SOME EMPIRICAL EVIDENCE
ON THE INTERNATIONAL BUSINESS CYCLE

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Business cycle fluctuations in the particular industrial countries cannot be regarded as something that is entirely isolated from the rest of the world. In general, there exists a close interdependence between business cycle movements in various countries through the foreign trade. An expansion or a contraction in business activity of a big industrial country can affect other countries : first, through a direct increase or decrease in the demand of the country undergoing the fluctuations, and secondly, through an increase or decrease in the demand of the primary producing countries. Thus, it must be expected that economies, depending on foreign trade more than others, are more sensitive to such international fluctuations. Below we attempt a brief examination of the degree of international synchronisation and diffusion of cyclical fluctuations and a comparison of the severity of business cycles in various industrial countries.

1. The statistical materials.

In this study we should use reference dates [1] for various countries determined on the basis of large samples of time series. Apart from the U.S.A., for which reference dates have been recorded by the N.B.E.R., and the U.K., similar work has been carried out for Canada and Italy, but only for the post-war period. The N.B.E.R. has also established tentative reference dates for Germany and France in the period 1919–1939. The reference dates for all these six countries are shown in Table I.

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1. According to the definition given by the National Bureau of Economic Research, reference dates are the dates of turns in general business activity.

TABLE 1

Reference dates of business cycles for various countries, 1919-1959

A. Pre-war period

a U.S.A.		b Canada		c U.K.		d Italy		e France		e Germany	
Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak
3/1919	1/1920			4/1919	6/1920			4/1919	9/1920	6/1919	5/1922
7/1921	5/1923			6/1921	11/1924			7/1921	10/1924	11/1923	3/1925
7/1924	10/1926			7/1926	5/1927			6/1925	10/1926	3/1926	4/1929
11/1927	8/1929			9/1928	7/1929			6/1927	3/1020	8/1932	
3/1933	8/1937			8/1932	9/1937			7/1932	7/1933		
6/1938								4/1935	6/1937		
								8/1938			

B. Post-war period

a U.S.A.		b Canada		c U.K.		d Italy		e France		e Germany	
Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak
10/1945	2/1945			2/1947	4/1951	5/1945	9/1947				
10/1949	11/1948	10/1949	10/1948	7/1952	12/1955	6/1948	12/1949				
8/1954	7/1953	6/1954	7/1953	11/1956	9/1957	8/1950	4/1951				
4/1958	7/1957			9/1958		6/1952	9/1955				
						6/1956	9/1957				

(a) Source: «Business cycle indicators; contributions to the analysis of current business conditions», edited by C.H. Moore (Princeton University Press, Princeton, 1961), vol. I, Appendix A, p. 671.

(b) Source: W. A. Beckett, «Indicators of cyclical recessions and revivals in Canada» in «Business cycle indicators», op. cit. p. 299.

(c) Source: C. Drakatos, «Short-term indicators of business activity in the U.K.», Ph. D. thesis (London University), February 1962.

(d) Source: Gastone Miconi, «Recessions in Italy during the last fifteen years», Review of the Economic Conditions in Italy, Banco di Roma, (November 1960).

(e) Source: A. F. Burns and W. C. Mitchell, «Measuring business cycles», N.B.E.R. (New York, 1946), pp. 78-79.

However, comparisons of business cycles of a number of countries can be made only by using a common comprehensive aggregative measure of general business activity. Such an examination should include all the industrial countries which are subject to business fluctuations. But the number of countries as well as the period over which the study can be made are necessarily limited by the availability of the statistical materials. In view of these objectives, use was made of the indices of industrial production of ten O.E.E.C. countries (i.e. Austria, Belgium, Denmark, France, W. Germany — excluding Saar and West Berlin — Italy, the Netherlands, Norway, Sweden and the U.K.), plus the U.S.A. and Canada, which are published in the O.E.E.C's Statistical Bulletin. These indices are on a quarterly basis, with 1953 = 100 and cover the period since 1950. The basic data used by the O.E.E.C. Statistical Service in preparing these indices are the national indices published by the Statistical Offices of the particular countries. There is no fundamental difference in the methods of calculation used for the various national indices. The use of these indices for studying short-term fluctuations is facilitated by the fact that they are all adjusted for normal seasonal variation [2].

2. Reference dates of industrial activity for various countries.

The figures of the industrial production indices of the twelve countries selected were plotted on charts, on which their specific turning points were marked off. The dates of peaks and troughs identified in this procedure are recorded in Table II.

It is observed that Belgium has undergone one and a half cycles - taken from peak to peak — whereas all the other countries have had two and a half cycles — taken from peak to peak — during the same period. It must be made clear that these dates refer to the turning points of industrial production and do not necessarily coincide with the reference dates of general business activity. Furthermore, since industrial production is considered to be more sensitive than other sectors to short-term fluctuations, the reference dates of industrial production may show more cycles than those which would be identified in general business activity. Some indications of the significance of these differences are provided by comparing these two kinds of dates for the U.S.A., the U.K., Italy and Canada.

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[2]. For a description of the procedure applied, see O.E.E.C. Statistical Bulletin «Definitions and methods; indices of industrial production» (3rd edition, 1958) pp. 16–18.

TABLE II

Quarterly reference dates of industrial activity
for various countries, 1950–1959

Countries	Peak	Trough	Peak	Trough	Peak	Trough
Austria	2Q1951	4Q1952	4Q1955	4Q1956	1Q1958	4Q1958
Belgium	2Q1951	3Q1952	—	—	1Q1957	2Q1958
Denmark	1Q1951	2Q1952	3Q1955	2Q1956	2Q1957	4Q1957
France	1Q1952	1Q1953	3Q1956	2Q1957	2Q1958	1Q1959
W. Germany	2Q1951	4Q1951	2Q1956	4Q1956	2Q1957	2Q1958
Italy	2Q1951	3Q1952	3Q1955	1Q1956	3Q1957	2Q1958
Netherlands	1Q1951	2Q1952	3Q1955	1Q1956	1Q1957	1Q1958
Norway	3Q1951	3Q1952	1Q1955	2Q1956	3Q1957	3Q1958
Sweden	3Q1951	4Q1952	1Q1955	4Q1955	3Q1957	3Q1958
U.K.	2Q1951	3Q1952	4Q1955	4Q1956	3Q1957	3Q1958
U.S.A.	1Q1951	3Q1951	2Q1953	2Q1954	1Q1957	2Q1958
Canada	2Q1951	4Q1951	3Q1953	3Q1954	1Q1957	3Q1958

Peaks and troughs of most of the production indices are clustered around certain dates. To facilitate comparisons, we calculated a diffusion index of specific turning points for the nine West European countries (excluding the U.K.) Since there are considerable differences in the volume of production of the particular countries, this index was constructed by assigning to peaks and troughs the following weights (calculated by the O.E.E.C., Statistical Service) which indicate the percentage contribution of the production of each country to the total in 1953.

	Austria	Belgium	Denmark	France	W. Germ.	Italy	Nether.	Norw.	Swed.
Weights :	3.2	7.0	2.3	23.2	35.3	14.2	5.8	2.3	6.7

The resulting diffusion index shows the percentage of European industrial production which reached peak or trough in every quarter since 1950 and is shown in Chart I.
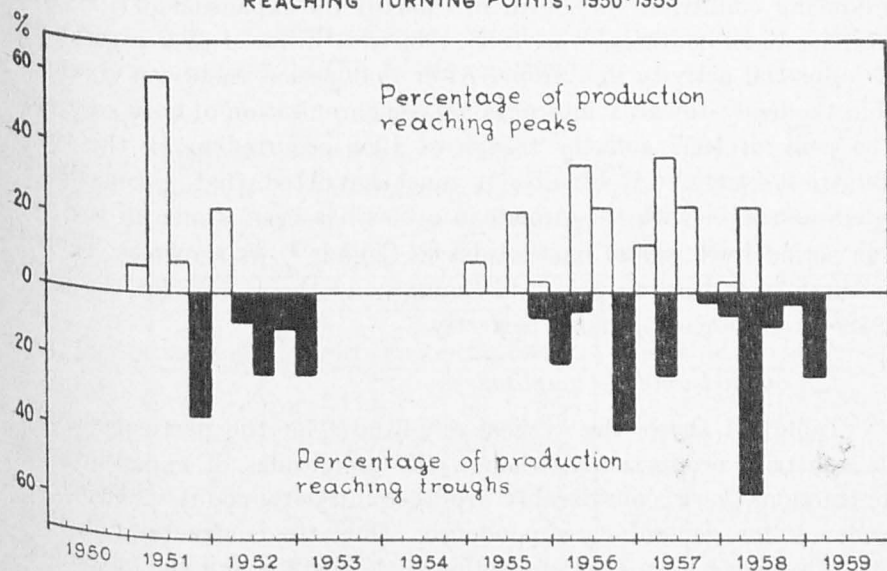
3. Synchronisation and diffusion of business cycles.

We see in Table I that in the pre-war period there was a well-established timing relation between British and American cycles, according to which British troughs typically lagged five months behind American troughs, and British peaks typically lagged about seven months behind American peaks. A systematic timing relation seems to have occurred also between American and French as well as German cycles during this period. It can be said, therefore, that until 1939 the cyclical

waves that originated in the U.S.A. were diffused internationally, as had been generally the case since the middle of the nineteenth century.

CHART I

PERCENTAGE OF INDUSTRIAL PRODUCTION OF NINE EUROPEAN COUNTRIES
REACHING TURNING POINTS, 1950-1959

After the second World War, the 1948–1949 recession [3] was almost isolated in the U.S.A. At that the U.K. as well as the other West European countries were continuing their efforts for reconstruction under the pressure of excess demand and shortage or dollars. The 1948–1949 American recession effected dollar crises in other countries and in the U.K. the pound was devalued in 1949. The boom in international demand that followed the Korean War affected almost all the European economies. During a period of nine months 77 per cent of total production of these countries (excluding the U.K.) reached peaks (Chart I). The

3. The first post-war American recession of 1945 is not discussed here because it market the transition from a wartime to a peacetime economy. See W. Fellner, «Trends and cycles in economic activity; an introduction to problems of economic growth» (Henry Holt and Company, New York, 1956), p. 91.

post-Korean recession at first appeared in the Western European countries, which after a relatively short period of readjustments started to expand again. Thus when the U.S.A. was hit by the recession of 1953-1954, expansion was already under way in Western Europe. This considerable time lag in international fluctuations constituted a major factor of stability, which lessened the fluctuations in industrial and primary-producing countries. As shown in Chart I the expansion of 1953-1955 and the small contraction of 1955-1956 were diffused over a great part of industrial activity in Europe. After that period there was a remarkable tendency towards international synchronisation of business cycles. The peak of 1957 and the trough of 1958 occurred in all the twelve countries examined [4]. Finally, it must be noted that a considerable synchronisation with the American cycles has been shown in the post-war period by business fluctuations in Canada [5]. As shown in Table II business cycle turning points in Canada and the U.S.A. for the period 1948-1954 coincide almost perfectly [6].

4. Comparision of amplitudes.

Table III shows the cyclical amplitudes for the particular indices of industrial production. Although the amplitudes of expansions and contractions very considerably from country to country, there is a tendency for general correspondence. Thus the contraction of 1951-1952 was larger than the contraction of 1957-1958 and the latter larger than the contraction of 1955-1956 in almost all the West European countries. Similarly the 1952-1955 expansion was far larger than the expansion of 1956-1957. In the U.S.A. and Canada the 1957-1958 contraction and the 1954-1957 expansion were the largest.

Comparisons of cyclical intensity are facilitated by using average

4. For a discusion of the common features that explain this synchronisation, see E. Lundberg, «Business cycles-Past and present experiences» Skandinaviska Banken Quarterly Review (October 1958), p. 112.

5. Evidence the pre-war period is in line with this experience. See G. Sosenbluth «Changes in Canadian sensitivity to United States business fluctuations», The Canadian Journal of Economic and Political Science (November 1957), pp. 485-489.

6. For a discussion of the factors underlying this relation see W.A. Beckett, «Indicators of cyclical recessions and revivals in Canada» in «Business cucle indicators; contributions to the analysis of current business conditions», edited by G.H Moore (Princeton University Press, Princeton 1961), vol. 1, pp. 297-299.

amplitude measures [7], although in some cases they are not adequately representative due to the considerable differences in the amplitudes of the particular cycle phases and to the small number of observations. It is observed that in West Germany and Italy the typical contraction in industrial production is of the form of a retardation in the upward movement. The U.K. has had the largest average declines of all the European countries, excluding Belgium for which average amplitude is based on only two contractions. Apart from Belgium, the deepest declines have occurred in the American economy.

TABLE III

Amplitude measures of business cycle movements
in industrial production of various countries 1950–1959

Countries	Amplitude measures of						
	Contractions				Expansions		
	1rst Contract.	2nd Contract.	3rd Contract.	Average	1st Expans.	2nd Expans.	Average
Austria	—2.7	+ 2.1	— 2.1	— 0.9	+ 38.5	+ 9.1	+23.8
Belgium	—6.4	—10.6	—	— 8.5	+ 25.7	—	+25.7
Denmark	—6.8	— 2.6	— 3.3	— 4.2	+ 17.5	+10.4	+14.0
France	—0,4	+ 3.4	— 1.4	— 1.1	+ 35.9	+ 7.6	+21.8
W. Germany	—0.9	+ 0.7	+ 2.0	+ 0.6	+ 49.3	+ 4.9	+27.1
Italy	0	+ 1.5	+ 0	+ 0.5	+ 29.7	+13.2	+21.5
Netherlands	—6.0	+ 1.7	— 4.8	— 3.0	+ 29.7	+ 7.2	+18.5
Norway	—3.9	+ 4.0	— 1.6	— 0.5	+ 21.7	+ 8.2	+15.0
Sweden	—3.9	+ 0.9	— 0.8	— 1.3	+ 12.7	+ 8.7	+10.7
U.K.	—7.7	— 2.6	— 2.6	— 4.3	+ 23.2	+ 3.5	+13.4
U.S.A.	—3.2	— 8.7	—13.4	— 8.4	+ 15.1	+18.4	+16.8
Canada	—3.1	— 1.8	— 5.2	— 3.4	+ 12.6	+21.9	+17.3

The differences in the amplitude of business fluctuations of various countries were further analyzed by examining the relation of average deviations of troughs from trend to the average rate of growth. For this purpose, the trend of industrial production was estimated by fitting to the annual data an exponential curve. The estimated trend equations are shown in Table IV.

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7. The amplitude of expansion is measured as the amount of rise (with sign +) or fall)with sign —) from trough to peak. The amplitude of contraction is measured as the amount of fall (with sign —) or rise (with sign +) from peak to trough. The calculation of these amplitude measures is made after the representation of the limits of the cyclical swings by three month averages centred on the peaks and trough and the expression of these averages in percentages of the average value of the series for each cycle.

TABLE IV

Trend equations of industrial production indices
for various countries 1950–1959
(1953 = 100)

Coutries	Trend equation (Origin 1950, t units 1 year)
Austria	$T_t = (87.08)\ (1.0725)^t$
Belgium	$T_t = (97.09)\ (1.0276)^t$
Denmark	$T_t = (93.59)\ (1.0372)^t$
France	$T_t = (88.64)\ (1.0676)^t$
W. Germany	$T_t = (76.56)\ (1.0946)^t$
Italy	$T_t = (79.83)\ (1.0794)^t$
Netherlands	$T_t = (86.69)\ (1.0551)^t$
Norway	$T_t = (88.43)\ (1.0510)^t$
Sweden	$T_t = (93.53)\ (1.0337)^t$
U.K.	$T_t = (93.79)\ (1.0299)^t$
U.S.A.	$T_t = (85.96)\ (1.0330)^t$
Canada	$T_t = (85.37)\ (1.0480)^t$

The rates of growth were plotted against the average deviations of troughs from trend in Chart II. In general, the higher the rate of growth in a country, the smaller is the average deviation of troughs from trend. Sweden, however, has low rate of growth, although the deviation of troughs is relatively small. Also, the rates of growth in Austria and Italy are relatively high despite the large deviation of their troughs. The U.K. has the smallest, except for Belgium, rate of growth and an average deviation of troughs which almost coincides with the median of the deviations of all the twelve countries examined.

The coefficient of correlation between the ranks of average deviations of troughs and the ranks of annual rates of increase in industrial production is $\tau = -0.24$ which was found to be statistically insignificant at the 0.05 level [8]. This shows that no significant relation can be established between rate of growth and amplitude of contractions in the countries examined.

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8. The corresponding value of S, corrected for continuity, is —15. Since $\sigma_s = 14.6$, we have S (corrected) = —1.03 σ_s. From tables of the normal distribution (because n)10) we see that the probability of obtaining —1.03 or smaller is 0.1515. See M. G. Kendall, «Rank correlation methods» (C. Griffin and Co. Ltd., London 1955), pp. 50–55.

CHART II

ANNUAL RATE OF GROWTH AND AVERAGE DEVIATION
OF TROUGHS FROM TREND IN INDUSTRIAL PRODUCTION
OF TWELVE COUNTRIES, 1950-59

Average deviation of troughs from trend

1 Austria
2 Belgium
3 Denmark
4 France
5 W Germany
6 Italy
7 Netherlands
8 Norway
9 Sweden
10 U.K.
11 U.S.A.
12 Canada