapid advance of Swedish industry, its excellence in specialised branches, and the successful export-orientation, were the main instruments that made her

one of the European countries with the highest per capita income in the interwar years, second only to Britain. Although a slow start had already been made during the second Kondratiev upturn - Sweden started rather late, in 1856, to build her railways - it was really the third cycle that saw rapid growth, which continued after World War II and wartime interruptions (if any) were less painful in neutral Sweden than in most other countries.

Perhaps the country that benefited most from the inventions of the Swedish milk separator was Denmark: the new equipment provided a changed technical basis for dairy farming, an important part of the Danish economy. It also contributed to the development of the cooperative movement in Denmark, which was instrumental - among other things - in transforming the export of pigs into the sale of packed pork, another innovation that required technical and organisational change resulting in the significant growth of another part of Danish agriculture. Denmark was already more advanced in the first half of the last century than the other Nordic countries, partly because of her geographical situation. By 1850, more than one fifth of the working population was employed in various branches of industry (including of course the industries based on agriculture). Already the first long upturn had an impact on Danish developments; the characteristic feature of the second upturn, railway building, started in 1847, the earliest in the Nordic camp, although its progress in the later decades was slower than in Sweden. It was during the second Kondratiev cycle that the already advanced Danish agriculture was further modernised and converted into a processing branch of the economy: industrialised agriculture. Industry primarily served the needs of agriculture and allied trades; its widening and development was a feature of the third upturn - early this century - and its main aim, in the beginning at least, was

the century (estimates vary) that Sweden overtook Denmark as the Nordic country with the highest per capita real income.

Norway was also almost totally bypassed by the first Kondratiev cycle; railway building started in 1854, at a relatively modest speed, which nevertheless stimulated industrial development. The real take-off occurred in the third cycle, around the turn of the century, with the development of hydroelectricity. In the five years 1900 to 1905, Norwegian hydroelectric production rose eightfold. Its beneficial effects, providing cheap energy, can best be illustrated by the growth of the chemical industry and the rising production of fertilisers, calcium nitrate as well as carbide. They made good use of German and American chemical inventions, which were further developed by Norwegian innovations. (By 1910, Norwegian output amounted to 20 per cent of world carbide production.) Hydroelectricity was the basis of the important electro-metallurgical industries, particularly the Norwegian aluminium industry. Shipping became an important branch of Norwegian economic life rather earlier. Norwegian shipping exploited successfully the second and third cycles - and even the down-phases: between the middle of the 19th Century and 1914, the merchant fleet earned at least 40 per cent (in some years considerably more) of the export income of Norway, the third largest shipping nation after the United States and Britain. It was in the opening decades of this century that traditional industries progressed more rapidly (for example, woodworking) or were modernised (fish processing). The discovery, in the second half of this century, of petroleum and natural gas in the North Sea opened a whole new chapter in Norwegian economic history.

IV. FINLAND

There are several reasons why any assessment of the impact on the Finnish economy of the Kondratiev-type long waves faces difficulties. Reliable information on the state of the Finnish economy only started to be collected rather late. Finland, of course, is not unique in this sense: in many European (and most other) countries the statistical information does not go back far enough - if at all - into the 19th Century in sufficient detail. A fairly complete statistical picture of the economy is available from the years when independence was consolidated, in the 1920s; the further back we go in history, the weaker the information basis becomes. Towards the end of the period when Finland was a Grand Duchy under Czarist Russia, from 1809 to 1917, the available data still permit some analysis, albeit limited in depth. But the first half of the 19th Century is already submerged in obscurity and for earlier times (those of Swedish domination) the available information is almost non-existent. The scholarly work of historians and economists in recent times has greatly added to the earlier poor knowledge of the past, but the bulk of these works have concentrated on the past 100-120 years of economic history and rarely, if ever, went back beyond the middle of the 19th Century.

The first cycle

Kondratiev's first upturn was in the period 1790 to 1813; then, after a downturn phase of thirty years, his second cycle's upturn followed from 1844 to 1874. These are the two cycles affected by the dearth of statistical information, particularly the first. What nevertheless reduces

the importance of being better informed is the fact that during the first Kondratiev cycle, around 1800, Finland was one of the poorest countries at the periphery of Europe; it was almost completely agrarian in character, a predominantly rural economy where, according to one historian, "there was a general improvement in the standard of living towards the latter half of the 18th Century".[24] This improvement, however, started from a very low level, and one cannot help subscribing to the view that among the four Nordic countries Finland had "the worst starting conditions for delayed development, not only with regard to the economic resource endowment, but because ... her political, cultural and social identities were by no means settled".[25] This latter quotation comes from a German economic historian, but similar views have been expressed by Finnish scholars too, emphasising poor conditions in general, the thin resource base in particular, and stressing the lowest degree of urbanisation in the whole of Europe.[26]

These generalised statements can be supported from various angles, even on the basis of the little information available, poor as it is.

Finnish population statistics (partly estimates) alone go back a long way. The earliest (more or less reliable) information concerns 1750, when Finland's population was estimated at 422,000; the population of Denmark and Norway was at that time at least some 50 per cent higher. By 1820 - that is, after the peak of the first Kondratiev cycle - the Finnish population was higher than that of Norway and comparable to the Danish one. (Although the 1812 inclusion/annexation of Karelia into Finland was partly responsible for this sudden increase, the population of the original Finnish territory also rose rapidly.) With slight fluctuations, this has been the situation ever since: the proportions in 1985 were the same.

The agricultural character of the country is best demonstrated by the 1805 information, according to which 82 per cent of the population was engaged in agriculture, forestry and fishing; only 3½ per cent worked in manufacturing industries. Agricultural and allied occupations remained dominant until about 1950 (59 per cent as late as 1940).

According to Myllyntaus, in 1810 about 5 per cent of the population lived in urban areas;[26] this share was by far the lowest in the Nordic countries and, although it started improving slowly, it remained the lowest in the North. Urbanisation in Finland reached 10 per cent by 1890, and 15 per cent by 1910, by which time it was twice as high in Sweden and Norway and 40 per cent in Denmark.

Finland's resource endowment was very poor indeed; it was restricted, in the main, to her forests, covering some three quarters of the country, leaving little arable land for agricultural activity, which was in any case limited by the harsh climate. There was no coal, and the small quantity of iron from low quality ore had to be made with charcoal.

It probably needs no detailed justification to support the statement that Finland's "political, cultural and social identities" were not yet settled in the early decades of the 19th Century. Indeed, anything else would have been a miracle in a country which changed masters in 1809 (from Sweden to Russia), which was attached to the Russian Empire afterwards - as a kind of buffer state - but which retained Swedish institutions, and even later on developed rather on the Nordic pattern than the Russian one, where about one eighth of the population was Swedish (this proportion being much higher in the more advanced areas and in the higher layers of society). It was much later, towards the end of the 19th Century, that a truly Finnish identity developed in all these respects.

On the whole, conditions during the first Kondratiev ('K') cycle were too primitive, the ties with the outside world too loose - and the impact of the first K-upturn probably small, if it existed at all. In any case, it is difficult to illustrate the impact by convenient economic indicators.

This is not to say of course that ties with the outside world did not exist or that some development did not occur. The Baltic trade was lively even in earlier centuries and although, because of her geography, Finland was at the northern-most end of that trade, it did not leave her unaffected. Typical Finnish staples of the mercantilist Baltic trade were furs, until the end of the 16th Century, joined by tar in the 17th Century and followed by timber towards the end of the 18th; it was the latter, timber in its unprocessed form, that connected Finland, through the hands of Baltic merchants, to the market centres of more advanced Europe.

The relatively primitive industrial activity was of a purely local significance, supplying mainly the domestic market. None of the industrial workshops could be called a 'factory'; the first mechanised factories were established later, well after the upturn phase of the first K-cycle. The reason for the occasional and very small exports of industrial goods was that it was easier for the producer to send abroad that part of his production which he was unable to sell in the local market than to send it to other parts of Finland, so bad were transport conditions in many parts of the country.

This limited industrial activity goes back to the 16th Century, when Gustav Wasa, King of Sweden and then overlord of Finland, founded very small workshops, primarily probably to supply his army and navy, although, naturally, some part of the production did reach the civilian population. The nature of the workshops makes the primary objective likely:

gunpowder, sailmaking, woollens, boatbuilding and sawmills. The first ironworks also started in the mid 16th Century, followed early in the 17th Century by others. It was in 1640 that the first papermill started operations and printing began. It is difficult to say whether Baltic traders of the Swedish intelligentsia started the first newspaper, but it was in 1771, more than a hundred years after Denmark or Sweden.

The first K-cycle, 1790-1813, must have been a traumatic time for Finland, in view of the end of the long period of Swedish rule and the start of the Russian period. Two years after the declaration of Finnish limited autonomy by Czar Alexander I at Porvoo in 1809, the charter of the Bank of Finland was granted by the Russian authorities. Although this was primarily motivated by political reasons - to discourage the position of the Swedish currency and promote the use of the rouble in the Grand Duchy - it is unlikely that with the fairly lively development of trade such a move would have been taken.

Although Finland's trade contacts with the European markets further south were not yet developed, it is likely that the booming conditions in some of the then leading European countries boosted the still small Finnish exports of mainly timber (Britain's national output grew at an annual rate of 2.6 per cent in the first decade of the 19th Century, the second half of the first K-upturn).

During the downturn phase of the K-cycle, 1813 to 1844, the Finnish scene did not change much. It was in this period that the first mechanical factories started to come on stream. Most noteworthy among these was Finlayson's textile mill in Tampere, which started operating in the early 1820s making woollen thread and cloth; it almost failed and in 1828 converted to making cotton, never to look back again. Papermaking also

started on a small scale in this period. New sawmills opened - but all these were still small plants and did not alter at all the basic agricultural character of the economy.

Kondratiev's second wave

A second K-upturn, from 1844 to 1874, stepped up very significantly economic activity in Europe (table II). Livelier demand was reflected in Finnish exports too: the value of forest product exports rose from 2.2 million FMK in 1836 to 4½ million FMK in 1846, and then gradually to 28 million FMK in 1876. Thus, the annual growth rate in the thirty years to 1876 - that is, during the K2 upturn period - was 6.3 per cent.

Forest products accounted for a very large part of Finnish exports through the whole history of modern Finland, and the development of these exports reflects well the impact of long cycles: the rapid advance in the upturn phases and the much slower growth during the downturn (table III).

The same data point to another development: the fact that within the total exports of forest products the processed varieties became gradually more important. It was in 1866 that paper exports first reached more than negligible amounts: they accounted for some 2 per cent of the total value of forest product exports; this paper was still produced from rags (to relate it to forest products is for the sake of convenience and for later comparability). Ten years later, in 1876, the proportion of paper had risen to 10 per cent (already mainly based on wood); at the turn of the century their share was 17 per cent (totally wood-based), and by 1913 it had reached 30 per cent. Thus the upturn phase of the K2 cycle saw the take-off of the trend that has characterised Finnish forestry exports ever since: the reduction of exports of timber in a relatively crude form, and

Table II. Economic progress in selected European countries during the long cycles

Period	Britain		France		Germany		Italy		Sweden	
	GDP*	I*	GDP*	I*	GDP*	I*	GDP*	I*	GDP*	I*
K1* upturn 1790-1813	2.6[a]	..	1.0[b]	1.5[b]	..	..	..	..	..	..
downturn 1813-1844	1.4[b]	..	1.3[b]	1.2[b]	..	..	..	..	..	..
K2* upturn 1844-74	2.4[c]	0.6[d]	1.9	2.0	3.0[e]	6.5[e]	0.9[f]	0.1[f]	3.4[g]	3.7[g]
downturn 1874-95	2.8	0.5	1.0	1.3	2.0	1.1	0.7	2.3	1.7	0.5
K3* upturn 1895-1913	1.4	1.5	3.0	2.3	2.8	4.0	2.7	2.3	4.0	3.8

Note: These data should be interpreted in the light of the previous chapters. The first K-upturn coincided with the Napoleonic wars that influenced advance in France. No information is available for the area that came to be Germany or Italy, for the first two periods in the table. The K-cyclical movement is clearly documented above for all countries in the periods of K2 and K3, with the exception of Britain where the K2 upturn lasted longer whilst the economy already started slowing down in the K3 period - see part III above.
*K1 = the first Kondratiev cycle, etc. GDP = national output (various measures)
I = fixed investment.
(a) 1801-11. (b) 1811-41. (c) 1841-74. (d) 1855-74. (e) 1850-74. (f) 1861-74.
(g) 1861-74.
Source: B.R. Mitchell. Statistical Appendix to C.M. Cipolla (ed.), The Fontana Economic History of Europe Collins-Fontana, London, 1973.

Table III. Growth of Finnish exports of forest products, 1846-1913
Annual per cent changes[a]

Period	Duration of comparable series	Per cent
K2* upturn, 1844-74	1846-76	6.3
K2* downturn, 1874-95	1876-90	2.6
K3* upturn, 1895-1913	1890-1913	7.8

Source: Finland im Anfang des XX Jahrhunderts, Ministerium der Auswartigen Angelegenheiten, Helsingfors, 1919.
(a) Calculated from value figures.
K2* = second Kondratiev cycle, etc.

the processing of it into various products to be sold as veneer, plywood, mechanical and later chemical pulp, newsprint and other paper and board.

The importance of this trend can only be understood if it is remembered that the forests are the most significant resource base in the economy and exports of forestry products accounted for about half of all exports even as early as 1860; this share was higher, around 70 per cent, at the turn of the century, 85 per cent in the early 1920s, reached its peak of 90 per cent in the later 1940s, and only after the rapid diversification and expansion of Finnish industrial production after the war, fell to under 50 per cent around the middle of the 1970s.[27]

The importance of forestry should be looked at from another angle too. The ownership of the forests was fairly well distributed: it was not too concentrated. Proceeds from timber production, and particularly from exports, led to gradually rising rural incomes. From the middle of the 19th Century, the transformation was noticeable: as a result of trade in timber and the increase in the value of wood, the subsistence agricultural economy gradually changed into a monetary economy. The gap in the standard of living between those who owned forests and those who did not widened.

Step-by-step modernisation of agriculture went hand in hand with these development. Farmers raised their incomes, but the situation of the landless workers improved only very slowly. Their number was quite high: apart from the regular (but landless) agricultural labourers, there were the 'daily hands' making a living out of occasional employment and accounting for some 40 per cent of the agricultural labour force around 1870 (in some areas this figure was over 50 per cent). The number of 'backwoodsmen', landless forestry workers, was also high. These two categories constituted the rural proletariat; they were the first to suffer

in times of crop failures and, of course, the very slowly but nevertheless advancing mechanisation of agricultural and forestry work also affected their livelihood. Those who lost their jobs or were for any other reason dissatisfied could take one of two steps: emigrate, or move into the towns to work in industry.

Thus forestry and agriculture secured two conditions of industrialisation: the supply of labour, that is, rural workers ready to move; and nationwide demand, stemming from the rising and fairly widely distributed income, providing the foundation of broadly-based industry aimed primarily at import substitution and the supplementation of already existing, albeit primitive, forest-based export industries.

Nowhere did industrialisation start with a big bang. It was a gradual process in Finland too. Around 1880, at the end of the K2 upturn, no more than just under 10 per cent of the working population was employed in industry; whilst this was almost three times as high as the same indicator at the beginning of the century - at 3½ per cent - it was still among the lowest in Europe.

The upturn phase of the second Kondratiev cycle (K2), 1844-74, covers the whole third quarter of the 19th Century. This was an eventful period in Finnish developments, quite apart from the forestry exports being stimulated to a rapid increase by booming conditions in Europe. Some of the main aspects can be listed briefly:

- technological advances in shipping lowered the transport costs of Finnish products, particularly forest products, to Britain and other countries;
- Britain was one of the chief destinations for Finnish exports; her transition to totally free trade was beneficial to Finland;

- from about the middle of the century (after 1843), it became possible to import advanced machinery from Britain (earlier subject to export prohibition);
- the whole period (actually, the reign of Alexander II, 1855-81, but particularly the 1860s) was one of considerable liberalisation, which included a certain degree of self-administration by the provinces; universal freedom to ply a trade (elimination of the guild system, 1868, total freedom of trade in Finland, 1879); freedom to establish banks and limited companies; equal rights of inheritance for women; education removed from the control of the Church and the compulsory school system introduced in 1866;
- in 1860 the Finnish Mark was introduced; in 1865 it was released from its strict ties to the rouble, and in 1878 put onto the gold standard;
- it was somewhat later that the metric system was introduced (gradually, between 1887 and 1892).

Some of these points require further elaboration.

The Finnish merchant fleet, although comparable in size to the Danish and Swedish ones (though never to the Norwegian fleet), was backward in the sense that it consisted chiefly of sailing ships. In their own class, as sailing ships, they were fine vessels, holders of quite a few speed records, but it was only a question of time before they became uncompetitive vis-à-vis steamships. The conversion to steam took a long time; even in 1914 only 18 per cent (in terms of tonnage) of Finnish merchant vessels was driven by steam, when almost all Danish and Swedish merchant vessels were steamships (actually, 83 per cent in both cases), as were two thirds of the four times larger Norwegian fleet.

The point concerning the possibility of importing British machinery (after the abolition of British export prohibition) can only be understood when set against the background of technology transfer in the 19th Century. Myllyntaus in his study of technology transfer to Finland details, among other things, the role played by imported machinery embodying advanced technology.[26] In the first half of the 19th Century, technologically-advanced machinery was almost uniquely British (and even later in the last century, though not with the same exclusivity). Therefore the prohibition of the export of such machinery was a significant hurdle on the road to industrialisation of a country like Finland. One way out was the recruiting of foreign (usually British) technicians. But the Finnish government did not favour immigration, and two statutes of the Czarist regime, in 1835 and 1848, restricted the recruiting of immigrant technicians and craftsmen. (Although some - such as Finlayson - did go to Finland, and he was not alone.) Given this situation, the lifting of the prohibition of machinery exports from Britain was a welcome step. Although the limitation of machinery imports from Britain was favourable to the infant Finnish engineering and machine-building industry, advanced technology was an important asset just at the time when industrialisation started to gather momentum: during the 30-year period of the K2 cycle's upturn, the first paper machines started production, engineering plants, a rolling mill, ceramic, leather and a few other factories commenced operations, mechanical pulp manufacturing took off (with 9 pulp mills in the 1870s alone), followed by chemical pulp works in the 1880s, and in 1871-83, 42 new corporations started in the sawmill and pulp industries alone. The sawmill industry was quite transformed when in 1861 it was

permitted to use steam power; sawmills moved to the ports from their sites inland, which had been tied to hydropower.

The second K-cycle has been associated with the railway boom. There certainly was a great change in the Finnish transport situation too, though railway building started late and only advanced slowly. Chronologically, the first major step was the opening of the Saimaa Canal in 1856; the first railway line connecting Helsinki and Hämeenlinna was ready in the early 1860s, and the Helsinki-St. Petersburg route opened before the end of that same decade.

In these 'railway' terms, Finland was still a peripheral country (not only geographically, but also in the sense of development): apart from Greece, Bulgaria, Romania and Serbia (that is, the Balkans), all other countries in Europe started their railway building earlier than Finland. And Finland was the country which finished the building of her eventual rail network the latest (second to Bulgaria); 47 per cent of Finland's final length of track was built after 1920.

By the end of 1859, the still very small Finnish industry found itself in a new situation: customs duties on Finnish goods exported to Russia were abolished or greatly reduced. Suddenly a new market was open to Finnish industrialists. The changes were spectacular: in the middle of the 1850s, the Finnish cotton industry employed 900 workers altogether; by 1870, one third of the Finnish industrial labour force (apart from those employed in sawmills and iron works) worked in the five cotton mills; Finlayson alone employed 2,300, another mill was almost the same size; by 1880, eight factories were classified as 'large' (producing one million FMK or more, they were rather large by international standards too): among them were three textile companies, two sugar refineries, and two pulp/paper mills.

To sum up, the second Kondratiev upturn accelerated Finnish developments. Bases for continued industrialisation were created but the economy remained almost completely agricultural, with forestry as the overwhelming creator of wealth and export earnings. The surplus population of eastern Finland and Ostrobothnia moved to Helsinki and the new industrial areas along the river Kymiijoki, to Kotka, Viipuri and Tampere, providing an industrial labour force, but the rural nature of the country hardly changed at all.

The economic advance was only disturbed once: by the crop failure and subsequent famine of 1867-8. Institutional developments in other areas were significant, with effects which only manifested themselves later. The introduction in 1866 of the compulsory school system resulted, for example, in the fact that by 1900 almost all persons of more than 15 years of age could read (and about 40 per cent could also write);[28] although this rate of literacy was nothing new in those days in the other Nordic countries, it was certainly fairly high compared with many other (otherwise more developed) countries in Europe or elsewhere, and was probably an important factor in Finland's later development.

Downturn in the last quarter of the 19th Century

According to Kondratiev's timing, the second upturn ended in 1874 and was followed by a 'down' phase that came to an end in the middle of the 1890s. Although interrupted by short-term cycles, these twenty years saw a 'growth recession': the average growth rate of national output rose in practically all countries, but at a considerably slower rate than in the K2 upturn phase. In some countries, fixed investment was particularly hard hit (in Britain, the average growth rate of investment activity was only ½ per cent

a year, in Germany it fell from 6½ per cent in the 25 years ending in 1874 to just over 1 per cent in the following 20 years); this, of course, left its mark on the Finnish economy, whose main export staple, timber, was primarily used in building and construction. Indeed, one of the worst peacetime recessions in Finland occurred in the years 1877 to 1886, which Hjerppe called the Long Depression, during which "GDP per capita fell and remained below the level prior to the depression up to 1886".[29] This was a great change as, apart from 1867/8, the years of severe crop failure and famine, "per capita income had already been increasing since at least the 1820s".[29]

An important development with serious consequences for Finland's economy was growing protectionism in Russia, leading to the abrogation of the 1859 settlement (which abolished or greatly reduced customs duties on Finnish goods); as from 1885 Finnish goods became dutiable again and, although they still enjoyed somewhat special treatment when imported to Russia, the competitive position in Russia of products of the still infant Finnish industry was decidedly weak in this overwhelmingly important market. The Finnish government started to grant loans for industrial modernisation, but industry had once again to turn to the domestic market, at least in the period of transition until exports to other countries could be built up.

Late developers nevertheless usually have one advantage: that whatever has been delayed - as compared to progress achieved elsewhere - will come to pass at a later time. This was the case with the Finnish railway. Railway construction started late; in the 1860s only 483 km had been built; another 369 km were added during the 1870s; but in the 1880s, the middle decade of the downturn, new railways exceeded a thousand kilometers (1,043

km to be precise) and another 755 km were added in the last decade of the 19th Century.

From humble beginnings, industrial development also advanced at a respectable pace (it is impossible to say how much faster it could have been had the outside world not passed a 'downturn'). By 1890, the metal/engineering industries had raised their share in total industrial production to 15 per cent from only about 7 per cent at the beginning of the decade. This was despite the protectionist measures taken by Russia - or perhaps even because of them, since Finnish works had to adapt to the higher requirements of other markets. Important in this advance was the coming on stream of the first open hearth furnace in Finnish steelworks. Some of the old industries were expanded and modernised in this period and new ones added, such as the first sulphate pulp mill and the first cellulose factory.

Urbanisation advanced slowly: the share of the population living in urban areas had reached 10 per cent by 1890 and continued to grow, reaching 13 per cent by 1900; whilst still extremely low when compared to almost any other country in the more developed countries of Europe (or to the other Nordic countries for that matter), it was nevertheless well up on the 6 per cent level in 1860.

The third cycle

The third cycle's upturn phase led from 1895 to the 1914-18 Great War. Output in Europe, including Russia, rose rapidly, in some countries two or three times as fast as in the previous twenty years; so did investment (table II). Demand for Finland's forest products increased accordingly. Industrial development in Finland continued, branching out into numerous

new areas such as rubber products, shoes, cement and other building materials, and more sophisticated products based on forestry, such as veneers and finer papers.

In the first five years of the K3 upturn, 1895-1900, the production value of the Finnish economy rose by 80 per cent; the export industries led the way - not only forest-based industries but also engineering/metals; later the progress continued at a more moderate pace because stagnation of agricultural exports (particularly butter) and rising imports limited the expansion of industry for the home market.

In the whole of this period, or more precisely from 1890 to 1913, Finnish GDP rose at an annual rate of 2.9 per cent. This was comparable to the German and French rates of growth in the same period, although somewhat behind that of Sweden. Labour productivity accounted for more than half of Finnish growth, 1.7 per cent a year - twice as high as in the preceding thirty years; this was due to two factors: the adoption of more up-to-date technology, and the growing share of industrial branches operating at a higher level of productivity.

Towards the end of this period, in 1913, there were 4,346 industrial enterprises employing 114,000; the bulk of the latter, 88,000, worked in the 1,294 limited (and other) companies which employed, on average, 68 persons (whilst the average employment in enterprises in individual ownership was only 8). Most of these were financed by domestic capital; foreign ownership was highest in the sawmill industry - about a quarter - but much smaller in other branches of the manufacturing industries and altogether, for all industries, the foreign stake was under 10 per cent; this contrasts sharply with the situation in Russia, where foreign interest in manufacturing in the same year was estimated at 44 per cent.[26]

In this prewar period, and even in the interwar years, the banking sector of Finland was relatively undeveloped. Between 1880 and 1940, those working in finance and commerce amounted to no more than between 2 and 3½ per cent of the working population; it was only after the Second World War that employment in these sectors started to increase rapidly.

There were considerable changes in Finnish agriculture as well. Dairy production expanded, the breeding of pigs, sheep and poultry expanded significantly - in some cases at the expense of grain production. Agricultural incomes rose fairly evenly; it has been calculated that in the three and a half decades to 1914 they rose by 2.8 per cent a year.[28]

The interwar years

According to Hjerppe[29] the disruption in per capita GDP growth caused by the 1914-18 Great War lasted "as long as ten years", and in the period 1913-20 GDP fell on average 1.4 per cent a year. The economic outlook of Finland in 1917 was indeed bleak as the Soviet Union (notably Lenin) accepted her declaration of independence. After the short but even darker period of civil war, the recovery started around 1920 from a low level. By then, 13 per cent of the working population was employed in industry, but the tertiary sector (banking, commerce, transport and all types of services) remained undeveloped; 19 per cent of the labour force worked in this sector, the same figure as in 1880. In the following twenty years to 1940, another 4 per cent of the labour force was added to both industrial and 'other' employment, at the cost of agriculture.

Although Finland was affected by the worldwide depression in the early 1930s, which had a severe impact on her economy around 1930, GDP grew significantly at an average rate of 4.4 per cent a year between 1920 and

1938. This was among the highest rates in Europe; only the indicator for Germany (the Third Reich in the last five years of that period) is comparable. Labour productivity in Finland also rose rapidly, at the annual rate of 2.8 per cent. According to Hjerppe, the contribution of services to GDP already exceeded that of both the industrial and primary sectors in this period.

Whilst in the interwar period as a whole these figures illustrate the rate of advance, it was by no means uninterrupted or even. First, it was only in 1922 that industrial production reached the prewar level; in the same early interwar years, after the cessation of cheap grain imports from Russia, Finnish agriculture started its long struggle towards more self-sufficiency. The next sub-period, 1922 to 1927-8, was that of general growth; new industries started, forestry exports were booming, industrial labour rose by 20 per cent and output by twice as much. Stagnation and downturn followed until about 1931-2, but the remaining years to 1939 were again better, with further considerable growth.

On the whole, the interwar years saw the renewed expansion of the forest-based industries. There was a widespread postwar building boom in Europe, and whilst formerly important sources of timber, Russia and Austria-Hungary, limited supplies (mainly for political reasons), the Finns were ready to step in: timber exports rose by 50 per cent between 1920 and 1927. But the world slump affected the timber trade; prices of sawn timber fell from a peak of 4.29 FMK/ft3 in 1927 to 1.51 in 1930, hitting forest-owning farmers.

In some years during this period forest products accounted for 85-90 per cent of all Finnish exports, making Finland the world's largest

exporter of sawn wood and plywood; pulp and paper exports also rose rapidly.[26]

Other manufacturing industries - and the economy as a whole - were disturbed immediately after the end of the War by rapid inflation: in 1921 the Finnish Markka stood at 9 per cent of its 1913 value; successful stabilisation followed in 1922 (and the gold standard in 1925). In the 1920s - in very general terms - the aim of manufacturing industry was to satisfy home demand. The earlier dependence on the Russian market, particularly in paper, textiles and metal goods, presented some difficulties when exporting to the Soviet Union became difficult, but this was soon overcome by the strengthening of home demand and also, in the 1930s, by the growing export of specialised manufactures to the West.

The worldwide depression made itself felt in the Finnish economy and industry in a number of ways: bankruptcies, shortages, growing unemployment, heavy debts of smallholders leading to compulsory auctions of properties, some banks stopping functioning or merged, and so on. The experience was painful and recovery took some time. Nevertheless, the interwar period of about twenty years was characterised by progress on all fronts and a few illustrations may help to demonstrate this perhaps better than the average growth rate of GDP quoted above:

- The urban population almost doubled between 1920 and the beginning of the Winter War;
- building and construction activity was lively; the number of construction workers rose from 21,400 in 1921 to over 40,000 by 1937;
- cement output doubled in the 1920s;
- the workforce of the Arabia company - in those days concerned mainly with ceramics - rose from a few hundred to over 2,000;

- the industrial workforce at the end of this period was about five times that in the beginning and the installed power supply in industry trebled to over one million HP;
- paper and pulp output rose fourfold;
- railway building continued: about one third of the final network, nearly 2,000 km, was built between 1920 and 1939;
- the metals/engineering industries developed rapidly, starting new branches and strengthening old ones (replacing the railway material seized by the Soviets - 10 per cent of locomotives and a third of other rolling stock - was one of the first tasks); the largest European copper mine at Outukumpu came on stream in 1932; exports of copper and small (but for Finland significant) sales abroad of ships, specialised machinery and tyres began;
- industrial production rose by 7½-8 per cent a year in the whole period (this means roughly doubling every ten years);
- the production of grains and potatoes doubled from 1920 to 1938.

By the end of the interwar period, on the whole a 'downturn' phase in most other parts of Europe, Finland was definitely further ahead than twenty years before, but it was still an agrarian country. The two big changes of urbanisation and industrialisation had begun but were still in their early stages; because these processes started late as compared with most other countries in the West, their progress was correspondingly fast; nevertheless, this did not yet change the fundamentally agricultural character of the country. Another twenty years had to pass before that major turn-around.

The postwar cycle

Finland had to pass through some very traumatic years before her economy started on the upward trend of the post-reconstruction years. In the early years of the 1939-45 World War, Finland had her separate Winter War with the Soviet Union: her subsequent modest participation in the German-Russian War ended with the armistice in 1944 which obliged the Finns to neutralise the German army operating from her territory; this was easier said than done, and ended with the Germans scorching northern Finland and Lappland. Eventually, in February 1947, came the peace treaty in Paris. Finland had to pay reparations amounting to $300 million in 1938 values over six years (reduced in 1948 by $73½ million), apart from many other obligations, such as the cost of the allied control commission and many other items; it has been estimated that the total direct costs amounted to $949 million in 1944 values. Equally painful - or even more so - was the loss of territory; 13 per cent of Finland had to be ceded to the Soviet Union, including Viipuri and Karelia. This area contained 30 per cent of total hydropower capacity, a tenth of industry, 9 per cent of the cultivated agricultural area, 12 per cent of forests, together with plants for between 12 and 25 per cent of the national capacity of various forest products.

Thus, after the six years of war, when the economy was disrupted, Finland was facing enormous burdens and exceedingly challenging tasks. Nevertheless, Finland refused Marshall Aid because of the political ties this would have implied, although she did receive considerable loans, mainly from the US and Sweden, which helped her to restructure her economy. Eventually Finland was the only country which completely fulfilled her obligations to repay war debts. But it took a long time before the prewar

level of production and standard of living were reached again and then surpassed.

Only about one third of the reparation payments (stipulated all in kind) were relatively easy - for want of a better expression - to perform: those were timber and wood products, pulp and paper (28 per cent of all reparations) and ships requisitioned from the existing Finnish merchant fleet (valued at 6 per cent). The rest were new ships, machinery, industrial equipment and cables (altogether 66 per cent); for these Finland either had no capacity at all, or the existing capacity was far from sufficient. Thus capacity had to be created. This required wholesale restructuring and expansion of Finland's industry; in the course of these developments the modernisation of industry and the transformation of the earlier mainly domestically-minded industry into export-orientation was also achieved. With the benefit of hindsight it is perhaps permissible to say that the reparation obligations were a blessing in disguise - admittedly, at the price of enormous sacrifices - because they forced Finland to carry out 'instant' industrialisation, which otherwise might have taken much longer and which created the industrial base that helped Finland to progress very rapidly after the painful years of transition.

There were two factors which helped. First, in the initial year of reparation, only 20 per cent of the deliveries were expected in metal goods (for which capacity was still missing), a proportion which rose to 60 per cent in the second year and to 70 per cent thereafter. Secondly, the Soviets did not interfere in Finnish economic life at all (as they did in the cases of Hungary and Romania, who carried similar reparation burdens).

Altogether, the burden of war reparations amounted to 5.2 per cent of net national product in the first three years, reducing to 2.2 per cent in

the subsequent three years, or on average 3.7 per cent over the whole period of 6-7 years.

The reparation payments came to an end in 1952 - but exports to the Soviet Union continued. From 1953 onwards, however, the whole of Finnish production served to raise the standard of living, whilst beforehand a good deal of economic advance (to the extent of 3.7 per cent a year) went towards repayment of war debts. And that advance was spectacular. According to Hjerppe,[29] GDP rose by about 4¾ per cent a year between 1946 and 1974; it was interrupted by the deepest postwar recession to hit the whole of the Western world in 1975-7, and then resumed its increase at a more moderate rate. A high share of this increase in output was due to the rising productivity of labour (table IV).

Table IV. The growth of real GDP and labour productivity in the postwar period

	Annual per cent changes		
	1946-60	1960-74	1974-85
GDP	4.9	4.5	2.9
Labour productivity	3.5	4.6	3.4

Source: Reference (29).

These estimates are similar to those of Myllyntaus, according to whom GDP grew at 4.4 per cent a year and industrial production by 5.7 per cent in the period 1948-80.[26]

In some shorter periods of the postwar era, just a few European countries succeeded in raising their national output faster than Finland, or at about the same rate (such as in the 1950s Germany and Italy at nearly 7 per cent a year, or Switzerland at 4.9 per cent), but over the whole long

period, the Finnish progress was among the fastest (or perhaps the fastest) in Europe.

It was in the middle of the reparation period that Finnish foreign trade recovered, as a result of the Korean commodity boom. In 1951 the price index for wood products was 51 per cent higher than the average in 1950 - and 1951 was the first year since the War that Finland had a balance of payments surplus.

Although the reparation obligations forced Finland to expand and modernise her industry, that was only the beginning of postwar industrialisation. Very significant further development followed in the course of which two parallel courses were pursued: promoting the adoption of the most up-to-date technology in the more traditional industries, and finding those niches where Finnish expertise could produce goods that, by their specialisation, sophistication or design, proved to be competitive in international markets. Various infrastructural developments supported this, such as a much improved transport and communications system and the vast expansion of higher education (university and other types).

The forests remained one of the mainstays of Finnish industry and exports. In 1950, 90 per cent of all exports consisted of forest products; this share was reduced to 40 per cent by 1987. Less processed varieties (roundwood, sawn wood, pulp) gradually gave way to more highly processed ones. In the 1980s, the metals/engineering industries' exports equalled those of forest products, and consisted not mainly of metals and heavy machinery as earlier, but of more sophisticated products too (for example, in the 1980s Finland became a net exporter of consumer electronics).[30]

In 1969, Finnish crude steel production amounted to under a million tonnes; after expansion, steel output in the early 1980s was nearer to 2½

million tonnes, rising at times when the steel industries elsewhere in Europe and the US were struggling in an extreme depression. Modern technology, a flexible approach to market needs, and good labour relations, as well as the growing needs of the rapidly advancing Finnish engineering and metal-using industry, provide the explanation for this expansion.

Finnish shipbuilding also fared much better than its opposite numbers in other countries, where many shipyards were closed down for good; in the past 10-15 years, two thirds of the world's icebreakers and one third of cruise liners have been built in Finnish yards, as were all Arctic drilling rigs, as well as many of the arctic carriers, scientific research ships, ferries, natural gas carriers, container ships and timber transport vessels.

A high degree of specialisation and the adoption of microprocessor technology have characterised the best known areas where Finnish engineering had become outstanding in the postwar decades: cranes and lifts; power generators, transformers and high-voltage cables; and plant and machinery for the timber, pulp and paper industries.

Growth was not limited to engineering alone: in the 1960s, consumer goods industries, particularly textiles and clothing, were among the fastest growing. The chemical industry - and later on petrochemicals - also advanced rapidly; it was based originally on agriculture and forestry and made good use of the biochemical work of Artturi Virtanen, who received the Nobel Prize in 1945 for his research in precisely this area. Branches allied to the chemical industries started successfully even in the interwar years (cellulose was the basis of artificial fibre production launched in 1938, the Finnish rubber industry was the first to produce winter tyres

before the War), but chemical exports became more important after the heavy investment which started in the 1960s.

Progress was not restricted to industry alone. Although the share of agriculture in GDP fell continuously, and employment in agriculture fell to 11 per cent of the total workforce in 1985 (it was as high as 59 per cent in 1940), by around 1980 it produced more than was needed for self-sufficiency in dairy products, beef, pork and eggs, 60-75 per cent of domestic needs for bread grains, greenhouse vegetables and sugar, apart from making a contribution to exports too. In the twenty years from 1949-51, the production of grains and sugarbeet doubled, the number of poultry, pigs and cattle (in this order) rose - but that of horses and sheep was greatly reduced - and reindeer breeding trebled. Despite its development, Finnish agriculture escaped being dominated by huge agro-industrial complexes: although the number of smallholdings of under 25 acres was reduced, family-operated farms with 25 acres of arable land and 85 acres of forest land still predominated.

The most rapid expansion was in the tertiary sector. In 1940, about a quarter of the working population was employed in services; this share grew to 54 per cent by 1980 and further to 57 per cent by 1985. The distribution of the labour force became very similar to that in other comparable industrial countries: about one third in industry, which has recently started to decline, over half (and growing) in services, and just over a tenth in agriculture, forestry and fishing. The fastest growing sectors in recent years have been financial institutions and business services.

The mono-cultural nature of the Finnish economy now belongs to the past. The forests remain by far the most important natural resource for

the Finns, and forest products will always be important in the national economy, but other sectors have 'grown up'. This is clearly illustrated by the classification of the top 40 Finnish companies (outside banking and finance), among which only five are forestry-based (table V).

Table V. The top 40 Finnish companies by sector

Mining	1	Metals	1	Air transport	1
Forest products	5	Engineering	3	Wholesale trade	7
Food	1	Electrical	1	Retail trade	2
Chemicals	3	Construction	3	Multiples	12

Source: Finn Facts, 6-7/87.

It was in the postwar period that Finland became more urbanised, later than most countries in Europe. Only since 1970 has the share of the rural population fallen below 50 per cent. This process had been gradually accelerating however. In 1880, 8½ per cent of the population lived in urban municipalities; a hundred years later, in 1980, this figure was about 60 per cent. The rate of growth of the urban population averaged 3 or 4 per cent from 1880 to 1950, but grew to 9 per cent in the next thirty years to 1980.[31] Thus, in the postwar period, Finland not only became a highly industrialised country, but also an urbanised one.

V. CONCLUDING THOUGHTS

Our initial question was: how did the long cycles in the world economy affect the Finnish economy (if at all)? Despite the fairly detailed discussion, it is not easy to give a straightforward answer, because of the unique nature of the Finnish society and economy, stemming from its similarly unique history.

The first Kondratiev cycle did not have much visible effect on the life of the Finns, whose Swedish overlords gave way to the Russians during the period of the first upturn. The second wave, characterised by the railway boom, had some effect on the Finnish economy, but its direct impact is difficult to separate from the introduction of a more liberal regime (which was an internal affair). Development in Finland - albeit starting from a very low level - continued during the downturn phase of the long wave and into the third upturn, which lasted until the 1914-18 War. At the time of independence, in 1917, Finland was still an agricultural country; although her forestry, together with the industries based on forestry, provided a good base for export earnings and, given the wide distribution of forest land ownership, for rising domestic income, her other industries were of local significance only. The workforce employed in industry remained small in number.

Although interrupted by the world crisis around 1930, development continued rapidly in the interwar years. This brisk advance was 'against the tide' in the downturn phase of the long cycle when the general development of the world economy was far from favourable and certainly not comparable to the Finnish progress. The events of the 1939-45 World War were traumatic: a painful loss of manpower, of area, of a sizeable part of industry, and burdensome reparation obligations. Eventually this war debt, which was to be paid in actual industrial products, forced Finland into accelerating industrialisation. Old industries had to be modernised and new ones created in order to fulfill the treaty obligations; once this was done, the Finnish industrialists were successful enough to find those areas, niches in the trade network, where they could stand up to international competition.

Thus, the fourth 'upward' phase of the long cycles safely launched Finland from its earlier peripheral rearguard into the 'avant-garde' of the Western countries.

*

Finland's postwar progress has indeed been spectacular. Senghaas noted that in the interwar period (1925-34) Finnish average national income per capita was comparable to those in some other countries, such as Italy, Greece, Hungary, Poland, Yugoslavia and Japan; but, apart from Japan, none of these countries registered an economic advance comparable to that of the Finns.[25] Myllyntaus also found features that make Finland comparable with Japan,[26] such as long isolation, agrarian structure at the take-off, nationalism parallel with the use of foreign experts, high cultural levels facilitating the introduction of modern technology; he added that in the Finnish case other aspects also helped, among them a fairly advanced infrastructure (in terms of institutions, administration, education and health), progressive local government, lack of feudalism, and hence limited class division and a free society with great social mobility.

Looking back at earlier sections of this study, it can also be said that the Finnish entrepreneurs, and the Finnish economy in general, shared those features which made - at an earlier period in time - Switzerland a progressive industrial country: flexibility, an innovative spirit, readiness to embrace novel technologies or products, and the successful fight for a place in the international division of labour.

* *

From the point of view of the long cycle theory there is one aspect that stands out: although in some respects (for example, forestry exports) the Finnish economy was not free of the depressing effect of the downturn of the cycle, in the downturn phases of the second and particularly the third Kondratiev cycle (that is, in the interwar decades) Finnish economic and industrial progress was rapid, albeit from relatively low levels.

This does not invalidate the long cycle in general but points to the importance of special factors: the path of 'late developers', the specific historical geopolitical and social conditions and other national characteristics. These, working together, may permit a small country to continue progressing even at times of relatively unfavourable economic conditions elsewhere, against the 'down' phase of the long cycle.

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STATISTICAL COMPENDIUM

Historical statistics are not easy to come by. Some of them are estimates, of limited reliability, and many of the statistical information which is taken for granted nowadays did not exist even in an estimated form. Nevertheless, the presentation of a selected series of international and Finnish information going back as far as possible is believed to be of help to those interested.

The collection of statistics that follows aims at supporting the text. It is obviously not complete, but this was not the purpose.

The compendium is in three main parts: the first contains international tables for comparing various phenomena in a possibly large number of countries, mainly but not exclusively in Europe; the second section consists of Nordic comparisons, covering the four Nordic countries; and the last part contains purely Finnish statistics. The overlaps will be clear: Finland is included in the international as well as the Nordic comparisons and the last, exclusively Finnish section is restricted to those additional data that are not included in earlier tables.

A wide array of selected indicators is shown in the first table; they are meant to accompany those parts of the main text that deal with the long cycles. The distribution of the working population, for which data covering well over a century are presented, is supposed to be a characteristic feature of development.

Economic historians have devoted considerable attention to the development of real income; their estimates often differ, depending on the method used. We present here two sets of estimates which together spread over seventy years, in order to illustrate the levels and changes in

various countries and - particularly - to assess Finland's place in this kind of comparison.

The clearest among Kondratiev's cycles was the second one, which Schumpeter identified with the railway boom. This is why the railway building activity has been analysed in two large tables.

When did the first daily newspapers start in the various countries? In itself, this is not something that many would consider too exciting, yet it points to the cultural level and the commercial development.

The Nordic comparison starts with population over a long period. The use of energy reflects, to some extent, the degree of economic activity and also the welfare of the population, particularly if followed over longer periods. For the same reason, a number of other indicators have been included in this Nordic comparison, such as motor vehicles in use, radio and television and aviation.

Although there is some comparable information on industrial production in general in the international part, other direct comparisons, restricted to the Nordic countries, can be found on specific commodity production, such as cement, textiles, beer and a couple of basic chemicals. A few selected aspects are also included in the Nordic section, such as farm mechanisation, fertilizer use, basic data on forests (uniquely important for Finland), manufacturing establishments and rural/urban population, indicating that as late as 1948 Finland was still among the least urbanised countries in Europe.

The last table in the Nordic section compares the mid-1980 situation in the four countries by means of many indicators. Although a '1985 snapshot' may not organically belong in this collection of mainly historical statistics, Finland's contemporary position is of interest.

The Finnish section starts with a list of 'firsts'; no list of this type can be complete, but it was believed that certain benchmark dates may help. Some of the data already covered in earlier tables are repeated in this third part in order to give more detailed information or to indicate their values in other periods. Real GDP and productivity, the distribution of the working population and a couple of other aspects belong in this category. The war reparations - particularly by commodity - are probably of great importance; they contribute to the understanding of industrial growth in Finland.

The index of industrial production, in our case, goes back to 1926; its changes are analysed in a chart that clearly indicates the short and medium-term cycles in industrial activity, which is otherwise represented by just a few data (of course, quite a few others are in the previous tables). There is more on agriculture and forestry, particularly on the exports of forest products.

Though some tables contain series up to the middle of the present decade, many of them conclude with 1969. The reason is partly convenience and partly also the recognition that a paper on long cycles is fundamentally addressing history and although the recent past and the present are of undoubted prime importance, their statistical data do not necessarily belong here.

Many of the statistics presented in this compendium are directly relevant to the main text of this paper; others, whilst not quoted or mentioned in the text, may usefully complete the picture.

The compendium concludes with four charts, covering long periods of the growth rates of GDP in Finland, the distribution of the workforce by sector, the annual per cent changes in the index of production in industry and the exports of forest products.

Sources

The main sources used when compiling this compendium were:

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Contents of the statistical compendium:

(i) International tables:

1. Selected indicators of development in Europe from around 1800 to 1913
2. Distribution of the working population, 1805-1985
3. Industrial employment, 1880-1985
4. Colin Clark's estimates of real income, productivity and industrial production in selected countries, 1913-1952
5. Per capita income in OECD countries and the USSR, 1938-85
6. Railway lines open, 1825-1939 (two pages)
7. Railways: analysis of selected aspects, 1820-1939
8. Newspapers, 1605 onwards

(ii) Nordic comparisons:

N1. Population, 1750-1985
N2. Energy: imports and electiricity generation, 1860-1969
N3. Television sets/lcences and telephones, 1967-83/5
N4. Energy consumption, 1929-1985
N5. Motor vehicles in use, 1925-69
N6. Aviation, 1930-69
N7. Radio-television licenses, 1930-69
N8. Farm mechanisation and fertilizer use, 1939-51
N9. Forests, 1950
N10. Production of cement, sulphuric acid and superphosphates, 1929-50
N11. Manufacturing establishments, 1948
N12. Rural and urban population, 1948
N13. Textiles, 1850-1969
N14. Beer production, 1932-1969
N15. Urbanisation in the Nordic countries, 1860-1910
N16. Merchant fleets of the Nordic countries, 1852-1914
N17. Nordic exports of timber and pulp, 1870-1910
N18. The Nordic countries in the mid-1980s

(iii) Finnish statistics:

F1. Some notable 'firsts'
F2. Growth of real GDP and labour productivity, 1860-1985
F3. Industrial enterprises and employment in 1913
F4. Distribution of the working population, 1805-1960
F5. War reparations, 1944-52

F6. Industrial production index, 1926-1969
F7. Production of pig iron and crude steel, 1850-1969
F8. Exports of forestry products, 1870-1969, m3 and tonnes
F9. The growth and pattern of manufacturing, 1960-86
F10. Size of farms, 1945-48
F11. Agriculture: selected indicators, 1910-80
F12. Exports of forest products, shares in export earnings, 1950-80
F13. Agricultural production: grains, potatoes and sugarbeet, 1879-1969
F14. Agriculture: livestock and allied production, 1881-1969

Chart F1. Growth rates of GDP, 1860-1985
Chart F2. Distribution of the workforce by sector, 1805-1985
Chart F3. Volume of GDP and industrial production, 1926-85
Chart F4. Exports of forest industry products, 1870-1985

Table 1. Selected indicators of development in Europe from around 1800 to (mainly) 1913

	GREAT BRITAIN	AUSTRIA-HUNGARY	BELGIUM	FRANCE	GERMANY	ITALY	SWEDEN	FINLAND
1. Population, million (1913 boundaries)								
1800	10.5	..	3.1	27.3	..	17.2	2.3	0.8
1850	20.8	30.7	4.3	35.8	34.0	24.4	3.1	1.6
1870	26.1	35.8	4.8	36.1	40.8	26.8	3.9	1.8
1900	37.0	45.5	6.6	39.0	56.4	32.5	5.1	2.7
2. Output of grain crops, annual averages, million quintals								
1845-54	64.0	100.6	..	146.6	122.6	..	10.5	..
1865-74	70.0	131.5	..	160.1	204.8	73.1	15.6	7.5(1878
1905-14	51.7	217.6	..	171.9	457.9	88.8	26.1	12.8
3. Farm livestock, cattle, sheep and pigs combined in the proportion 5:1:2, i.e. sheep equivalent, millions								
1870	59.8	97.6	..	91.8	123.0	28.2	12.1	6.3(1881
1910	67.0	115.7	..	103.6	150.4	48.6	16.7	8.2
4. Index of industrial production, 1905-13=100; value index for Sweden, volume for others; Austria only, excl. Hungary, averages for the periods.								
1781-1790	3.8	..	..	10.9	..	..	..	..
1815-1824	9.5	..	..	16.3	..	..	..	..
1845-1854	27.5	..	..	33.7	11.7	..	2.2	..
1855-1864	36.6	..	..	42.6	15.0	34.6	4.1	..
1875-1884	60.6	39.1	..	58.6	33.0	50.2	10.7	..
1895-1904	85.2	74.4	..	82.7	68.9	64.8	58.4	..
1904-1913	100	100	..	100	100	100	100	..
4a. Average annual % change from previous period in the index of industrial production; the Belgian growth rate is for 1901-1913								
1815-1824	2.7	..	..	1.2	..	..	..	..
1845-1854	3.6	..	..	2.4	..	..	..	..
1855-1864	2.9	..	..	2.4	2.5	..	6.4	..
1875-1884	2.5	..	..	1.6	4.0	3.8	4.9	..
1895-1904	1.7	3.3	..	1.8	3.8	1.3	8.8	..
1904-1913	1.6	3.3	4.0	2.1	4.2	4.9	6.2	..
5. Output of coal and lignite, annual averages, million tonnes								
1820-1824	17.7	0.1	..	1.1	1.2	..	..	..
1830-1834	22.8	0.2	2.4	2.0	1.9	..	..	..
1850-1854	50.2	1.4	6.8	5.3	9.2	..	..	..
1870-1874	123.2	9.9	14.7	15.4	41.4	0.1	0.05	..
1890-1894	183.2	27.5	19.9	26.3	94.0	0.3	0.20	..
1910-1913	275.4	50.7	24.8	39.9	247.5	0.6	0.36	..
6. Output of pig iron, annual averages, million tonnes								
1820-1824	0.42	0.07	..	0.15	0.08	..	..	..
1850-1854	2.72	0.22	0.20	0.56	0.25	..	..	0.007
1890-1894	7.40	0.98	0.76	2.00	4.33	0.01	..	0.023
1910-1913	9.79	2.20	2.17	4.66	14.84	0.37	..	0.009
7. Output of steel, annual averages, million tonnes								
1870-1874	0.49	0.06	..	0.13	0.21	..	0.02	..
1890-1894	3.19	0.55	0.28	0.77	2.89	0.22	0.17	..
1910-1913	6.93	2.45	2.28	4.09	16.24	0.98	0.51	0.007

continued

Table 1. continued

	GREAT BRITAIN	AUSTRIA-HUNGARY	BELGIUM	FRANCE	GERMANY	ITALY	SWEDEN	FINLAND
8. Capacity of steam engines, millions of horsepower; Austria excludes Hungary								
1840	0.62	0.02	0.04	0.09	0.04	0.01	..	..
1850	1.29	0.10	0.07	0.27	0.26	0.04	..	..
1870	4.04	0.80	0.35	1.85	2.48	0.33	0.10	..
1896	13.70	2.52	1.18	5.92	8.08	1.52	0.51	..
9. Raw cotton consumption, annual averages, thousand tonnes								
1781-1790	8.1	..	..	4.0	..	..	0.3	..
1825-1834	105.6	6.8	0.1	33.5	3.9	..	0.3	0.1
1855-1864	369.4	32.7	10.9	74.1	42.0	1.8	5.1	0.7
1885-1894	691.8	96.9	25.3	127.0	208.2	73.2	12.7	3.8
1905-1913	868.8	191.4	83.3	231.1	435.4	186.0	20.4	7.8
10. Raw wool consumption, annual averages, thousand tonnes								
1801-1814	49.6	..	..	44.0	..	..	..	..
1825-1834	66.1	..	..	66.5	20.1	..	..	..
1855-1864	107.4	31.2	..	110.4	38.2	12.4	..	..
1885-1894	193.6	37.5	..	229.5	147.0	19.8	..	..
1905-1913	232.6	54.2	..	253.7	190.7	36.3	..	..
11. Railway lines open, thousand kilometres (more details in later tables)								
1840	2.39	0.14	0.33	0.50	0.47	0.02	..	..
1860	14.60	4.54	1.73	9.17	11.09	2.40	0.53	0.11
1880	25.06	18.51	4.11	23.09	33.84	9.29	5.88	0.89
1900	30.08	36.33	4.59	38.11	51.68	16.43	11.30	2.93
1910	32.20	43.28	4.68	40.48	61.21	18.09	13.83	3.65
12. Production of electrical energy, billions of kWh; Austria(1920 boundaries) alone								
1907	2.7	..	..	0.7	3.2	0.9	0.3	..
1913	4.8	..	..	1.8	8.0	2.2	1.4	..
1920	8.5	1.77	1.3	5.8	14.5	4.7	2.6	..
1930	17.7	2.50	4.4	16.9	29.1	10.7	5.1	0.01
13. Registered motor vehicles and (production), thousands, cars and commercial vehicles								
1905	32	..	..	22(14)	27(3)	..	..	..
1913	208	12	10	125(45)	93(20)	24	..	..
1930	1524(233)	32	159	1460(232)	679(96)	293(47)	145(2)	37
1938	2422(445)	49	233	2251(227)	1816(338)	469(71)	220(7)	53
14. Illiteracy, approx.percentage of adults. England and Wales 30-33%, Scotland 20%; Austria excludes Hungary and the Italian possessions; all Germany less than 30%, Prussia alone 20%. The figures concern the years around 1850.								
around 1850	20-33	40-45	45-50	40-45	20-30	75-80	10	..

Table 2. Distribution of the working population

Percentages in total. A = agriculture, forestry and fishing;
I = industry (prior to 1962 exclusively and in later years chiefly, manufacturing
O = all other activities

FINLAND	A	I	O
1805	82	4	14
1880	71	10	19
1920	68	13	19
1940	59	17	24
1960	36	23	41
1970	23	35	42
1980	12	34	54
1985	11	32	57
DENMARK			
1850	49	22	29
1880	50	24	26
1930	29	22	49
1962	18	40	42
1980	8	29	63
1985	7	28	65
NORWAY			
1891	50	23	27
1930	35	20	45
1950	26	26	48
1962	22	36	42
1980	8	30	62
1985	7	28	65
SWEDEN			
1860	64	17	19
1880	59	11	30
1900	56	13	31
1945	25	30	45
1962	13	41	46
1980	6	32	62
1985	5	30	65
RUSSIA/USSR			
1897	59	13	28
1959	46	35	19
FRANCE			
1856	52	22	26
1886	47	20	33
1962	21	40	39
1980	9	36	55
1985	8	32	60
GERMANY a			
1882	48	27	25
1962	14	49	37
1980	6	45	49
1985	5	41	54

ITALY	A	I	O
1881	51	20	29
1962	27	41	32
1980	14	38	48
1985	11	34	55
U.K.			
1841	22	36	42
1881	13	36	51
1921	7	36	57
1962	4	48	48
1980	3	38	59
1985	3	32	65
AUSTRIA			
1939	39	25	36
1962	23	43	34
1980	11	40	49
1985	9	38	53
BELGIUM			
1846	51	32	17
1880	40	29	31
1930	17	36	47
1962	6	47	47
1980	3	35	62
1985	3	30	67
NETHERLANDS			
1849	44	19	37
1889	35	23	42
1962	10	42	48
1980	6	32	62
1985	5	28	67
SWITZERLAND			
1890	30	42	28
1941	21	36	43
1962	11	49	40
1980	7	40	53
1985	6	38	56
SPAIN			
1887	69	16	15
1910	56	14	30
1940	52	19	29
1962	42	32	26
1980	19	36	45
1985	17	32	51

IRELAND b	A	I	O
1841	51	27	22
1881	42	16	42
1962	35	26	39
1980	19	32	49
1984	16	29	55
HUNGARY c			
1857	80	10	10
1890	78	10	12
1920	58	16	26
1930	53	21	26
1960	38	26	36
1985	21	31	48

NOTES:

(a) From 1962 onwards: West Germany.

(b) From 1962 the Republic of Ireland.

(c) Prior to 1920, historical ('Greater') Hungary.

Table 3. Industrial employment

Per cent of labour force

Date	around 10%	around 15%	around 20%	around 25%	around 30%	over 32%
around 1880	Finland Sweden Russia Hungary	Spain Ireland	Netherl. France Italy Norway	Denmark Germany	Belgium	Britain Switzerl.
around 1930	—	Finland	Denmark Norway Spain Ireland Hungary	Sweden Austria	France Italy Netherl.	Germany Britain Belgium Switzerland
around 1960	—	—	—	Finland Ireland Hungary	Spain	Denmark Norway Sweden Russia(USSR) France Germany Italy Britain Austria Belgium Netherl. Switzerl.
1985	—	—	—	—	Finland Denmark Norway Sweden France Britain Belgium Netherl. Spain Ireland	Germany Italy Austria Switzerl.

Table 4. Colin Clark's estimates of real income, productivity and production in selected countries, 1913-52

FINLAND = 100 throughout

YEAR	DENMARK	SWEDEN	NORWAY	AUSTRIA	SWITZERLAND	UK(GB)	NETHERLANDS
(i) Real income per head of population							
1913	242	128	124	113	159	288	211
1924	287	177	174	136	202	289	220
1927	229	156	148	111	189	255	195
1930	255	170	156	120	205	263	209
1934	225	153	135	84	177	236	163
1938	205	162	137	78	161	221	165
1946	216	204	148	40	219	228	148
1950	186	184	136	74	188	177	149
1952	..	170	129	75	176	162	136
(ii) Real product per man-hour							
1913	179	93	85	76	102	179	127
1927	196	121	138	98	134	200	147
1938	187	142	139	95	141	191	169
1950	158	156	132	76	148	138	145
(iii) Industrial production (in 'international units', net)							
1910-13	274	708	164	398	493	4838	541
1920-24	292	620	158	254	370	4636	558
1925-29	184	496	111	221	257	3495	442
1930-34	209	577	115	165	207	3351	499
1935-38	177	539	99	152	126	2957	429
1948	137	610	110	108	..	2875	379
1950	141	559	103	146	..	2444	400
1952	123	541	112	158	..	2318	394

Table 5. Per capita income in OECD countries and USSR, 1938-85

Ranking	1938			1948			1968			1985		
		Ø	SF**		Ø	SF**		Ø	SF**		Ø	SF**●
1	USA	579	343	USA	1525	268	USA	4380	256	USA	16494	150/144
2	UK	465	275	Switzerl.	950	167	Sweden	3230	189	Switz.	14195	n
3	Sweden	449	266	Sweden	805	141	Switzerl.	2790	163	Norway	13960	127/123
4	Switz.	440	260	Denmark	781	137	Denmark	2540	149	Sweden	12006	109/110
5	Norway	345	204	UK	777	137	France	2530	148	Denmark	11312	103/108
6	Germany	335	198	Belgium	646	114	Norway	2360	138	Finland	11024	100/100
7	Netherl.	314	186	Finland	569	100	Germany	2200	129	Japan	10997	100/102
8	Belgium	262	155	Norway	550	97	Belgium	2160	126	German.	10243	93/106
9	Denmark	308	182	Netherl.	487	86	Netherl.	1980	116	France	9251	84/99
10	France	260	154	Ireland	485	85	UK	1850	108	Austria	8743	79/93
11	Ireland	250	148	France	418	73	Finland	1710	100	Netherl.	8628	78/99
12	Finland	169	100	Austria	368	65	Austria	1550	91	Belgium	8022	73/94
13	Austria	154	91	Germany	360	63	Japan	1400	82	UK	7943	72/95
14	Italy	133	79	Italy	225	40	Italy	1390	81	Italy	6278	57/83
15	USSR	105	62	USSR	181	32	Ireland	1070	63	Ireland	5123	46/62
16	Japan	86	51	Japan	143	25	USSR(?)	n	n	USSR(?)	n	n

*1938 from Woytinsky; other years from OECD. Australia and New Zealand omitted, but USSR included.

** SF: Finland=100.

● The second figure in the last column (eg 144 for the USA) indicates the comparison on PPP (Purchasing Power Parities) basis; Finland ranks no 8 on PPP basis.

n: not available.

Germany means West Germany.

Table 6. Railway lines open, 1825-1939

Kilometres and index numbers (in the second line for each country), 100 = as indicated

Boundaries as in year shown.

Country	Year of first railway	1850	1860	1870	1880	1890	1900	1910	1913	1920	1939	% of 1939 length built after 1920
AUSTRIA-HUNGARY	1837	1357	2927	6112	11429	15273	19229	22642	22981	/6639	6700	1
		6	13	27	50	66	84	98	100	..	..	
BELGIUM	1835	854	1729	2897	4112	4526	4562	4679		4938	5140	4
		17	34	56	80	88	89	91		96	100	
DENMARK	1847	30	109	770	1584	2005	2914	3445		4328	5294(1930)	22
		1	2	15	30	38	55	65		82	100	
FINLAND	1861	-	-	483	852	1895	2650	3356		3988	5864	47
				8	15	32	45	57		68	100	
FRANCE	1828	2915	9167	15544	23089	33280	38109	40484	/	38200	42600	26
		7	22	36	54	78	89	95		(90)	100	
GERMANY	1835	5856	11089	21471	33838	42869	51678	61209	63378	/57546	58841(1935)	2
		9	17	34	53	68	82	97	100			
GREECE	1869	-	-	12	12	697	1033	1573		2396	2976	24
				1	1	23	35	53		81	100	
IRELAND	1840(48)	865	2195	3201	3816	4496	5125	5476	5491	..	..	..
		16	39	58	69	82	93	100	100			
ITALY	1839	620	2402	6429	9290	13629	16429	18090		20385	23046(1935)	13
		3	10	28	40	59	71	78		88	100	
NETHERLANDS	1839	176	335	1419	1841	2610	2771	3190		3606	3677	2
		5	9	39	50	71	75	87		98	100	
NORWAY	1854	-	68	359	1057	1562	1981	2976		3286	3968	21
			2	9	27	39	50	75		83	100	
PORTUGAL	1854	-	67	714	1144	1932	2168	2448		3268	3582	10
			2	20	32	54	61	68		81	100	
RUSSIA/USSR	(1836)45	501	1626	10371	22865	30596	53234	66581		71600	86400	21
		1	2	12	26	35	62	77		83	100	
SPAIN	1848	28	1649	5295	7490	10012	13214	14684		15886	17446	10
		1	9	30	43	57	76	84		91	100	
SWEDEN	1856	-	527	1727	5876	8018	11303	13629		14869	16599	12
			3	10	35	48	68	83		90	100	
SWITZERLAND	1847	25	1053	1421	2571	3243	3867	4463		5078	5132	1
		1	21	28	50	63	75	87		99	100	
GREAT BRITAIN	1825	9797	14603	21553	25060	27827	30079	32184		32707	32849(1925)	½
		30	44	66	76	85	92	98		99	100	
SERBIA	1884	-	-	-	-	540	571	892	976	..	..	..
						55	59	91	100			
BULGARIA	..	-	-	224	224	803	1566	1897		2205	3352	52
				7	7	23	47	57		66	100	

continued

Table 6. continued

Country	Year of first railway	1850	1860	1870	1880	1890	1900	1910	1913	1920	1939	% of 1939 length built after 1920
ROMANIA	..	-	-	248	921	2424	3100	3437	3549	/10585	11310	7
				7	26	68	87	97	100			
CZECHOSLOVAKIA	..									/13420	13595	1
HUNGARY	..									/ 8141	8671	7
POLAND	..									/19281	20438	6
YUGOSLAVIA	..									/ 9321	10521	13

* From 1920, Austria alone.

NOTE: A stroke '/' indicates major territorial change, particularly around 1920.

Table 7. Railways: analysis of selected aspects

I. Railway building started

before 1830	1830-39	1840-49	1850-59	1860-69	1870 and later
Britain France	Belgium Germany Italy Netherl. Austria-Hungary	Denmark Ireland Russia Spain Switzerl.	Norway Portugal Sweden	Finland Greece Bulgaria Romania	Serbia

II. 50% of the longest pre-1940 rail network built in decade ending

1870	1880	1890	1900	1910
Belgium Britain Ireland	Austria-Hungary France Germany Netherl. Switzerl.	Italy Portugal Spain Serbia Romania	Denmark Norway Russia Sweden	Finland Greece Bulgaria

III. Addition to the rail network after 1920 (in % of eventual length)

0-5%	5-10%	10-20%	20-30%	30% and over
Austria Belgium Germany Netherl. Switzerl. Britain Czechoslov.	Romania Hungary Poland	Italy Portugal Spain Sweden Yugoslavia	Denmark France Greece Norway Russia/USSR	Finland (47%) Bulgaria (52%)

Table 8. Newspapers

I. First newspaper published in selected countries (year)

Belgium	1605
Germany	1609
Switzerl.	1610
Netherl.	1618
Britain	1622
France	1631
Denmark	1634
Italy	1636
Sweden	1645
Norway	1763
Finland	1771

II. Copies per thousand population in 1970, selected countries

Sweden	566
Japan	511
Finland	466
Norway	383
Denmark	364
USSR	336

Table N1 Population, thousands

Year	Finland	Denmark	Norway	Sweden
1750	422	1769: 798	1769: 724	1751
1800	833	1801: 929	1801: 883	2347
1820	1178	1834: 1231	1825:1051	2585
1840	1446	1289	1845:1328	3139
1850	1637	1415	1855:1490	3471
1860	1747	1608	1865:1702	3860
1870	1769	1785	1875:1819	4169
1880	2061	1969	..	4566
1890	2380	2172	2001	4785
1900	2656	1901: 2450	2240	5137
1910	2943	1911: 2757	2392	5522
1920	3148	1921: 3104	2650	5905
1930	3463	3551	2814	6142
1940	3696	3844	1946:3151	6372
1950	4030	4281	3278	7041
1960	4446	4585	3591	7495
1970	4616	4921	3879	8046
1980	4780	5125	4087	8316
1985	4901	5113	4148	8350

(Years not identical with the Finnish census years are marked.)

Table№2. Energy

I. Coal and petroleum imports (thousand tonnes)

Year	COAL IMPORTS				PETROLEUM IMPORTS			
	Finland	Denmark	Norway	Sweden	Finland	Denmark	Norway	Sweden
1860	14	205	126	259	-	-	-	-
1870	33	431	235	465	1	5	2	5
1880	34	702	462	959	3	8	7	12
1890	69	1081	767	1657	9	29	14	38
1900	204	1940	1520	3130	19	42	40	80
1910	362	2771	2159	4453	33	89	65	140
1920	90	2711	1827	3172	12	169	85	190
1930	917	5059	2737	5970	38	527	270	577
1937	2232	6016	3962	8938	209	686	542	1185
1940	690	4117	1853	5721	100	154	242	541
1950	1929	6676	1832	7145	542	1860	1390	3767
1960	3175	5478	1040	3767	2624	5154	3633	13210
1969	3225	4251	1283	2672	10220	17798	8728	29178

II. Electricity generated, million kWh

Year	Finland	Denmark	Norway	Sweden
1923	0.33	0.31	6.20	2.99
1930	1.21	0.58	7.63	5.12
1939	3.11	1.07	10.47	9.05
1950	4.18	2.22	16.92	18.18
1960	8.63	5.18	31.12	34.72
1969	19.98	16.57	51.02	58.09

Table N3. Television sets/licences and telephones

Per thousand inhabitants

	I. Television					II. Telephones			
	Finland	Denmark	Norway	Sweden		Finland	Denmark	Norway	Sweden
1967[a]	193	237	179	289	1967	204	293	255	489
1983[b]	357	369	319	390	1985	617	783	622	890

(a) Sets. (b) Licences.

Table N4. Energy consumption (UN data)

	Finland	Denmark	Norway	Sweden	
I. Per capita consumption of commercial primary energy,					thousand tonnes of coal equivalent
1929	0.58	1,62	3.71	1.82	
1937	1.03	1.71	3.44	2.50	
1949	0.97	1.70	3.97	2.82	
1950	1.17	2.09	4.37	3.22	
1973	4.99	5.45	5.08	5.99	
1982	4.74	4.88	6.18	4.83	
1985	5.23	5.33	6.51	4.96	
II. Per capita consumption of commercial and non-commercial primary energy in 1949					thousand tonnes of coal equivale (not available from UN for othe years)
non-commercial	1.38	0.25	0.43	0.57	
commercial plus non-commercial	2.35	1.95	4.40	3.39	
III. Per capita electricity consumption, kWh					
1929	287	158	2878	809	(The two sets of figures - 1929-50 and 1973-85 - are not strictly comparable.)
1937	774	294	3092	1267	
1950	1034	502	2348	2576	
1973	6272	3763	17133	9686	
1978	7113	4487	18379	10570	
1982	8637	5035	21030	12355	
1985	10588	5764	24777	16165	

IV. Electricity generation by type Per cent shares in total. H=Hydro, N=Nuclear Th=Thermal

a = less than ½%

	H N Th	H N Th	H N Th	H N Th
1929	70 - 30	- - 100	100 - -	92 - 8
1937	74 - 26	- - 100	99 - 1	87 - 13
1950	88 - 12	1 - 99	100 - a	95 - 5
1973	42 - 58	a - 100	100 - a	77 3 20
1978	40 8 52	a - 100	100 - a	59 22 19
1982	33 40 27	a - 100	100 - a	55 39 6
1985	26 38 36	a - 100	100 - a	52 43 5

Table N5. Motor vehicles in use, thousands (PC=Passenger cars, CV=Commercial vehicles)

Year	Finland		Denmark		Norway		Sweden	
	PC	CV	PC	CV	PC	CV	PC	CV
1925	6.6	3.9	46.4	13.1	17.6	7.6	59.1	20.5
1939	30.1	23.2	117	45.3	56.2	42.9	181	68.1
1950	26.8	34.4	118	61.4	60.1	56.3	252	94.5
1960	183	75.2	408	170	219	119	1194	130
1969	643	110	1023	261	700	146	2194	156

Table N6. Aviation (P=Passengers, thousands; F=Freight, thousand tonnes)

Year	Finland		Denmark		Norway		Sweden	
	P	F	P	F	P	F	P	F
1930	4.4	0.06	8.6	0.1	-	not available	1.1	0.04
1939	25	0.43	72	0.5	2.2		18.2	0.56
1950	97	1.7	345	4.7	162		245	5.3
1960	914	12.5	1884	26.2	685		1012	21.2
1969	1823	29.6	5842	112	1737		2184	97.2

Table N7. Radio/television licences, thousands

Year	Finland		Denmark		Norway		Sweden	
	Radio	TV	Radio	TV	Radio	TV	Radio	TV
1930	107	-	340	-	84	-	482	-
1940	348	-	761	-	429	-	1470	-
1950	722	-	1087	-	786	-	2095	-
1960	1228	93	1350	388	1021	49	2686	599
1969	1744	1015	1464	1228	1171	796	2927	2345

Table N8. Farm mechanisation and fertilizer use

	Number of tractors on farms, thousands			Arable acres pertractor	Fertilizer consumption in mid-1930s, lb/arable acre
	1939	1949	1951	1951	
Finland	4	8	12	514	18.1
Denmark	4	11	22	316	46.8
Norway	3	7	10	198	39.0
Sweden	20	52	60	153	30.2
(UK)	55	280	325	57	53.0
(Switzerland)	8	17	20	62	64.1

Table N9. Forests

million hectares, 1950

	All forest land	% of national territory	Classified productive	of which:		
				Coniferous	Broad-leaved	Inaccessible
Finland	21.7	71	20.7	15.9	4.8	-
Norway	7.5	24	6.1	4.5	0.7	0.9
Sweden	23.5	57	22.9	17.2	5.0	0.7
Alpine countries:						
Switzerland	0.9	22	0.8	0.5	0.2	0.1
Austria	3.1	38	2.8	1.9	0.6	0.3

Table Livestock per thousand population, 1938

	Cattle	Sheep	Hogs
Finland	510	258	139
Denmark	834	50	716
Sweden	481	52	217

Table N10. Production of cement, sulphuric acid and superphosphates

Thousand tonnes

	Cement			Sulphuric acid			Superphosphates		
	1929	1939	1950	1929	1939	1950	1929	1939	1950
Finland	278	563	743	18	25	94	30	53	64
Denmark	799	696	873	n	n	n	289	388	430
Norway	319	390	583	n	n	n	n	n	n
Sweden	570	1182	1936	129	171	329	236	261	433

n=nil or not available.

Table N11. Manufacturing establishments, 1948

	Number of establishm.	Employment thousands	Average employment per establ.	HP installed thousands	Average HP per establ.	Gross output value $ mn	Average gross output per establ. 000$
Finland	5794	290	50	1290	222	1290	223
Denmark	7406	267	36	755	102	1504	203
Norway	5926	225	38	n	n	1350	228
Sweden	16509	775	47	3848	233	5456	330

n=not available

Table N12. Rural and urban population, 1948

	Percentage of population in places with inhabitants numbering		
	less than 10.000	10.000 - 100.000	100.000 or more
Finland	52.8	37.9	9.3
Denmark	58.2	9.1	32.7
Sweden	57.8	21.7	20.5
(Switzerland)	67.0	15.3	17.7
(England&Wales)	25.6	29.2	45.2

Table N13. Textiles

I. Raw cotton consumption, thousand tonnes

	Finland	Sweden
1850	0.3	2.0
1860	1.8	8.2
1870	1.4	6.4
1880	3.0	9.2
1890	4.4	13
1900	6.4	17
1910	6.8	21
1920	6.5	23
1930	7.1	23
1940	10	20
1950	11	28
1960	18	28
1969	16	15

II. Man-made fibres production, thousand tonnes

	Finland	Norway	Sweden
1939	0.8	0.2	2.9
1940	0.2	0.3	3.6
1950	7.8	13.5	14.1
1960	16.4	14.3	28.5
1969	33.8	30.0	35.3

Table N14. Beer production, thousand hectolitres

	Finland	Denmark	Norway	Sweden
1932	105	2005	420	1563
1940	473	1865	607	1563
1950	776	3540	598	1756
1960	917	4023	843	2795
1969	2465	6523	1442	4339

Table N15. Urbanisation in the Nordic countries, 1860-1910

Per cent of population living in urban areas

	Denmark	Finland	Norway	Sweden
1860	23	6	15	11
1880	28	8	20	15
1890	33	10	24	19
1900	38	13	28	22
1910	40	15	29	28

Table N16 Merchant fleets of the Nordic countries, 1852-1914

Thousand net tons

	Denmark			Finland			Norway			Sweden		
	all ships	steam-ships	p.c.*	all ships	steam-ships	p.c.*	all ships	steam-ships	p.c.*	all ships	steam-ships	p.c.
1852	103	2	2	..	..	..	320	-	-	204	-	-
1870	178	10	6	209	4	2	974	13	1	346	27	8
1889	271	94	35	257	6	2	1611	168	10	504	135	27
1900	394	247	63	340	54	16	1508	505	33	614	325	53
1914	520	434	83	478	86	18	1784	1214	68	901	750	83

* percentage of steamships in all ships.

Table N17. Nordic exports of timber and pulp, 1870-1910

	Finland	Norway	Sweden
1) Timber exports, thousand standards (a)(b)			
1870	85	447	435
1890	230	397	875
1910	585	267	930
2) Pulp exports, thousand tons dry weight			
1880 all pulp	6	13	10
1890 mechanical	13	91	38*
chemical	-	21	35*
all pulp	13	112	73*
1900 mechanical	20	154	67
chemical	5	84	138
all pulp	25	238	205
1910 mechanical	38	242	141
chemical	50	165	510
all pulp	88	407	651

*1892.

(a) For comparison: Timber exports of Russia were , in the same units, 330 in 1890 and 1300 in 1910.
(b) One standard = 4.7 m3.

Table N18. The Nordic countries in the mid-1980s

Unless otherwise stated, all data concern 1985

	Unit	Sweden	Denmark	FINLAND	Norway
Population	thousands	8350	5114	4908	4152
" density	per 1000km^2	19	119	15	13
" of capital	thousands	663	627	486	449
" " " with suburbs	"	1450	1352	794	711
" in capital	% of total	17	26	16	17
" in three largest cities	"	31	35	23	25
" age 0-14 males	"	18.7	19.0	19.6	20.9
" age 15-24 males	"	14.5	16.1	15.2	16.2
" age 65 and over males	"	15.1	12.7	13.0	13.2
" age 0-14 females	"	17.4	17.9	18.4	19.4
" age 15-24 females	"	13.5	14.8	14.3	15.1
" age 65 and over females	"	19.6	17.2	15.6	17.9
Death per 100.000 inhabitants	no.	1089	1076	903	1023
cause of death: malignant tumours	"	230	269	188	222
heart condition	"	439	365	340	347
stroke	"	113	103	109	129
pneumonia, asthma, bronchitis	"	69	69	51	79
Area	million hectares	45.0	4.3	33.7	32.4
of which:					
arable land, pasture	%	8	66	7	3
forest	"	59	11	69	26
Crops : cereals	000 tonnes	5616	7963	3616	1272
potatoes	"	1117	1073	708	470
sugarbeet	"	2170	3516	739	-
Livestock: horses	thousands	57	33	35	14
cattle	"	1837	2704	1608	976
sheep	"	426	52	110	2415
pigs	"	2589	8960	1256	693
poultry	millions	11	15	8	4
Fertilizer consumption					
nitrogenous (N)	000 tonnes	253	408	196	113
phosphorous (P_2O_5)	"	101	111	159	56
Kalium (K_2O)	"	102	150	153	82
Production					
meat	"	491	1329	295	186
milk	"	3581	5068	3174	2028
butter	"	75	110	76	24
cheese	"	116	256	80	72
sugar	"	348	575	103	-
beer	million hl	3.7	10.1	2.8	2.0
cigars (1983)	million	170	625	62	..
cigarettes (1983)	000 million	10.4	9.8	8.0	0.7
pipe tobacco (1982)	000 tonnes	6.5	4.8	0.9	5.0
timber	million m3	53	3	42	11
sawnwood	"	11.5	0.8	7.3	2.4
woodpulp	million tonnes	9.1	-	8.0	2.0
rayon (1984)	000 tonnes	38	-	53	20
sulphur (1983)	" (S)	206	-	218	178

continued

Table N18 continued (2)

	Unit	Sweden	Denmark	FINLAND	Norway
Iron ore (1983)	mn t Fe	8.4	..	..	2.3
Copper ore (1983)	000 t Cu	64	..	38	23
Lead ore (1983)	000 t Pb	78	..	..	..
Zinc ore (1983)	000 t Sn	206	..	56	32
Chromium ore (1983)	000 t Cr	..	..	91	..
Silver ore (1983)	tonnes Ag	171	..	30	..
Gold ore (1983)	tonnes Au	3.2	..	..	..
Hard coal (1984)	000 t	..	..	..	481
Coke (1984)	"	1231	..	..	..
Petroleum, crude	mn t	..	..	..	35.0
Motor spirit	"	3.3	1.2	2.5	1.2
Natural gas	000 Terajoule	..	..	..	1166
Sulphuric acid	000 t	884	..	1145	..
Fertilizers N	"	201	..	303	479
" P_2O_5	"	140	170	250	164
Synthetic resins(1984)	"	528	..	304	..
Newsprint	000 t	1594	..	1811	877
Other paper and board	"	5408	..	5633	727
Cement (1983)	"	2231	1654	1944	1666
Crude steel (1983)	"	4204	493	2416	903
Pig iron & ferroalloys(83)	000 t	2167	..	1957	1620
Copper (1983)	"	63	..	55	29
Aluminium (1983)	"	107	..	..	718
Lead (1983)	"	30	..	..	..
Zinc (1983)	"	..	..	155	..
Passenger cars (1982)	000	344	..	30	..
Commercial vehicles(1982)	000	54	..	..	..
Bicycles (1982)	000	321	..	..	..
Ships (1983)	000 BRT	210	430	252	101
Industrial production	% rise of index 1980 to 1986	10	26	17	26
Electricity production(1984)	mn kWh	124	22	43	106
	000kWh/head	14.8	4.4	8.9	25.6
hydropower	% of total	55.1	0.2	30.6	99.7
nuclear power	"	41.3	-	41.1	-
External trade (1986) imports + exports per capita	US $ 000/head	8.4	8.6	6.5	9.3
Imports from Nordic countries (excl.Iceland)	% of total	19.4	17.8	16.7	28.7
Imports from USSR	"	2.3	1.5	21.0	1.1
Net imports (minus means net exports) of coal	mn t	5.2	12.9	6.3	1.6
crude petroleum	"	1.4	0.5	1.0	-3.1
motor spirit	"	2.4	0.9	..	0.5
Diesel,heating & bunker oil	mn t	5.9	4.3	2.8	1.7
synthetic resins	"	0.1	0.4	0.3	0.2
newsprint	"	-1.4	0.2	-1.6	-0.8
other paper & board	"	-4.1	0.6	-5.7	-0.6

continued

Table N18 continued (3)

	Unit	Sweden	Denmark	FINLAND	Norway
woollen yarn	000 t	1.5	5.0	2.3	..
synthetic yarn & thread	"	23	40	16	7
cotton fabrics	"	12	14	12	5
iron and steel	mn t	-1.4	0.9	-0.4	-0.4
passenger cars	000(N) or ooo t (T)	-20 N	170 N	127 T	181 N
commercial vehicles	-same-	-12 N	72 N	18 T	44 N
Merchant fleet	mn BRT	2.5	4.7	1.5	9.3
Telephones	per 1000 inhabitants	890	749	592	622
TV licences	"	390	370	370	318
Daily newspapers	copies "	521	359	535	501
Cinema attendance	per capita/year	2.5	2.2	1.4	3.1
Paper use (1984): newsprint	kg/cap.	35	34	42	32
all paper	"	232	174	180	139
Per capita consumption	1981-5				
coffee	average, kg	11.2	10.8	12.4	10.0
tea	"	0.34	0.45	0.18	0.20
cocoa	"	1.71	1.78	0.88	1.38
beer	" litre	46	128	56	46
wine	"	10.9	18,4	8.7	4.2
spirits	"	2.3	1.6	2.8	1.4
GDP per head	US $ 1985	12006	11312	11024	13960
distribution:					
private consumption	%	51	55	54	49
public "	"	27	25	20	18
investment	"	19	19	23	22
net exports	"	2	0	1	8
Inflation	% change				
producer prices	1980-86	59	38	33	44
consumer prices	"	61	52	56	65
Development aid	% of GDP	0.86	0.80	0.40	1.01
Military expenditure	"	3.0	2.3	..	3.2

Table F1. Finland: some notable 'firsts'

16 th century:	King Gustav Wasa founded small factories for woollens, gunpowder, silmaking, also sawmills and boatbuilding yeards
1542	First ironworks in Ojamo, followed by
1616	a larger one at Swarta and others, producing over 100 tonnes/year but employing maximum 10
1640	around this time: the first papermill
1642	first printing house at Turku
1766	first regulation of fisheries
1771	first daily newspaper
1779	Tampere becomes the first Finnish city
1793	first major glass factory at Nuutajärvi
1809	Finnish autonomy declared by Alexander I at Porvoo
1811	Bank of Finland's charter granted
1821	Tampere granted right to import raw materials and machinery free of duty
1828	Finlayson starts cotton mill at Tampere
1833	first Finnish-built steamship launched on Lake Saimaa
1834	the first plant to become the present Wärtsilä Group - a sawmill in Wärtsilä - comes on stream
1841	the first paper machines start operating
1850	the first real engineering/machine-building firm (later Wärtsilä) founded
1856	Saimaa Canal built
1860	first mechanical pulp factory at Viipuri country starts
1861	first rolling mill; first leather factory at Oulu
1861	liberalisation of industry - sawmills permitted to introduce steam power and start moving to ports
1861	first railway Helsinki-Hämeenlinna (1868/70: Helsinki-St.Petersburg)
1862	Forestry School at Evo founded
1863	State Forest Board set up
1866	compulsory schooling system introduced
1868	first steamship launched from Helsinki shipyard
1868	(late 1860s) mechanical pulp manufacturing starts
1874	Arabia works founded
1875	Imperial Finnish Economic Society employs first horticultural adviser
1875	School of Decorative Arts starts
1880	first open hearth (Siemens-Martin) furnace at Dalsbruk steelworks
1880	first sulphate pulp mill comes on stream
1885	first sulphite pulp factory
1890	first icebreaker commissioned by Board of Navigation comes into service
1895	first rubber factory (for galoshes)
1898	first shoe factory at Korkeakoski
1899	central organisation of cooperatives (Pellervo) established
1905	first paper board machine built (at Viipurin Konepaja)
1906	'Eduskunta' - single chamber assembly, later parliament, established
1907	Finnish Federation of Labour, first national trade union, founded
1910	Outokumpu copper deposit discovered; exploitation started 1914
1912	first veneer factory
1913	first cement factory

Table 1 - continued

1913	Plant breeding station at Tammisto established
1917	On behalf of the new Soviet state, Lenin accepts Finland's unilateral declaration of independence
1922	stabilisation of Finnish markka
1922	sulphuric acid and superphosphate production starts
1924	first icebreaker ordered by Finnish Government
1936	Nokia starts making winter tyres, first in world
1938	production of artificial fibres starts at Vuoksi river valley
1940	collective bargaining starts
1945	A.I. Virtanen obtains Nobel Prize in chemistry, for his discoveries in biochemistry
1947	Labour Court established
1947	flash smelting technique invented at Outokumpu company
1948	Neste Oy founded
1948	Finland becomes a member of IMF and IBRD
1950	Finland joins GATT
1951	first postwar balance of payments surplus
1959	state unemployment assitance scheme introduced
1961	Finland becomes an associate member of EFTA
1969	Finland joins the OECD
1973	free trade agreement with EEC
1977	first nuclear reactor starts producing electricity at Loviisa
1984	largest cruise liner (45.000 t 'Royal Princess' for P&O) launched

Table F2. Finland: Growth of real GDP and labour productivity

Average annual per cent changes

	1860-1890	1890-1913	1913-1920	1920-1938	1938-1946	1946-1960	1960-1974	1974-1985	1860-1985
Number of years	30	23	7	18	8	14	14	11	125
GDP	2.2	2.9	-1.4	4.4	0.5	4.9	4.5	2.9	3.0
Labour productivity	0.9	1.7	-2.0	2.8	-0.2	3.5	4.6	3.4	2.1

Table F3. Finland: industrial enterprises and employment in 1913

Ownership	Number of enterprises	Employment	
		total	average per enterprise
Individuals	2605	20394	8
Cooperatives	393	1784	5
Limited and other companies	1294	88171	68
Municipalities	29	947	33
State	25	2402	96
Total	4346	113698	26

Table F4. Finland: distribution of the working population

In per cent of total

	1805	1880	1900	1920	1940	1960
Agriculture, forestry and fishing	82.1	71.3	51.5	68.8	58.8	35.5
Extractive industries	a	a	a	a	0.1	0.3
Manufacturing industries	3.6	9.6	9.7	12.7	16.6	22.5
Construction	a	a	1.6	a	2.2	8.7
Commerce, finance	0.7	2.0	2.0	3.3	3.2	11.6
Transport, communication	0.7	3.4	3.1	2.7	3.7	6.3
Services	10.5	13.7	7.7	4.9	7.9	14.8
Other	2.4	a	24.4	7.6	7.5	0.3
TOTAL, thousands	855	502	833	1499	1971	2033

a=not shown separately or less than 0.1%

Table F5. Finland: war reparations (1944-52)

I. Reparation payments, by commodity

	Value, million $	Per cent
New ships	66.0	29.1
Ships requisitioned from 1944 Finnish merchant fleet	14.0	6.2
Machinery and industrial equipment	70.7	31.2
Cables	12.9	5.7
Pulp and paper	34.9	15.4
Timber and wood products	28.0	12.4
altogether	226.5	100.0

II. The burden of war reparations:

	1945-48	1949-52	1945-52
Reparation costs as per cent of			
a) net national product at market prices	5.2	2.2	3.7
b) total state expenditure	13.7	7.2	10.4

Table F6. Finland: industrial production, 1926-69

Index numbers, 1937=100

Years	0	1	2	3	4	5	6	7	8	9
1920s	..	..	..	..	..	..	56	63	69	67
1930s	61	54	56	64	78	84	92	100	103	99
1940s	73	75	79	89	83	87	105	117	133	140
1950s	151	175	167	177	203	225	231	237	229	249
1960s	282	314	332	344	369	396	416	429	453	511

Table F7. Finland: Production of pig iron and crude steel

Thousand tonnes

	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1969
Pig iron	5	15	20	22	24	31	8	10	3	25	64	137	1231
Crude steel	-	-	-	-	-	-	-	6	28	77	102	254	978

Table F8. Finland: Exports of forestry products

	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1969
Wood thousand m3	522	1570	1263	3382	4788	4049	5299	1328	3827	5635	4478
Woodpulp thousand tonnes	-	3	14	24	87	170	633	266	1056	1594	2217
Newsprint thousand tonnes	-	-	-	-	46	90	188	61	379	691	1156

Table F9. Finland: The growth and pattern of manufacturing 1960-86

Industry	Average annual volume growth, %				Per cent share in 1986
	1960-1973	1973-1981	1981-1986	1960-1986	
Food	5.1	2.5	1.6	3.6	12.6
Textile, clothing, leather	3.9	2.8	-1.9	2.4	6.5
Forest industries total	5.8	0.9	2.1	3.6	18.0
Wood industry	4.1	-0.3	0.4	2.0	5.0
Paper and pulp	7.0	1.6	2.8	4.5	13.0
Chemicals	13.1	2.8	2.6	8.0	10.4
Metals and engineering	7.1	5.8	4.3	6.2	36.9
Basic metals	10.4	6.3	4.8	8.1	4.3
Metal products, machinery and equipment	6.7	5.7	4.3	5.9	32.6
Other manufacturing	6.5	3.7	2.9	4.9	15.6
TOTAL MANUFACTURING	6.6	3.3	2.7	4.8	100.0

Table F10. Finland: Size of farms in 1945-48

Classified by acreage; percentages

	under 2½	2½-5	5-12½	12½-25	25-50	50-125	over 125	TOTAL
Number of farms	14.0	12.8	25.3	22.6	20.0	4.3	1.1	100=283.300
Acreage	1.0	2.2	10.2	19.7	36.8	17.7	12.6	100=5634 million acres

Table F11. Finland: Agriculture - selected indicators

I. Imports per capita (kg/year)

	Wheat	Rye	Barley	Oats	Potatoes
1910-12	52.3	115.7	3.7	9.3	4.2
1929-31	46.6	30.1	0.8	7.5	3.1

II. Degree of self-sufficiency in crop production, per cent

a) Interwar	Cereals	Vegetables	Animal feeds
1924-28	56	54	77
1930-31	68	66	84
1934-35	82	77	90

b) Postwar: 1980

Bread grain	70
dairy prod,	128
beef	102
pork	119
eggs	151
sugar	60
fruit	30
greenhouse vegetables	73
fish	73

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Table F12. Exports of forest products

Per cent share in export earnings*

	Raw wood	Sawn-wood	Fibre-board	Ply-wood	Panels	Mechan. pulp	Chemic pulp	Paper& board	Pack-aging
1950	10	29	2	7	-	3	26	23	a
1960	8	27	1	6	a	1	22	32	1
1970	2	18	1	8	1	a	23	45	3
1980	2	23	1	6	1	a	16	48	4

*The percentages are rounded and do not necessarily add up to 100.

(a) Less than ½ %.

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Table F13. Finland: Agricultural production - grains, potatoes and sugarbeet

Thousand tonnes

	All grains	Rye	Barley	Oats	Wheat	Mixed corn	Potatoes	Sugar-beet
1879-81	537	253	125	150	3	6	275	..
1889-91	731	330	141	245	4	11	456	..
1899-1901	710	297	105	294	4	10	376	..
1909-10	759	275	117	348	4	15	465	..
1919-20	812	256	116	420	11	9	558	..
1929-31	1108	305	157	604	25	17	876	..
1938-39	1596	338	198	797	244	19	1216	..
1940-41	997	215	129	480	163	29	990	..
1949-51	1417	208	189	714	277	43	1252	193
1959-61	1852	158	379	915	357	56	1284	375
1968-69	2680	134	812	1150	528		900	376

NOTE: The quantities are annual averages for the years shown. Up to and including 1929-31 the original data are in hectolitres; the conversion to tonnage is approximate. From 1940 onwards production on the territory ceded to the USSR is excluded.

Table F14. Finland: Agriculture - Livestock and allied production

	Horses a	Cattle a	Pigs a	Sheep a	Poultry a	Reindeer a	Cow's milk b	Butter c	Meat c d
1881	269	1029	149	..	..	..	..	..	..
1892	290	1287	176	996	310	106	..	..	..
1900	311	1428	211	985	..	..	..	..	..
1910	301	1199	422	1330	..	..	..	..	..
1920	385e	1824e	374	1704	879	53	..	..	..
1930	357	1810	395	1024	1907	64	2.1	27	66
1940 e	348	1470	311	729	1865	77	2.0	24	..
1950 e	409	1782	446	1220	3524	87	2.5	53	106
1960	251	1921	483	341	5743	181	3.5	93	129
1969	101	1981	757	159	7248	238	3.6	101	201

(a) Numbers, thousands.
(b) Production, million tonnes.
(c) Production, thousand tonnes.
(d) All meat.
(e) Not strictly comparable with earlier years because of changes in the time of the census or in definitions.

Chart F1.

FINLAND: GROWTH RATES OF GDP, 1860–1985

Average annual rates for the periods indicated

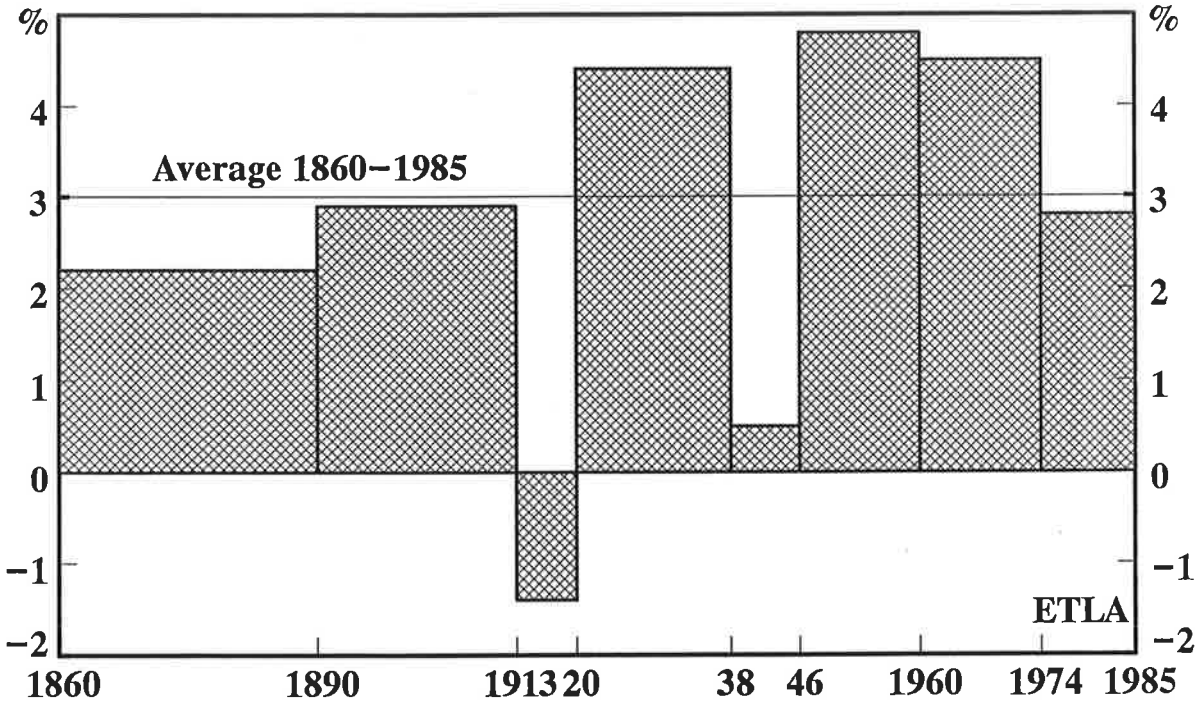


Chart F2.

FINLAND: DISTRIBUTION OF THE WORKFORCE BY SECTOR, 1805–1985
Percentages in total

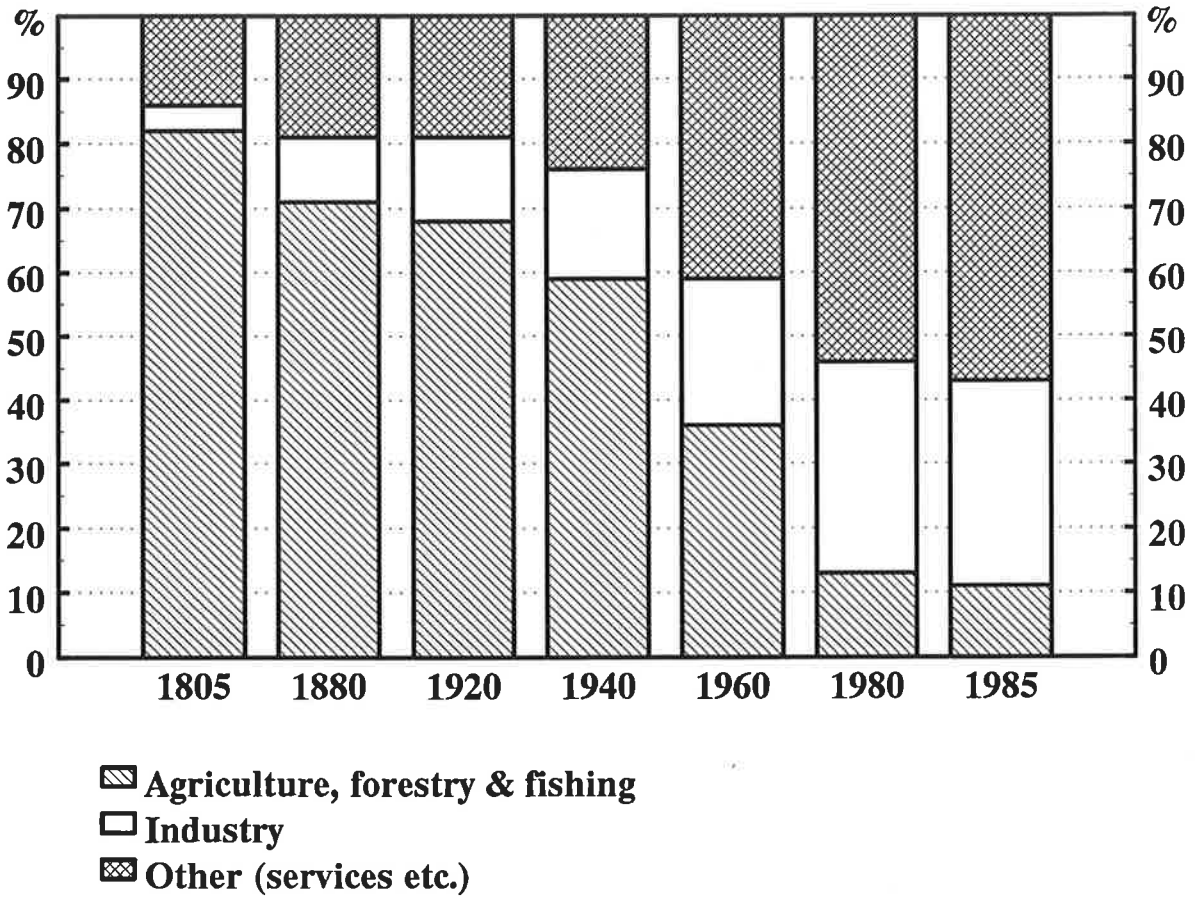


Chart F3.
FINLAND: VOLUME OF GDP AND INDUSTRIAL PRODUCTION, 1926–85 (1926=100)

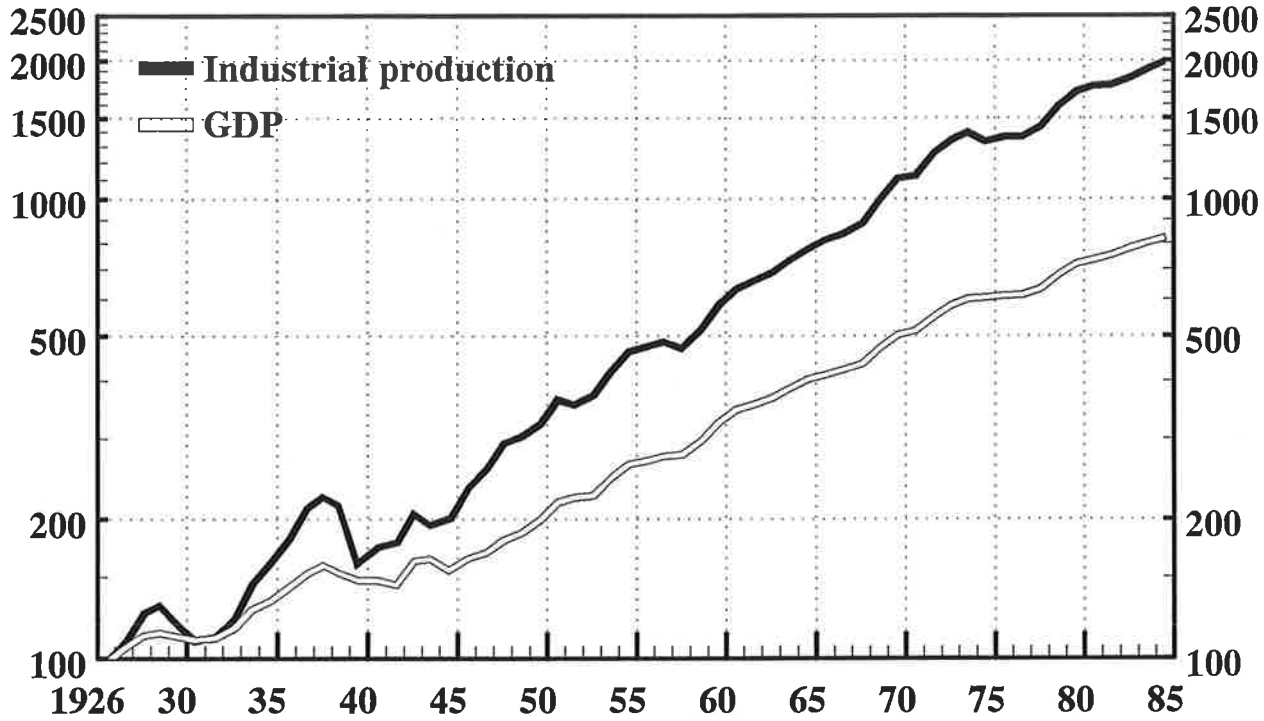
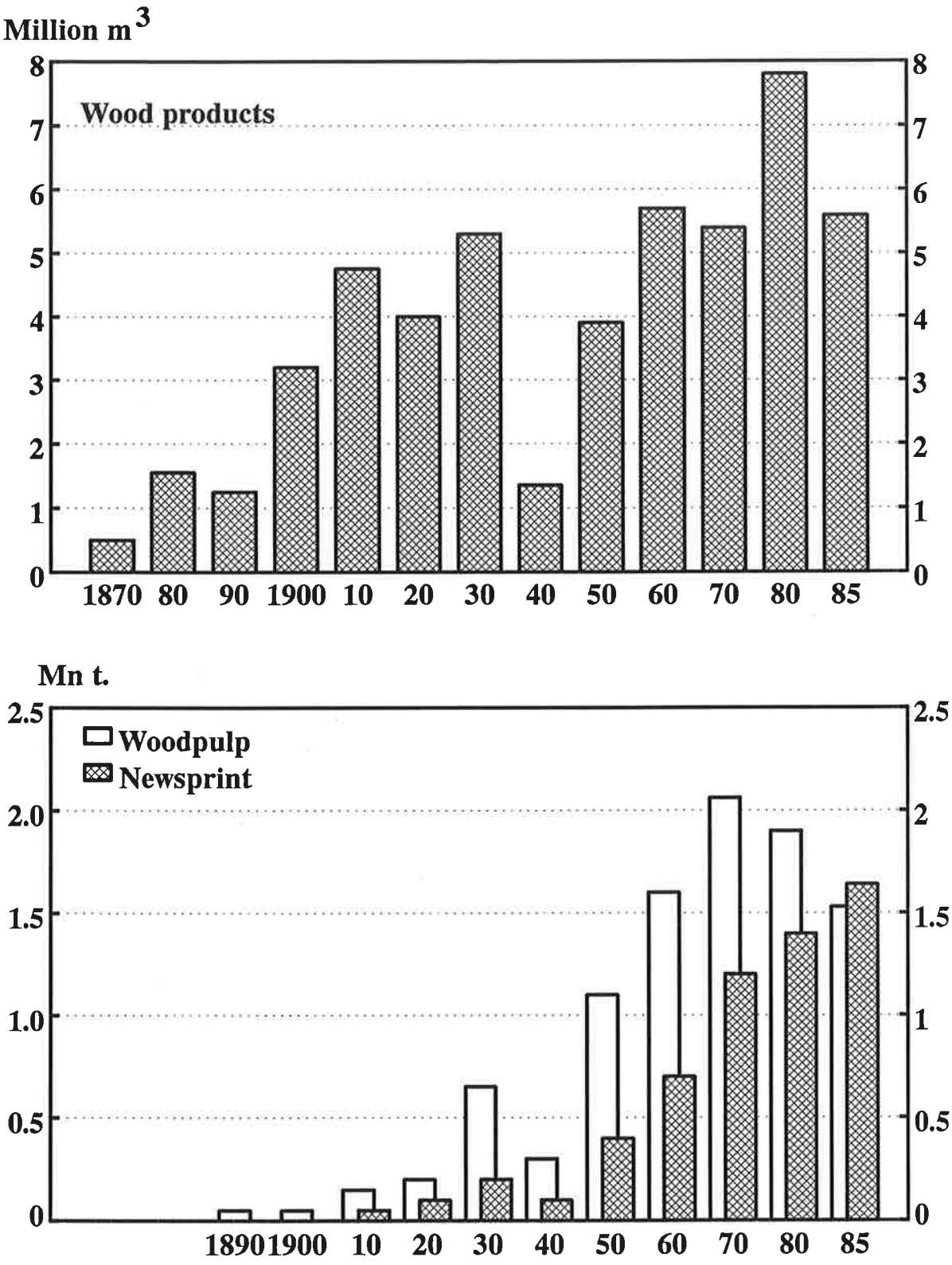


Chart F4.

FINLAND: EXPORTS OF FOREST INDUSTRY PRODUCTS 1870–1985



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0033A/20.12.1988