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CHAPTER VIII

COMPARATIVE CYCLICAL BEHAVIOR OF CENTRAL BANK DISCOUNT RATES

Section 1. Domestic and Foreign Factors

(1) In this chapter we examine the cyclical behavior of the central bank, or official, discount rates in four countries. From the outset this must be understood: central bank rates are not primarily products of market activities. They are the result of deliberate action on the part of the central banks, frequently called for by statute and law in particular situations. The bank may, for example, be obliged to keep a certain minimum reserve against its liabilities. The actions may however occur long before these or other critical points have been reached. They may then be the product of the belief on the part of the central bank authorities that changes in the discount rate are appropriate as to timing and extent in order to avoid such critical points.

Some of the reasons for a variation of the rate would also apply under strictly commercial conditions, but in central bank policy they are submerged among other, wider aims of general economic policy. Sometimes these aims involved stabilization of the general price level, or of a particular group of prices. Sometimes movements of prices in definite directions were intended. There is thus little, if anything, automatic about the moves made by central banks; they belong to a different kind of game. This does not in the least mean that there are no compelling reasons for making certain moves. But countries differ as to ideas, purposes, and objectives of policy, and the means of realizing them differ too, although all countries may be on the gold standard.

Another important *differentium specificum* is the international implication of each decision to change the discount rate. It would be most important to learn on what occasions the central banks changed the discount rate for domestic and when for foreign reasons. It is difficult to form even an expectation as to whether the domestic or the foreign influences should dominate, or to state unambiguously whether one or the other prevails. Information about these factors is exceedingly hard to come by. In this respect Table 80 is a unique exception, inasmuch as the Reichsbank itself at-

tempted to state whether increases in its rate were due to external or internal causes. Table 81 lists the occasions when the Reichsbank indicated *why* the discount rate was raised for external reasons. Discount policy is thus one of the central factors aimed at influencing international financial transactions.

Besides this, there is the expected effect upon the domestic interest rates. To what extent they are affected by changes in bank rate could be answered only for each country separately, because national financial structure can and does vary considerably within the common framework of the gold standard. Some discussion of this point is included here, though an extensive investigation is entirely outside the scope of this work. When a paper standard prevails an interdependency of bank rate and the other interest rates exists too, but it is presumably of a still less transparent nature.

Section 2. The Incompleteness of Information

(2) Before proceeding, our position must be stated more fully. To begin with, the chief interest is in the comparative cyclical behavior of central bank rates. This is only one of many important aspects of these rates. The great complexity of the field of central bank operations can hardly be revealed in this study. We do not attempt in particular a history of discount policy; several important works exist on this topic,[1] although the last word has probably not yet been said. But it is doubtful how fundamental progress can ever be made in view of the great lack of important data. Central bank policy historically has been a field of bigotry, of mutilated evidence, of confused ideals of policy often changed from one short period to another, of whitewashing the institution and of lip service to a dimly recognized community of interest with the central banks in other countries. On the other hand there is no doubt that many data are "authentic" and precise—as far as they go; and we shall see that they do not go at all far, because there always existed many other activities of these banks about which very little is known but that add up to a great influence upon the money market. Thus even the most detailed knowledge of discount rates is only half the story.

[1] Cf. R. G. H. Hawtrey, *A Century of Bank Rate*, London, 1938; Elmer Wood, *English Theories of Central Banking Control, 1819–1858*, Cambridge, Mass., 1939, the latter a beautiful work which has not found the recognition it deserves.

TABLE 80

Increases of Discount Rate of Reichsbank, 1876–1910

Year	Number of increases	Because of loss of gold or to prevent it (unfavorable exchange rates)	Because of domestic demand for money	Because domestic / foreign den
1876	3	—	1	2
1877	3	2	1	—
1878	1	1	—	—
1879	2	1	1	—
1880	2	2	—	—
1881	2	1	—	1
1882	2	1	—	1
1883	—	—	—	—
1884	—	—	—	—
1885	1	1	—	—
1886	3	—	1	2
1887	—	—	—	—
1888	2	1	1	—
1889	2	—	2	—
1890	2	—	—	2
1891	1	—	—	1
1892	1	—	—	1
1893	2	—	—	2
1894	—	—	—	—
1895	1	—	1	—
1896	2	—	1	1
1897	2	—	2	—
1898	4	1	3	—
1899	4	—	2	2
1900	—	—	—	—
1901	1	—	1	—
1902	1	—	1	—
1903	1	—	1	—
1904	1	—	1	—
1905	4	—	4	—
1906	3	—	3	—
1907	2	2	—	—
1908	—	—	—	—
1909	2	—	—	2
1910	1	—	1	—
	58	13	28	17

Source: *Die Reichsbank, 1876–1910*, 1912, p. 222.

TABLE 81

Changes in Discount Rate of Reichsbank, 1876–1910

Year	From (Per cent)	To (Per cent)
1876		
Jan. 3	5.0	6.0
Jan. 19	6.0	5.0
Feb. 4	5.0	4.0
May 18	4.0	3.5
July 11	3.5	4.0
Oct. 25	4.0	4.5[a]
[a] Gold movement to Austria and Denmark		
1877		
Jan. 5	4.5	4.0
May 11	4.0	5.0[b]
June 16	5.0	4.0
Sept. 12	4.0	5.0
Oct. 3	5.0	5.5
Nov. 12	5.5	5.0
Dec. 3	5.0	4.5
[b] Gold movement to Belgium and France		
1878		
Jan. 21	4.5	4.0
Aug. 29	4.0	5.0[c]
Dec. 11	5.0	4.5
[c] Gold movement to England		
1879		
Jan. 11	4.5	4.0
Mar. 21	4.0	3.0
Aug. 13	3.0	4.0
Oct. 11	4.0	4.5
Dec. 10	4.5	4.0
1880		
Aug. 18	4.0	5.0[d]
Sept. 4	5.0	5.5[d]
Oct. 6	5.5	5.0
Oct. 18	5.0	4.5
Nov. 9	4.5	4.0
[d] Gold movement to Switzerland, France, and Austria		
1881		
Aug. 26	4.0	5.0[e]
Oct. 5	5.0	5.5
Nov. 26	5.5	5.0
[e] Gold movement to America		
1882		
Feb. 1	5.0	6.0[f]
Feb. 18	6.0	5.0
Mar. 3	5.0	4.5
Mar. 10	4.5	4.0
Sept. 8	4.0	5.0
[f] Gold movement to France		
1883		
Jan. 18	5.0	4.0
1885		
Mar. 10	4.0	5.0[g]
Apr. 4	5.0	4.5
May 11	4.5	4.0
[g] Gold movement to England		
1886		
Jan. 22	4.0	3.5
Feb. 20	3.5	3.0
Oct. 18	3.0	3.5
Nov. 29	3.5	4.0
Dec. 18	4.0	5.0
1887		
Jan. 18	5.0	4.0
May 11	4.0	3.0
1888		
Sept. 17	3.0	4.0[h]
Dec. 6	4.0	4.5
[h] Gold movement to Russia, Austria, and Rumania		
1889		
Jan. 12	4.5	4.0
Feb. 4	4.0	3.0
Sept. 4	3.0	4.0
Oct. 3	4.0	5.0
1890		
Feb. 22	5.0	4.0
Sept. 26	4.0	5.0
Oct. 11	5.0	5.5[i]
[i] Gold movement to Russia and Rumania		
1891		
Jan. 12	5.5	4.0
Feb. 3	4.0	3.5
Feb. 13	3.5	3.0
May 15	3.0	4.0
1892		
Jan. 11	4.0	3.0
Oct. 28	3.0	4.0[j]
[j] Gold movement to Austria and in the previous month to Russia		

TABLE 81, concluded

Year	From (Per cent)	To (Per cent)
1893		
Jan. 17	4.0	3.0
May 12	3.0	4.0
Aug. 11	4.0	5.0
1894		
Jan. 9	5.0	4.0
Feb. 5	4.0	3.0
1895		
Nov. 11	3.0	4.0
1896		
Feb. 12	4.0	3.0
Sept. 7	3.0	4.0[k]
Oct. 10	4.0	5.0
[k] Gold movement to Austria and Russia		
1897		
Jan. 19	5.0	4.0
Feb. 26	4.0	3.5
Apr. 10	3.5	3.0
Sept. 6	3.0	4.0
Oct. 11	4.0	5.0
1898		
Jan. 20	5.0	4.0
Feb. 18	4.0	3.0
Apr. 9	3.0	4.0[l]
Oct. 10	4.0	5.0
Nov. 9	5.0	5.5
Nov. 19	5.5	6.0
[l] Gold movement to England		
1899		
Jan. 17	6.0	5.0
Feb. 21	5.0	4.5
May 9	4.5	4.0
June 19	4.0	4.5
Aug. 7	4.5	5.0[m]
Oct. 3	5.0	6.0
Dec. 19	6.0	7.0
[m] Gold movement to England		
1900		
Jan. 12	7.0	6.0
Jan. 27	6.0	5.5
July 13	5.5	5.0
1901		
Feb. 26	5.0	4.5
Apr. 22	4.5	4.0
June 18	4.0	3.5
Sept. 23	3.5	4.0
1902		
Jan. 18	4.0	3.5
Feb. 11	3.5	3.0
Oct. 4	3.0	4.0
1903		
Feb. 11	4.0	3.5
June 8	3.5	4.0
1904		
Oct. 11	4.0	5.0
1905		
Jan. 10	5.0	4.0
Feb. 14	4.0	3.5
Feb. 25	3.5	3.0
Sept. 11	3.0	4.0
Oct. 3	4.0	5.0
Nov. 4	5.0	5.5
Dec. 11	5.5	6.0
1906		
Jan. 18	6.0	5.0
May 23	5.0	4.5
Sept. 18	4.5	5.0
Oct. 10	5.0	6.0
Dec. 18	6.0	7.0
1907		
Jan. 22	7.0	6.0
Apr. 23	6.0	5.5
Oct. 29	5.5	6.5[n]
Nov. 8	6.5	7.5[n]
[n] Gold movement to England, Holland, and America		
1908		
Jan. 13	7.5	6.5
Jan. 25	6.5	6.0
Mar. 7	6.0	5.5
Apr. 27	5.5	5.0
June 4	5.0	4.5
June 18	4.5	4.0
1909		
Feb. 16	4.0	3.5
Sept. 20	3.5	4.0[o]
Oct. 11	4.0	5.0[o]
[o] Gold movement to Russia		
1910		
Jan. 21	5.0	4.5
Feb. 10	4.5	4.0
Sept. 26	4.0	5.0

Source: *Die Reichsbank, 1876–1900*, 1912, pp. 214–221.

Section 3. The Fourteen Variables of Central Bank Policy

(3) Discount rates are only one of many instruments used by the central banks. Yet this is almost the only one for which information—not at all complete information!—is available. This limitation applies not only to the present study but also constitutes an implicit criticism of many others in this field which have been consulted for the present purposes.

In using short-term rates, it was pointed out how important it was to use *effective* rates, or as far as exchange rates were concerned, to avoid "posted" rates so that the measurements would actually refer to prices at which a large and if possible predominant volume of transactions occurred. The same principle must prevail elsewhere. If there are several prices, rates, or other factors, a convenient representation in one number could only be achieved by means of a weighted index. We now inquire into this possibility.

In order to obtain a comprehensive picture of the situation, Table 82 gives a reasonably complete list of instruments of policy. Three classes are distinguished, chiefly domestic or chiefly foreign or external and both—meaning that the respective instruments in each class are working, or intended to work, in the indicated directions. A classification of the stimuli from domestic or foreign sources which set the various instruments in operation may or may not coincide with that of Table 82. Those entries printed in italics seem to be the generally and continually most important ones.

The attempted classification may be questioned. We have tried to meet possible criticism by stating that the variables belong *chiefly*, but not exclusively, in their respective classes.

These signify two things, not necessarily connected. *First*, the reason for a change in one of the variables stems largely from either internal (domestic) or external (foreign) economic forces. A rise of the domestic price level or great stock market activity are of the first kind; loss of gold to other countries, or changes in the foreign trade balance when caused by a drop in exports due to foreign competition abroad, are of the second kind. *Second*, the central banks, having been induced by such variations to alter their course, expect through the respective variable to affect in a given way the domestic or foreign activity showing an undesirable tendency.

The argument that some of the forces are entirely negligible *even when used*, in comparison with others enumerated, is only partly

TABLE 82

List of Instruments of Central Bank Policy

I *Chiefly domestic*:	(1) *Open market policy*
	(2) "Private" rates, i.e., discriminatory rates of discount below or above the official rate
	(3) Subsidiary rates, e.g., "lombard" rates, "advances" rate, etc.
	(4) Quantitative regulation of amounts of bills discounted
	(5) Type of bills admitted, especially regarding maturity; imposition of length of loan
	(6) Tie-in of discounts and discount rate with interest rates at open market, e.g., by custom or law
	(7) Regulation of minimum balances or reserves required of commercial banks at central bank
	(8) Moral pressure upon commercial banks, brokers, etc.
II *Chiefly foreign*	(9) *Premium on gold sales and purchases*
	(10) Administrative means (other than 9) for attracting and repelling specie, including sterilization of gold
	(11) Foreign exchange bills bought and sold*
	(12) Forward operations in foreign exchange
	(13) Cooperation (by negotiation, treaty, or through international bank) with other central banks
III *Domestic & foreign*	(14) *Discount rate*

* This applies mostly for the postwar period. This is not always an *instrument* of policy but, as gold often becomes, an *object* of policy.

valid. This opinion would have to depend to a large degree upon precise information, which is not available. Rough guesses as to the more important can be made; we have accepted this possibility by placing the asterisk opposite three instruments. In that respect we may even find disagreement regarding the gold premium policy, and a decision is hard to make in view of the mutilated evidence. For some countries it is not even known whether, for considerable periods, some of these primary instruments of policy were used at all! An excellent illustration is provided by the Bank of England, which for years engaged in "borrowing on consols." There is no complete agreement about the techniques used, the amounts involved, and the periods when the operations were carried out. Yet there is reason to believe that the Bank of England considered them as important corollaries to its discount rate. In other cases there are outright denials by officials that some techniques were ever

used, while there is fair evidence from other sources to the contrary.

Section 4. Seasonal Variations

(4) In general we have restricted discussions of seasonal variations and the techniques of their computation and elimination,[2] in order to safeguard this study from further complication and from the consequent inability to treat this subject on the level that it requires. But in the present case seasonal change is closely associated with central bank policy (and with exchange rates) and some of the pioneer work in devising statistical procedures occurred here, e.g., E. W. Kemmerer, R. Bachi, and others (cf. footnote 5).

The interrelation among the seasonal indexes of various activities in the same country seems to have been very close and a strong factor determining discount rate policy. In this sense seasonal market events, e.g., the importation of food and raw materials into England in the fall, "force" the Bank of England correspondingly to raise its rate. It is difficult to see that the bank meant this to be a policy at all,[3] since the seasonal nature of the deterioration of its reserve ratio was as obvious as any other trivial seasonal occurrence. No merchant ever had any doubt as to the seasonal character of many of his activities. As a consequence the planning of his business made allowance for this by embracing a period of at least a whole year. At any rate it is impossible to believe that the central bank cannot suppress seasonal variations, if it is strong enough to suppress cyclical variations! In that respect the following distinction has to be made: (a) control of the seasonal (cyclical) variations of the bank's own activities, and (b) control of seasonal (cyclical) variations outside the bank. The main interest and chief difficulty lies of course with (b).

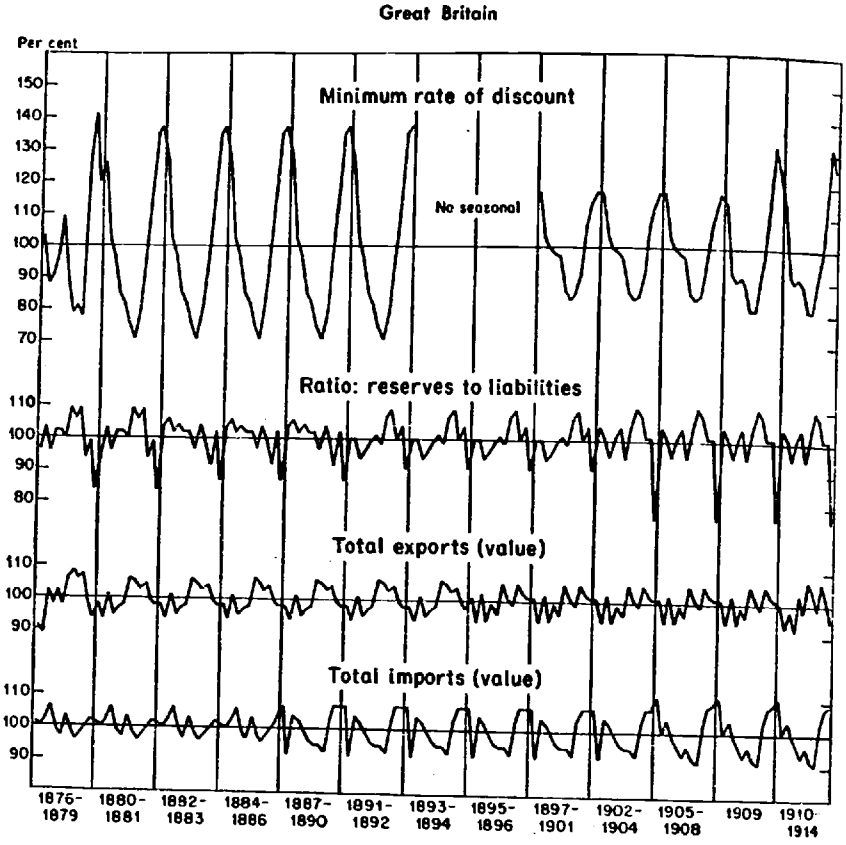
The situation becomes however still more involved. An impression that seasonal variations are interdependent is gained from Charts 45 and 46 showing discount rate, legal reserve ratio, total exports, and total imports for Great Britain and Germany respectively. There were no seasonal variations in the French discount rate, although they occur in the open market rate. All statistics cover only the pre-World-War-I period. Seasonals in central bank data

[2] Cf. Chapter III, section 3, pages 82 ff.

[3] In some instances the tie-up of discount rate variation with others is the consequence of legal minimum reserve ratios.

CHART 45

Seasonal Indexes of Discount Rate, Reserve Ratio, Total Exports and Imports, Prewar, 1876–1914

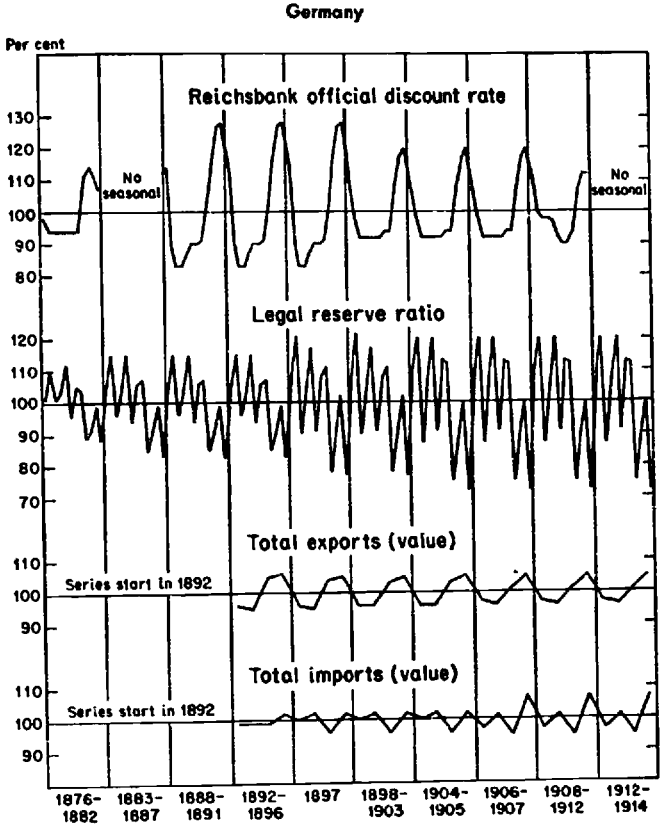


were nowhere observed after 1925. This is in itself remarkable, since most other activities that had shown them before 1914 retained them; but they disappeared in most of the financial field. The two charts show clearly very good positive or negative correlations. They also contain some surprising inconsistencies that would deserve closer study than can be undertaken here.

A further important interrelationship holds across the borders of countries. The seasonal variations in this field in New York and London are intimately linked to each other, as was fully recognized in practice and by many writers. Most noteworthy of the

CHART 46

Seasonal Indexes of Discount Rate, Reserve Ratio, Total Exports and Imports, Prewar, 1876–1914



latter is E. W. Kemmerer,[4] from whose work we quote the following:

By August net gold movements are transformed from exports to imports and the months of September, October and November are normally months of heavy imports of gold, the heaviest being in October. The low rates during the latter part of this period are of course due to the large quantities of bills offered which are drawn against our great cereal and cotton exports. June, July, and August are the months of smallest merchandise ex-

[4] E. W. Kemmerer, *Seasonal Variations in Demand for Currency and Capital in the United States,* National Monetary Commission, 1910.

ports. Imports are low in July, August, and September, and variable in the last three months of the year, tending to be high during those months in recent years. The exports, however, so much exceed the imports in the fall and early winter, that exchange falls to the lowest point of the year about October, and gold moves in large quantities to the United States.

These fall months are the months of what is commonly known as the "autumnal pressure" or "autumnal drain" in the London money market. They are months of heavy demand for cash for crop moving purposes in England, on the Continent, and in many of the British Colonies, and in agricultural countries elsewhere. From July to November both the bank rate of discount and the market rate normally rise, while October is the month of lowest reserves in the Bank of England during the year.

From the first part of October until the latter part of November the relative demand for money in the United States declines somewhat, although continuing comparatively high, and from that time on until the end of the year it fluctuates considerably, increasing somewhat just prior to the time of January 1 settlements (*op. cit.*, page 146).

Kemmerer furthermore found a noticeable parallelism between the seasonal variations of the Paris exchange and the London exchange. The Berlin exchange is even more dominated by the sterling exchange than is the French.

Writing of Great Britain, G. Clare also pointed out this interdependence. We give two salient remarks:[5]

It is seen that in the spring our commercial and banking transactions with the rest of the world leave a balance in our favor, which is remitted to us in gold, but that, in the autumn, when we are paying for our share of the world's harvest, the balance turns against us, and the gold ebbs away (*op. cit.*, page 70).

And from the 3rd (revised) edition (London, 1931):

It will be observed that the claims of the United States on us (Great Britain) being principally for agricultural produce, must fall mainly in the autumn and early winter months, but that our counterclaims being such as appertain to no one season of the year in particular, are presumably distributed pretty evenly over the whole twelve months; and it will be found, as a consequence, that on an everage of years the exchange from August to December is against us, but during the other months is in our favour. An export of gold from this side—if it is to take place at all—may generally be expected about the end of the harvest season (pages 191–192).

Many other writers might be mentioned.

(5) The correlation between the four series occurs for both

[5] G. Clare, *A Money Market Primer*, 2nd ed., London, 1923.

countries, but is more pronounced for Great Britain. There we find a correspondence among a seasonal rise in the discount rate, a falling reserve ratio, and rising imports; all this occurs in the second half of the year. The regularity is astonishing, even when the shapes of the curves undergo amplitude changes. The fourth series stays somewhat apart, since the rise of exports in the autumn is apparently not high enough to offset the pressure upon the exchanges caused by the increased imports. But it is also possible—indeed likely—that the former carry credit provisos while the latter are against cash. The amplitude of the curve for the reserve ratio is remarkable at the December trough; up to 1890 it was considerable, it decreased up to 1900, and from 1902 on it became really large. In this latter period the amplitude of the imports also increased. Yet from 1897–1909 the amplitude of the seasonal discount rate changes diminished.[6]

All this is so far of minor importance; the real difficulty lies in the disappearance of any seasonal variation of the bank rate in the period 1894–1896. During these years the other movements remained almost completely unchanged. There were other interruptions too in 1876, 1879–1880, and 1883, and the same observation holds for the other series. A correlation that holds whether or not one series—here the discount rate—is included can hardly be of much value, unless it could be shown that during the periods mentioned events on another plane, i.e., cyclical or random fluctuations, occurred which made seasonal movements unnecessary. These events, if they occurred at all, must have been quantitatively different from what they otherwise were in those years when the high correlation on the seasonal level was observed. It would lead too far to go into this matter at length but it is clear that a very complex situation of interaction of one level of covariation with others is given while at the same time we are still groping for an understanding of relationships in the absence of such complications.

Actually, if the Bank of England discount rate series itself is considered, some information may be gleaned from its behavior, although the interaction of various levels cannot be so simply ascertained. Nevertheless it is interesting to note that in 1876 the rate stood for the last seven months at 2 per cent, after a fall from 5 per cent; a specific cycle trough is set for December 1876. There was an

[6] Reference is due to the shape of the seasonal trend of the internal demand for gold, which in an over-all sense moves counter to that of the discount rate. This is unexpected but must be linked to the seasonal variations of gold movements over the frontier and to the quantities involved in all cases.

even larger drop of the rate in 1879, followed by six months at 2 per cent. In 1880 however, the rate did not reach 2 per cent again, nor in 1883. During the thirty-six months of 1894–1896 the rate was thirty consecutive months at 2 per cent; this was of course the well-known period of easy money in London with a specific cycle trough put in August 1896. In the majority of cases therefore cheap money conditions prevailed. The rate touched 2 per cent at other occasions, but too briefly to eliminate seasonal variations. So there is some support for the notion that large quantitative changes are a likely connecting link between the various levels of interdependence distinguished.

The chart for Germany requires only mentioning, since the same situation prevails there, but to a minor extent. Even before 1892, when the foreign trade figures start, the discount rate showed no seasonal, 1883–1897; the reserve ratio had an unbroken record with a clear tendency for the seasonals to increase. The seasonal variations of the Reichsbank rate on the other hand tended to become smaller in two or three steps and finally disappeared at the end of 1912 (in Great Britain they became larger from 1909 onward). The foreign trade variations are smaller than in England. The paradox—to the extent that it is one—is minor in this case.

To conclude these remarks we make these observations:

(a) The individual series have, like most seasonal indexes, great stability over many years.

(b) There occur abrupt rather than gradual changes. When one of these series is strongly affected by policy, that for whatever reasons repeats or creates a seasonal movement, the abruptness can be explained as a change in policy. If it is not such a series, an explanation is more difficult to find.

Section 5. Frequency Distributions and Cycles of Discount Rates

(6) We consider the frequency distributions first. They are made from seasonally uncorrected data; the French contain no seasonal variations and for the rest we know how little difference, for this purpose, seasonal variations make. The distributions are shown in Tables 83 and 84 for prewar and postwar.[7]

Ordering them for the pre-World-War-I case according to the

[7] Cf. Tables 9 and 10 for those of the open market rates. The differentials are analyzed below in section 6.

TABLE 83

Frequency Distribution of Central Bank Discount Rates, January 1876–July 1914, Seasonally Uncorrected Data

BANK OF ENGLAND MINIMUM DISCOUNT RATE		BANK OF FRANCE DISCOUNT RATE		REICHSBANK OFFICIAL DISCOUNT RATE	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
2.00–2.09	71	2.0	70	3.0	89
2.10–2.19	5	2.1	1	3.1	3
2.20–2.29	2	2.2	1	3.2	4
2.30–2.39	3	2.3	1	3.3	3
2.40–2.49	1	2.4	1	3.4	1
2.50–2.59	43	2.5	40	3.5	17
2.60–2.69	11	2.6	1	3.6	5
2.70–2.79	8	2.7	1	3.7	6
2.80–2.89	5	2.8	2	3.8	8
2.90–2.99	10	2.9		3.9	4
3.00–3.09	89	3.0	267	4.0	143
3.10–3.19	9	3.1	2	4.1	8
3.20–3.29	6	3.2	3	4.2	9
3.30–3.39	6	3.3	2	4.3	5
3.40–3.49	8	3.4	2	4.4	4
3.50–3.59	12	3.5	33	4.5	21
3.60–3.69	8	3.6	2	4.6	5
3.70–3.79	5	3.7		4.7	11
3.80–3.89	10	3.8	1	4.8	4
3.90–3.99	6	3.9	2	4.9	7
4.00–4.09	62	4.0	23	5.0	47
4.10–4.19	2	4.1	1	5.1	
4.20–4.29	4	4.2		5.2	3
4.30–4.39	2	4.3		5.3	1
4.40–4.49	5	4.4	1	5.4	5
4.50–4.59	12	4.5	2	5.5	17
4.60–4.69	4	4.6		5.6	5
4.70–4.79	2	4.7		5.7	1
4.80–4.89	3	4.8		5.8	1
4.90–4.99	6	4.9	1	5.9	3
5.00–5.09	28	5.0	3	6.0	16
5.10–5.19	2			6.1	
5.20–5.29	1			6.2	
5.30–5.39				6.3	1
5.40–5.49				6.4	1
5.50–5.59	2			6.5	1
5.60–5.69	2			6.6	
5.70–5.79	1			6.7	1
5.80–5.89	1			6.8	1
5.90–5.99				7.3	1
6.00–6.09	4			7.5	1
6.70–6.79	1				
7.00–7.09	1				
Total	463	Total	463	Total	463
Arithmetic mean	3.36%		2.92%		4.17%
Median	3.08%		3.00%		4.00%
Standard deviation	0.99%		0.55%		0.88%
Coefficient of variation	0.29		0.19		0.21

TABLE 84

Frequency Distribution of Central Bank Discount Rates, January 1925–December 1938, Seasonally Uncorrected Data

BANK OF ENGLAND MINIMUM DISCOUNT RATE		BANK OF FRANCE OFFICIAL DISCOUNT RATE		REICHSBANK OFFICIAL DISCOUNT RATE		NEW YORK FEDERAL RESERVE BANK DISCOUNT RATE	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
2.00–2.19	78	2.0–2.1	11	4.0–4.1	78	1.00–1.19	16
2.20–2.39		2.2–2.3	1	4.2–4.3	1	1.20–1.39	
2.40–2.59	2	2.4–2.5	52	4.4–4.5		1.40–1.59	47
2.60–2.79	2	2.6–2.7	2	4.6–4.7	2	1.60–1.79	1
2.80–2.99	1	2.8–2.9	2	4.8–4.9	1	1.80–1.99	
3.00–3.19	12	3.0–3.1	17	5.0–5.1	16	2.00–2.19	7
3.20–3.39	1	3.2–3.3	2	5.2–5.3	1	2.20–2.39	2
3.40–3.59	1	3.4–3.5	27	5.4–5.5	1	2.40–2.59	17
3.60–3.79		3.6–3.7	2	5.6–5.7	2	2.60–2.79	1
3.80–3.99	1	3.8–3.9	2	5.8–5.9		2.80–2.99	3
4.00–4.19	5	4.0–4.1	6	6.0–6.1	10	3.00–3.19	7
4.20–4.39		4.2–4.3	1	6.2–6.3	2	3.20–3.39	
4.40–4.59	25	4.4–4.5		6.4–6.5	2	3.40–3.59	25
4.60–4.79		4.6–4.7		6.6–6.7	4	3.60–3.79	1
4.80–4.99	3	4.8–4.9	1	6.8–6.9	1	3.80–3.99	4
5.00–5.19	22	5.0–5.1	9	7.0–7.1	20	4.00–4.19	16
5.20–5.39	1	5.2–5.3	2	7.2–7.3	1	4.20–4.39	1
5.40–5.59	7	5.4–5.5	1	7.4–7.5	6	4.40–4.59	3
5.60–5.79	1	5.6–5.7	3	7.6–7.7		4.60–4.79	1
5.80–5.99	1	5.8–5.9	1	7.8–7.9	1	4.80–4.99	1
6.00–6.19	4	6.0–6.1	13	8.0–8.1	4	5.00–5.19	12
6.20–6.39		6.2–6.3	1	8.2–8.3		5.20–5.39	
6.40–6.59	1	6.4–6.5	1	8.4–8.5	1	5.40–5.59	
		6.6–6.7		8.6–8.7	1	5.60–5.79	
Total	168	6.8–6.9		8.8–8.9		5.80–5.99	1
		7.0–7.1	7	9.0–9.1	10	6.00–6.19	2
		7.2–7.3		9.2–9.3			
		7.4–7.5	4	9.4–9.5		Total	168
				9.6–9.7			
		Total	168	9.8–9.9	1		
				10.0–10.1	1		
				11.8–11.9	1		
				Total	168		
Arithmetic mean	3.39%		3.68%		5.53%		2.76%
Median	3.02%		3.09%		5.01%		2.53%
Standard deviation	1.39%		1.52%		1.75%		1.31%
Coefficient of variation	0.41		0.41		0.35		0.47
Mode	2.25%		2.06%		3.85%		2.04%
Relative skewness	0.82		1.07		0.96		0.55

magnitude of the means they are as follows: for the Bank of England the arithmetic mean is 3.36 per cent, the median 3.08 per cent; these values lie between those for France, which are 2.92 per cent and 3.0 per cent, and those for Germany, which are 4.17 per cent and 4 per cent. This reproduces the order for the open market rates in the same countries. For the postwar case, the Bank of England rate has a mean of 3.39 per cent and a median of 3.02 per cent—a trifling change. But the French rate is now higher with 3.68 per cent and 3.09 per cent respectively and the German goes up to 5.53 per cent and 5.01 per cent respectively. To this must be added the New York rate, which yields 2.76 per cent and 2.53 per cent. A great deal of monetary history is told in the shift of position of these figures.

Table 85 summarizes the data for discount rates, as well as comparing them with the open market rates. It will be noted that the discount rate averages higher than the open market rate (except for New York, 1925–1938), with Berlin showing the greatest spread before 1914, and London in 1925–1938. On the other hand the stability of the discount rates was greater, as evidenced by the coefficient of variation. Both rates showed greater instability after 1914.

The further description of the frequency distributions by the usual measures encounters serious difficulties, as a glance at Chart

TABLE 85

Discount Rates and Open Market Rates

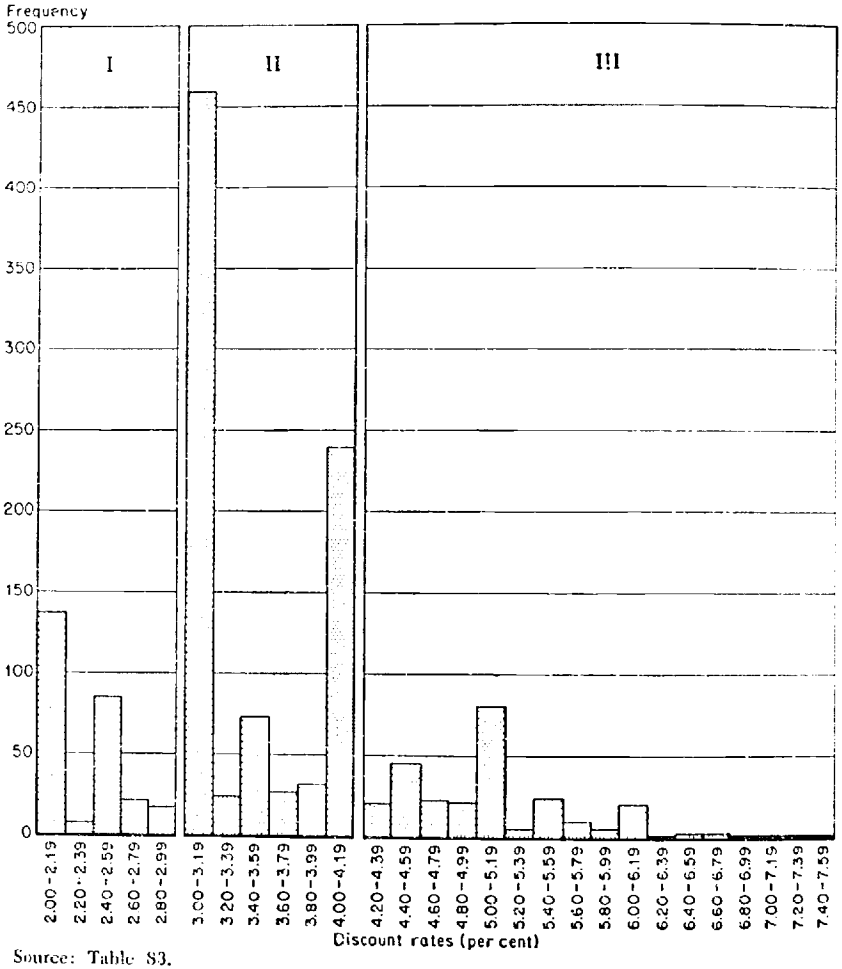
	BEFORE 1914		1925–1938	
	Open market rate	*Central bank discount*	*Open Market rate*	*Central bank discount*
		Arithmetic mean		
New York	4.85[a] 3.73[b]		2.69[a] 2.79[b]	2.76
London	2.64	3.36	2.43	3.39
Paris	2.45	2.92	3.09	3.68
Berlin	3.16	4.17	4.81	5.53
		Coefficient of variation		
New York	0.23[a] 0.67[b]		0.68[a] 0.80[b]	0.47
London	0.43	0.29	0.76	0.41
Paris	0.27	0.19	0.48	0.41
Berlin	0.33	0.21	0.36	0.35

[a] Commercial paper.
[b] Call money.

CHART 47

European Central Bank Discount Rates, Prewar

Combined Frequency Distribution, 1876–1914



Source: Table 83.

47 will tell. It may even be doubted whether the formation and the use of the various averages given above is permissible, but they do at least give some idea that cannot otherwise be expressed vividly. These distributions are very unusual and though the standard deviation, coefficient of variation, and the measure of skewness have been computed, they shall not be discussed here any further. The main difficulty comes from the lack of concentration which is

so marked that one cannot even speak of bimodality or multimodality, especially, in view of data which are in the narrow, technical sense undoubtedly homogeneous. Common to all is the tremendous peak on or near the very top of the distributions. Nowhere is it as marked as in the case of the French rate. This is simply the expression of the well-known fact that the French discount rate was far more stable than those of any other country. This was brought about by the definite—historically famous—intention of the Bank of France, as expressed in many statements,[8] to keep it as stable as possible. This program—going back to the founder of the bank, Napoleon—was so successfully carried out that the French rate stayed unchanged at 3 per cent—during our period—from June 1900 to February 1907. In the first half of the nineteenth century there were even much longer periods of complete stability, but the international transactions were then on a much smaller scale. This stability is the more remarkable as the Bank of France dealt directly with the public and would therefore be exposed without any cushioning, as was the Bank of England, to the varying needs and moods of the money market. This suggests strongly the complementation of discount policy by other means, as indeed was the case. Prominent among them and of most direct international significance was the gold premium.

The frequency distributions are so interesting that further manipulations are suggested. They are after all intended to supply information about structural, static properties of our data that do not reveal themselves easily, nor from the study of the time series alone. In Table 86 and Chart 48 we show the following: the French data being by far the most remarkable have been split into two sets covering 1876–1894 and 1895–1914, i.e., 225 and 235 months each. For each of these two periods frequency distributions were made in order to determine whether there existed perhaps a systematic change in the nature of the data to which the peculiarity of the distribution might have to be attributed. As it turns out, the measures for the two new distributions are almost in perfect agreement with each other. The standard deviations and coefficients of variation (for whatever they may be worth in this case) and the medians are identical and the others vary only slightly.

[8] For example, "The size of our reserves allows us to contemplate without emotion important variations of our metallic stock, and we only exceptionally have recourse to a measure [i.e., an increase in the rate, O. M.] which is always painful for commerce and industry." *Interviews, loc. cit.*, p. 190.

TABLE 86

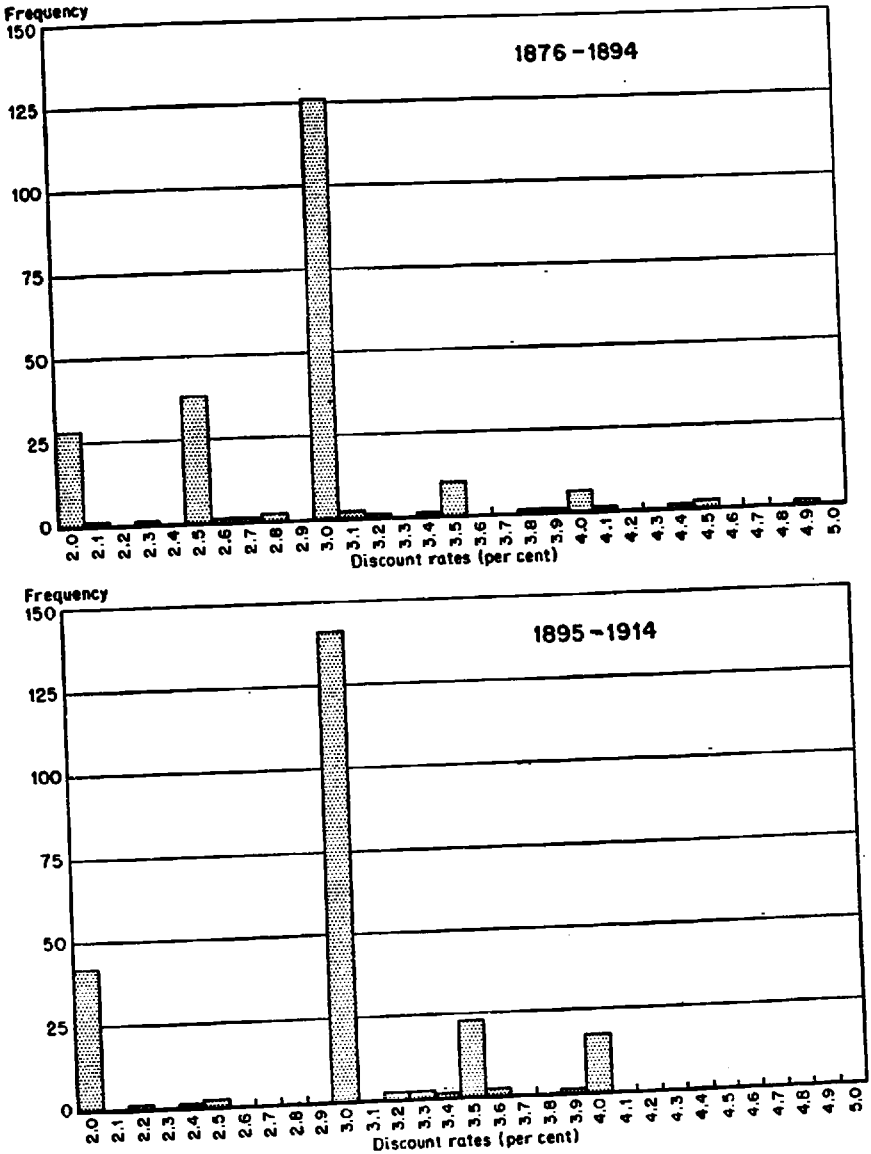
Frequency Distribution of Bank of France Official Discount Rates, Prewar, Two Periods, Seasonally Uncorrected Data

Class	January 1876–December 1894 Frequency	January 1895–July 1914 Frequency
2.0	28	42
2.1	1	
2.2		1
2.3	1	
2.4		1
2.5	38	2
2.6	1	
2.7	1	
2.8	2	
2.9		
3.0	126	141
3.1	2	
3.2	1	
3.3		2
3.4		2
3.5	1	1
3.6	10	23
3.7		2
3.8	1	
3.9	1	
4.0	6	1
4.1	1	17
4.2		
4.3		
4.4	1	
4.5	2	
4.6		
4.7		
4.8		
4.9		
5.0	1	
Total	225	Total 235
Arithmetic mean	2.90%	2.95%
Median	3.00%	3.00%
Mode	3.20%	3.10%
Standard deviation	0.56%	0.55%
Coefficient of variation	0.19	0.19

CHART 48

European Central Bank Discount Rates, Prewar

Frequency Distribution, Bank of France, 1876–1894 and 1895–1914



Source: Table 86.

(7) Each of our original distributions of Tables 83 and 84 consists really of several. It is however, not a case of simple heterogeneity of the data. Each distribution may be viewed as composed of three distributions in the following manner:

Distribution I is an ordinary L-shape, III is nearly normal, with II—a modified U shape—the link between them. This type of composition was originally described by Lexis[9] and is now familiar in population studies where it describes mortality incidence (at least when there still is high infant mortality). Applied to discount rates, it means that the lower rates at which there is some equilibrium with the general level of interest rates of the country are those normally encountered. These are the rates where the central banks think they belong; this is particularly evident for France. The distribution marked III on Chart 47 describes in the various instances those rates usually relied upon in times of acute crises.

The transition from one to the other can be very abrupt, but II shows how gradual (or not) it is. We shall not investigate how "normal" distribution III actually is, but even in the present state it is strongly reminiscent of that type.[10] At least it expresses for each central bank a preference of one "crisis rate" over others. Table 83 will show this quite distinctly. In accord with the average levels of interest and discount rates these crisis rates differ from one country to another. A distinction is to be made regarding the height of the crisis rate and the crisis change of the rate at whatever level; e.g., in London the critical change was always considered to be 1 and 1.5 per cent, the first called a "Goschen" change, the second a crisis change.

(8) We recall the discussion of Chapter I, section 5 about the search for cycles and the different ways to look upon economic periods. It is easy to see why there should be difficulties in applying the notion of cyclical variation to the present time series: some of them—especially that for France—show such jerky motions or have

[9] *Zur Theorie der Massenerscheinungen*, Freiburg, 1877, pp. 42 ff. Later Karl Pearson dissected such distributions into five constituents. Scale has a great deal to do with the distributions obtained, also whether the log or log log is considered.

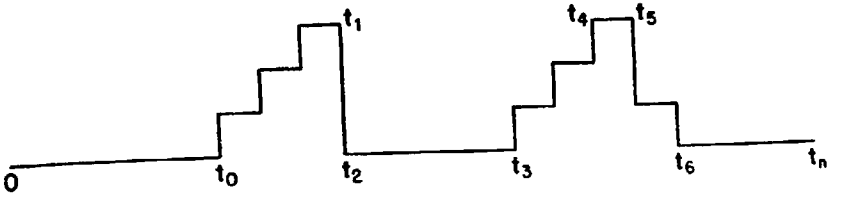
[10] One cannot suppress the remark that it may seem odd to find the deliberately chosen crisis rates normally distributed! This would according to general belief imply that many small, unrelated causes are at work to produce a normal distribution. This seems to exclude completely that they are products of policy decisions.

The answer is that, although a series, which reflects many small causes, takes the form of a normal distribution, the converse is not necessarily true.

distinct patterns, different from the familiar one of specific cycles, that the use of the latter concept is somewhat shrouded in doubt. The French pattern, e.g., is shown in Chart 49. Start with t_1 and assume this to be the peak of one cycle; is the trough at t_2 or t_3?

CHART 49

Step Cycles



Is there sense in calling the period t_2 to t_3 part of a "contraction"? Is the next peak at t_4 or t_5, the next trough at t_6 or later? Clearly the definition of the cycle must govern its determination, but the danger always exists that definitions may be used outside their proper domain. Other series have cycles much more in the traditional sense, especially Great Britain, in which case this probably is the consequence of the far more frequent changes which, although policy measures, produce a cyclical pattern if the open market rate has an independent cycle of sufficient strength. This comes about because the official rate was held on the average a conventional distance above the open market rate.

The number of cycles for the 463 months[11] before 1914 is much smaller than in previous instances (Table 87). England has ten, Germany eight, and France five. The average durations show reciprocal relationships; the average full cycle for the French rate lasted 85.8 months, the British 44.9, and the German 56.6 months. While the distribution of the total duration is almost equally divided, between expansion and contraction for England and Germany, the French distribution is 23.1 per cent to 76.9 per cent. We see here the consequence of using t_3 instead t_2 in Chart 49 as the trough. If t_2 had been chosen, the roughly one to three proportion could easily have become three to one, depending on the concrete case.

For the interwar period (168 months) we can only expect very

[11] The basic series are monthly averages, tending to make them smoother than the basic data, which accrue at uneven intervals and thus produce a far more jerky effect.

TABLE 87

Number and Duration of Specific Cycles of Central Bank Discount Rates, Seasonally Corrected Data

	NUMBER OF:			AVERAGE DURATION[a] OF:			AVERAGE PER CENT DURATION OF SPECIFIC CYCLES[b]	
	Expansions	*Contractions*	*Full cycles*[c]	*Expansions*	*Contractions*	*Full cycles*	*Expansions*	*Contractions*
				(MONTHS)				
Prewar, January 1876–July 1914, 463 months[d]								
Great Britain	10	10	10	22.6	22.3	44.9	50.3	49.7
France	5	5	5	19.8	66.0	85.8	23.1	76.9
Germany	8	8	8	29.4	27.2	56.6	51.9	48.1
Postwar, January 1925–December 1938, 168 months								
Great Britain	1	2	1	9.0	21.0	29.0	30.0	70.0
France	2	3	2	18.0	27.3	52.5	39.7	60.3
Germany	2	1	1	6.5	8.0	16.0	44.8	55.2
United States[e]	2	2	2	25.5	14.5	40.0	63.7	36.2

[a] Duration of only complete cycles, expansions, and contractions are included in their respective columns.

[b] The percentages are calculated from a base equal to the average duration of expansion plus that of contractions. The sum equals the average duration of cycles only when the number of full cycles is the same as the number of expansions and contractions.

[c] Only complete cycles are counted; parts of cycles at both ends are dropped. Cycles are measured from trough to trough.

[d] The Central Bank discount rates of Germany and Great Britain are seasonally corrected; the Bank of France rate had no seasonal trend. In the postwar period there were no seasonal trends in any of the data.

[e] Federal Reserve Bank of New York discount rate.

imperfect results, because of the infrequency of cycles. The figures are nevertheless given in the second part of Table 87. Interesting changes occur besides the appearance of a United States rate: there are more movements for France than for any other discount rate; but this is mostly due to the fact that elsewhere cycles and other movements simply disappear altogether from the picture! There is, for example, only one cycle for Germany of a total length of 16.0 months, covering less than 10 per cent of the number of observations. The one British cycle is almost twice as long, of which 30 per cent is expansion and 70 per cent contraction, while the German is split more evenly 45 to 55 per cent.

It is quite clear that the whole phenomenon of a cycle that emerges with some clarity for the period before World War I is now threatened, and that we are on uncertain grounds if we want to carry over our prewar description to the later period. All this is of course not due to some "natural" cause, to be found in the behavior of other series that together determine that of the discount rates, but it is instead the product of deliberate action, probably caused by a change in the general goals of policy. The latter were hardly clearer than in the time before 1914, as we have seen, but the elimination of seasonal and other variations because of the preference for maintaining stability was one of the various goals. In other words, although we cannot give a full description of the policy in either period, we are nevertheless able to note a change and even to indicate its direction.

It is noteworthy that the difficulties of the Bank of England after 1925 were hardly less than before 1914; yet the bank discount rate had fewer cycles than before.

(9) Another way of looking at the same phenomenon is through the examination of the numbers of changes of the discount rates in the respective prewar and postwar periods. We do this in three steps, by indicating the total number of changes and the average number of changes per specific and per reference cycle. This information is embodied in Table 88. Attention has to be drawn especially to the behavior of the French discount rate and to the fact that, while in the 463 months before World War I there were only 55 changes, in the 168 postwar months there was almost the same number—53—the frequency increasing after 1934. The comparison of the prewar and postwar figures for the average number of changes during the respective reference cycles is striking; we discuss this matter in somewhat more detail below. The appearance of such wide divergences makes it difficult to believe that the monetary theory of business cycles applies equally well for *both* periods: how could the deliberate action of the central banks—working on the discount rates—express itself in such a widely divergent manner? Or were the cycles they intended to influence so widely at variance? If this should be the answer, how can one obtain theories of these cycles whose applicability does not become too restrictive?

Further analysis of the behavior of the official discount rates is found in Table 89. This table is easy to read: we determine the number of zero, positive, and negative changes; positive and negative changes are subdivided into classes whose (small) intervals

TABLE 88

Changes in Central Bank Discount Rates

	Total number of changes[a]	AVERAGE CHANGES					
		SPECIFIC CYCLE			REFERENCE CYCLE		
		E	*C*	*Total*[b]	*E*	*C*	*Total*
January 1876–July 1914, 463 months, seasonally corrected data[c]							
Great Britain	393	21.1	17.7	38.8	36.5	25.4	60.0
Germany	277	18.9	14.9	33.8	24.3	20.0	45.2
France	55	6.0	4.0	10.0	4.9	2.8	7.5
Postwar, January 1925–December 1938, 168 months							
Great Britain	32	4.0	5.2	13.0	1.0	11.5	12.5
Germany[d]	41	6.5	8.0	16.0	12.0	12.5	34.0
France	53	2.5	7.5	9.0	7.0	5.0	12.0
United States	45	8.0	7.0	15.0	6.5	11.5	27.0

E = changes during expansion.

C = changes during contraction.

[a] Total number of changes in discount rates in period covered.

[b] Average changes determined for whole cycles, measured from trough to trough. Averages for complete cycles may not be equal to the sum of averages of expansions and contractions since there may be expansions or contractions which are not part of complete cycles.

[c] The central bank discount rates of Germany and Great Britain are seasonally corrected. The Bank of France rate had no seasonal trend. In the *postwar* period there were no seasonal trends in any of the data.

[d] The National Bureau of Economic Research has determined reference cycles for Germany in the postwar period through 1932. Therefore the average number of changes during the one reference cycle of the central bank rates for this country is determined for the period January 1925–December 1932. For the specific cycle, the period is January 1925–December 1938.

depend of course upon the nature of the series and are therefore not the same for all four countries. All this is done for seven complete and one incomplete five-year period before World War I, and for three complete postwar periods. The underlined figures are percentages, arranged so that all changes (including zero) for each five-year interval are taken as 100. Then the zero, plus and minus changes (and the sum of the latter two) are expressed as percentages. This permits a direct comparison in all directions for the same bank, for the different banks, and for all periods.

It would lead too far to discuss this table exhaustively, so that we shall point out only the highlights. But the reader should study it with at least the following considerations in mind:

(a) The absolute, average interest rate level at each bank has to be taken into account (see Tables 83 and 84); this makes a greater or smaller spread of the variations more or less probable.

(b) The variations shown are, as we know, induced by external and internal factors. Do these more detailed frequency distributions give hints as to which are preponderant?

(c) Are there common signs of stress which would be revealed by the large number of positive changes in the higher class intervals? (These mean of course by how much the rate was changed how many times.)

The five-year periods do not conform to any cyclical units, but that does not matter, especially since we are not necessarily looking for the familiar cycles but may find crises, possibly distributed at random, as in the cases of the earlier chapters.

Taking the *prewar* period it is at least clear that the over-all number of changes did not increase, that on the contrary there appears to be a downward tendency. This is similar to those observed in different, but closely related, fields such as seasonal variations of interest rates. A decrease could be interpreted as some evidence of a growing stability of the financial system as far as it is represented by these and the earlier statistics. Since the discount rates are heavily determined also by the external relations of the country, a growing stability elsewhere would naturally help to improve it at home too. After World War I the tendency was reversed in France, a country that during these years was laboring under enormous internal political difficulties (Front Populaire, Stavisky scandal, etc.) and experiencing a great external strain at least as long as the gold bloc held together. On the other hand no changes at all occurred in the rate of the Bank of England and the Reichsbank after 1933. The plus and minus changes for each country do not always balance for each five-year period. The explanation is obvious. Some changes may come at the end, others at the beginning of such a period, and—more important—increases and decreases usually are made at different rates; since only the number of changes are counted this is not taken into account. But the reasons can easily be deduced from Table 89. There one will see that for some central banks it is true that increases by higher percentages are a little more frequent than decreases.[12] In other words

[12] This remark refers exclusively to the official discount rates and not to the over-all "policy"; the same is true of the preceding interpretive remarks. What the policy was is an entirely different affair.

TABLE 89

Frequency of Zero, Positive, and Negative Changes in Central Bank Discount Rates, Five-Year Intervals

Changes (per cent)	*1876–1880*		*1881–1885*		*1886–1890*		*1891–1895*		*1896–1900*		*1901–1905*		*1906–1910*		*1911–July 1914*		*Total 1876–1914*	
	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−
Prewar: 463 months, seasonally corrected data																		
Bank of England minimum discount rate																		
0	24		20		11		32		27		37		22		22		196	
0.1–0.29	4	6	4	10	6	7	2	3	7	6	3	6	7	3	3	6	36	47
0.3–0.49	3	2	5	2	4	3	2	8	3	3	—	4	3	7	3	2	23	31
0.5–0.69	1	4	1	2	2	5	1	3	3	1	1	2	2	5	2	3	13	25
0.70–0.89	4	3	5	3	8	5	—	1	2	2	—	2		3			19	19
0.90–1.00	1	1	2	3	2	2	2	2	2	3	5	—	1		1		16	11
1.10–1.29	1	2			2	1	2	1					2	1			7	5
1.30–1.49	—	1	—	1	1	1	1	—	1	—			3			1	6	4
1.50–1.69	2	—															2	—
1.70–1.89				1										1			0	2
1.90–2.09			1														1	
Total	16	19	18	22	25	24	10	18	18	15	9	14	18	20	9	12	123	144
Percentage distribution:																		
Pos., neg.	*26.7*	*31.7*	*30.0*	*36.7*	*41.7*	*40.0*	*16.7*	*30.0*	*30.0*	*25.0*	*15.0*	*23.3*	*30.0*	*33.3*	*20.9*	*27.9*	*26.6*	*31.1*
No change	*41.7*		*33.3*		*18.3*		*53.3*		*45.0*		*61.7*		*36.7*		*51.2*		*42.3*	
Bank of France official discount rate																		
0	47		51		52		56		53		60		54		35		408	
0.1–0.2	—	2	1	2	—	2	—	2	—	1	—	—	2	—	1	2	4	11
0.3–0.4	2	1	1	2	1	1	—	2	2	1	—	—	2	—	2	1	10	8
0.5–0.6	3		1		1	1	—	—	2	1	—	—	—	2		1	7	5
0.7–0.8	1	2	1				—	—	—	—	—	—	—	—	1		3	2
0.9–1.0	—	2		1	1	1	—	—	—	—	—	—	—	—			1	4
Total	6	7	4	5	3	5	—	4	4	3	—	—	4	2	4	4	25	30
Percentage distribution:																		
Pos., neg.	*10.0*	*11.7*	*6.7*	*8.3*	*5.0*	*8.3*		*6.7*	*6.7*	*5.0*			*6.7*	*3.3*	*9.3*	*9.3*	*5.4*	*6.5*
No change	*78.3*		*85.0*		*86.7*		*93.3*		*88.3*		*100.0*		*90.0*		*81.4*		*88.1*	

TABLE 89, continued

Reichsbank official bank discount rate[a]

Changes (per cent)	*1876–1880*		*1881–1885*		*1886–1890*		*1891–1895*		*1896–1900*		*1901–1905*		*1906–1910*		*1911–July 1914*		*Total 1876–1914*	
	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−
0	22		44		37		40		24		34		28		28		257	
0.1–0.2	4	8	2	3	4	4	1	2	3	3	3	6	6	6	1	3	24	35
0.3–0.4	4	8	1	3	2	2	2	2	6	9	4	4	2	7	2	5	23	40
0.5–0.6	3	4	1	2	2	2	3	2	1	3	1	2	1	2	1	1	13	18
0.7–0.8	1	2	3	—	—	2	3	1	4	2	2	2	1	4	—	1	14	14
0.9–1.0	3	—	—	—	3	—	1	1	4	1	1		2		1		15	2
1.1–1.2	—	—	—	1	1	1	—	1	—	—	1	—					2	3
1.3–1.4								1									—	1
1.5–1.6																	—	—
1.7–1.8													1				1	—
Total	15	22	7	9	12	11	10	10	18	18	12	14	13	19	5	10	92	113
Percentage distribution:																		
Pos., neg.	*25.4*	*37.3*	*11.7*	*15.0*	*20.0*	*18.3*	*16.7*	*16.7*	*30.0*	*30.0*	*20.0*	*23.3*	*21.7*	*31.7*	*11.6*	*23.3*	*19.9*	*24.5*
No change	*37.3*		*73.3*		*61.7*		*66.7*		*40.0*		*56.7*		*46.7*		*65.1*		*55.6*	

[a] Covers 462 observations. The data available for the Reichsbank start January 1876; therefore it was not possible to observe the first change, December 1875 to January 1876.

(*table continues*)

TABLE 89, continued

Postwar: 180 months, seasonally uncorrected data

Changes (per cent)	*1925–1929* +	−	*1930–1934* +	−	*1935–1939* +	−	*Total 1925–1939* +	−
Bank of England minimum discount rate								
0	45		43		60		148	
0.1–0.2	3	1	—	4	—	—	3	5
0.3–0.4	—	2	1	4	—	—	1	6
0.5–0.6	1	3	1	2	—	—	2	5
0.7–0.8	3	1	—	2	—	—	3	3
0.9–1.0	1	—	1	—	—	—	2	—
1.5	—	—	—	1	—	—	—	1
1.7	—	—	1	—	—	—	1	—
Total	8	7	4	13	—	—	12	20
Percentage distribution:								
Pos., neg.	*13.3*	*11.7*	*6.7*	*21.7*	—	—	*6.1*	*11.1*
No change	*75.0*		*71.7*		*100*		*82.2*	

Changes (per cent)	*1925–1929* +	−	*1930–1934* +	−	*1935–1939* +	−	*Total 1925–1939* +	−
Bank of France official discount rate								
0	47		52		27		126	
0.1–0.2	—	3	2	—	3	5	5	8
0.3–0.4	1	3	2	—	2	6	5	9
0.5–0.6	—	2	—	4	1	2	1	8
0.7–0.8	—	1			1	2	1	3
0.9–1.0	—	1			1	1	1	2
1.1–1.2	—	1			1	1	1	2
1.3–1.4	—				1		1	—
1.5–1.6	1						1	—
1.7–1.8					1	2	1	2
1.9–2.0					1		1	—
2.3						1	—	1
2.7					1		1	—
Total	2	11	4	4	13	20	19	35
Percentage distribution:								
Pos., neg.	*3.3*	*18.3*	*6.7*	*6.7*	*21.7*	*33.3*	*10.6*	*19.4*
No change	*78.3*		*86.7*		*45.0*		*70.0*	

TABLE 89, concluded

Changes (per cent)	1925–1929 +	1925–1929 −	1930–1934 +	1930–1934 −	1935–1939 +	1935–1939 −	Total 1925–1939 +	Total 1925–1939 −
	Reichsbank official bank discount rate							
0	40		39		60		139	
0.1–0.2	2	5	—	2	—	—	2	7
0.3–0.4	1	4	1	4	—	—	2	8
0.5–0.6	—	3	—	5	—	—	—	8
0.7–0.8	2	1	1	4	—	—	3	5
0.9–1.0	1	1	—		—	—	1	1
1.1–1.2			1		—	—	1	—
2.4			1		—	—	1	—
3.2			1				1	—
3.7			—	1			—	1
Total	6	14	5	16	—	—	11	30
Percentage distribution:								
Pos., neg.	10.0	23.3	8.3	26.7	—	—	6.1	16.7
No change	66.7		65.0		100		77.2	

Changes (per cent)	1925–1929 +	1925–1929 −	1930–1934 +	1930–1934 −	1935–1939 +	1935–1939 −	Total 1925–1939 +	Total 1925–1939 −
	New York Federal Reserve Bank discount rate							
0	40		36		58		134	
0.1–0.2	8	3	—	9	—	1	8	13
0.3–0.4	5	2	—	12	—	1	5	15
0.5–0.6			—				—	
0.7–0.8	1		1				2	
0.9–1.0			1				1	
1.1–1.2		1	1				1	1
Total	14	6	3	21	—	2	18	29
Percentage distribution:								
Pos., neg.	23.3	10.0	5.0	35.0		3.3	10.0	16.1
No change	66.7		60.0		96.7		74.4	

the central banks appear to be more reluctant to "let go" than to "take over"—a not uncommon phenomenon associated with power.

(10) Now we take up three closely connected measurements that have been used with the other series: we propose to study (a) the concentration and dispersion of the specific cycle turning points, (b) the correlation coefficients of the series, and (c) the covariation with their reference cycles.

(a) *The concentration and dispersion of peaks and troughs* is examined only for the prewar series, since later there are not enough observations (cf. Table 90). There are even then only five groups of peaks and four of troughs obtained for the three European central banks. This is considerably less than for the short-term interest rates (cf. Table 93). The mean deviations for the average

TABLE 90

Concentration and Dispersion of Central Bank Discount Rates, Specific Cycle Turning Points, Three European Countries, January 1876–July 1914

	Coinciding peaks[a]			
	Average peak[b]	*Mean deviation (months)*	*Average mean deviation (months)*	*Percentage coinciding*
Three European countries	Jan. 1882	0.33	3.47	65.2
	July 1889	7.33		
	Feb. 1900	2.33		
	Oct. 1907	4.67		
	Dec. 1913	2.67		
	Coinciding troughs[c]			
	Average trough[b]	*Mean deviation (months)*	*Average mean deviation (months)*	*Percentage coinciding*
Three European countries	Mar. 1888	2.33	8.25	48.0
	Oct. 1896	21.67		
	Jan. 1906	8.67		
	June 1914	0.33		
	Average Mean deviation of coinciding peaks as per cent of Corresponding average for troughs			
Three European countries	42%			

[a] Coinciding peaks: within the range of peaks is no trough.
[b] The arithmetical mean of the coinciding peaks or troughs is computed.
[c] Coinciding troughs: within the range of troughs is no peak.

peaks and troughs have a very great range, from 0.33–7.33 months and 0.33–21.67 respectively. Especially the latter figure stands apart. Even the reference cycles were more closely packed. Of course we found that troughs (here of more doubtful identification than the peaks) are less likely to coincide than peaks; it is reasonable to assume this for the present series too, as policy measures would naturally tend to be used in simultaneous crises but relaxed very differently. (It might be noted that at the trough the Reichsbank discount rate tended to lead the Bank of England, which in turn led the Bank of France.)

The average mean deviations are 3.47 months for peaks and 8.25 for troughs—a much larger difference than for the private rates (Tables 90 and 91). The difference would be still larger, save for the June 1914 value of only 0.33 months. This exception is easily

TABLE 91

Dispersion among Peaks and Troughs, Three European Countries, 1876–1914

	PEAKS		TROUGHS	
	Per cent correspondence	*Average deviation (months)*	*Per cent correspondence*	*Average deviation (months)*
Business cycles	100	2.44	100	2.25
Short-term interest rates	72	2.67	78	3.21
Central bank discount rates	65	3.47	48	8.25

understood in view of the imminence of war, which caused the central banks to begin raising their rates in anticipation. It is most remarkable that some of the years which occur in Table 23 are not repeated here, notably August 1893 when the mean deviation for that peak was zero; and there is no other concentration near enough! On the other hand 1893 was a year that did not occur among the reference dates either, although it is well known that it witnessed widespread, acute crises. Finally the percentages of the turning points which coincide are worse here than for the private rates. For peaks it is 65.2 per cent, for troughs only 48.0 per cent, as compared with 72.0 per cent and 73 per cent for the private rates.

From this it becomes clear that *the central bank rates do not show a very uniform behavior, either in regard to their own short-term rates and reference cycles, or to each other* (see Table 91). But all

this requires further investigation before such a statement can be made more definite.

(b) Table 92 gives the *correlation coefficients* of the three pairs of European discount rates 1876–1914, and the six pairs for the interwar period 1925–1938. It may be recalled that correlation coefficients take every single value of the time series into considera-

TABLE 92

Correlation between Central Bank Discount Rates, Seasonally Uncorrected Data

	r	CONFIDENCE LIMITS[a] Lower	Upper
January 1876–July 1914, 463 months			
Bank of England minimum discount rate—Bank of France official discount rate	+0.53	0.44	0.61
Bank of England minimum discount rate—Reichsbank official bank discount rate	+0.73	0.67	0.78
Bank of France official discount rate—Reichsbank official bank discount rate	+0.42	0.32	0.52
January 1925–December 1938, 168 months			
Bank of England minimum discount rate—Bank of France official discount rate	+0.49	0.33	0.63
Bank of England minimum discount rate—Reichsbank official bank discount rate	+0.82	0.74	0.88
Bank of France official discount rate—Reichsbank official bank discount rate	+0.46	0.29	0.60
Bank of England minimum discount rate—New York Federal Reserve Bank discount rate	+0.86	0.80	0.90
Bank of France official discount rate—New York Federal Reserve Bank discount rate	+0.41	0.24	0.56
Reichsbank official bank discount rate—New York Federal Reserve Bank discount rate	+0.65	0.52	0.75

[a] For confidence coefficient of 99%.

tion; they measure thus much more than, say, cyclical interrelationship and therefore the two approaches may yield quite different results. This point becomes important again, even when another equally noncyclical approach is made, as below in section 6.[13]

The reader will furthermore recall what was said in Chapter III

[13] The same situation was encountered before in Chapter III, pages 103 ff. and especially in Chapter VI, *passim*.

about correlation and functional dependency.[14] Here we are primarily concerned with parallelism of our series without desiring to jump to the conclusion that if shown it signifies a causal (functional) interrelationship. This does not apply to section 6 below, where we shall examine correlation and cyclical covariation of official discount rates and their respective open market rates.

TABLE 93

Interest Rate Correlation Coefficients

	1876–1914		1925–1938	
	Open market rates	*Central bank discount rates*	*Open market rates*	*Central bank discount rates*
New York–London	+0.45		+0.93	+0.86
London–Berlin	+0.73	+0.73	+0.84	+0.82
New York–Berlin	+0.40		+0.77	+0.65
New York–Paris	+0.36		+0.34	+0.41
London–Paris	+0.67	+0.53	+0.34	+0.49
Berlin–Paris	+0.62	+0.42	+0.13	+0.46

Before 1914 the correlation between the British and German rates is high ($r = +0.73$), while the other two pairs give much less satisfactory results. In the interwar period the British and American rates give $r = 0.86$ and the previously mentioned rises to 0.82; the others can more or less be neglected as not significant, with the possible exception of Berlin–New York where $r = 0.65$.[15] Thus we find further confirmation of a none too strong parallelism even when the cyclical approach is pushed into the background.

In general the coefficients of correlation for the discount rates paralleled those for open market rates. Table 93 shows that, particularly for the interwar years, the ranking of the two groups gave the same order. The independence of the French money market

[14] This becomes important once more below in section 6 when comparing the official and the open market discount rates, where the coefficients are expected to show the existence of a highly plausible functional interdependency. See also the remarks made there about our use of seasonally uncorrected data.

[15] These coefficients must be viewed in the light of the number of observations, which is high—even in the much shorter postwar period (168 months). The difference between the prewar and postwar samples is great, but because of their absolute magnitudes a separate significance test is not required. The same situation was encountered previously and explained, for the first time, in footnote 24 of Chapter III; cf. also the remarks on significance regarding the coefficient C of covariation there and below, section 6. The confidence limits shown take care of all these considerations.

and central bank is brought out, again most notably in the interwar years, by the low values of the coefficient. The relationships for London with New York and Berlin increased after 1914, whereas that with Paris decreased.

(c) The *covariation of the specific cycles* with their respective *reference cycles* is of more than general interest. The relation between these two deserves particular attention from the point of view of most versions of the monetary theory of the business cycle.

One version of that theory claims that a credit expansion, in its early stages perhaps fed by an influx of gold or other funds from abroad, might come to an end through interference by the central bank, which operates effectively mostly at the two turning points; i.e., when activity is low, the central bank lowers the rate, dragging most others down with it and thus starting the upturn. When activity is high, the central bank, fearful of the depletion of its reserves—mostly through external drain of gold from countries where prices have not risen as much—cuts further expansion by rate increases.

Other versions attribute a different behavior to the central bank: they claim that an expansion—and consequently the subsequent contraction—would never reach great heights or depths respectively had not the central bank in its role as the lender of last resort continued to accommodate the commercial banks and thus fed the expansionist movement until it turned inflationary. Only at the end would the central banks raise their rates sharply. Whatever the version, the expectation is for a high degree of correspondence between the business cycle and the discount rates. In general the discount rate troughs lagged behind the reference cycle troughs; only the Bank of England rate led at the peak. Of course even a persistent lag between both series expresses a correspondence; an illustration will be given below, p. 404, where the lags of the official discount rates behind the open market rates are analyzed in greater detail.

Taking our reference cycles we obtain Table 94 and find for Great Britain and Germany before World War I a high and for France a low degree of correspondence.[16] The total correspondence,

[16] The latter need not follow from the low variability and peculiar cycles of the French discount rate, since there could still be a good covariation with reference cycles that would then be out of step with those of the other countries. The one or the other must at least be the case; of course, the discount rate may be out of step with its own reference cycle, and both with the reference cycles of the other two countries.

TABLE 94

Phase Comparison of Specific Cycles of Central Bank Discount Rates[a] and Their Respective Reference Cycles

	SAME PHASE:			Different phase	SAME PHASE:			Different phase
	Expansions	Contractions	Total		Expansions	Contractions	Total	
	(MONTHS)				(PERCENTAGES)			
	Prewar[b]							
Great Britain	172	152	324	139	37.1	32.8	70.0	30.0
France	74	194	268	195	16.0	41.9	57.9	42.1
Germany	192	155	347	79	45.1	36.4	81.5	18.5
	Postwar,[c] January 1925–December 1931, 84 months[d]							
Great Britain	14	38	52	32	16.7	45.2	61.9	38.1
France	22	37	59	73	16.7	28.0	44.7	55.3
Germany	22	23	45	39	26.2	27.4	53.6	46.4
United States[e]	38	28	66	18	45.2	33.3	78.6	21.4

[a] The rates for Germany and Great Britain are seasonally adjusted. The rates for France had no seasonal trends.

[b] Periods covered: Great Britain, January 1876–July 1914, 463 months; France, January 1876–July 1914, 463 months; Germany, February 1879–July 1914, 426 months.

[c] In the postwar period none of the rates had seasonal trends.

[d] Period covered for France: January 1925–December 1935, 132 months. In the case of the three other countries there were no specific cycles in the discount rates after 1931.

[e] New York Federal Reserve Bank discount rate.

in the order named, is 70.0, 81.5, and 57.9 per cent. The first two are high, but not higher than some covariations encountered before. The open market rates (Table 14) showed in every instance a better correspondence and even their lowest was slightly better than the best now. The Bank of England does not emerge as the best conforming in spite of the most numerous changes in its rate. Instead it is the Reichsbank which gives a value closest to that of the short-term rate covariation. As a consequence these two interest rates will show an extremely high correspondence with each other (see Table 97).

The distribution of the number of months for which covariation can be observed is highly irregular; the French case with a small percentage for expansion is of course a direct outcome of the arbitrary choice made in defining a specific cycle there (see the beginning of this section). This breaks the uniformity of greater

percentages of expansion over those of contraction in short-term interest rates; for the discount rates it is inconclusive.

The statistics for the postwar period can be treated only with great caution because of the smallness of the sample and the disappearance of cycles in the discount rates in the conventional sense, at least after 1933. At any rate we observe, as often before, a deterioration in previously shown regularities—even if these were not of particularly high order. This is the case in every single instance. The newly added data for the United States (taking the rate of the Federal Reserve Bank of New York) exceed in covariation all others and would even be second best in the prewar period. But here too cycles disappeared altogether after September 1937; the rate was held constant at one per cent throughout World War II.

Summing up (*c*): the fairly good covariation between discount rates and reference cycles is insufficient to "prove" or "disprove" either version of the traditional monetary theory of the cycle. An outstanding characteristic is however that the lack of uniform behavior in the case of each single country and between prewar and postwar for all countries raises doubts as to the generality of the assertion of the monetary theory. In view of the extraordinary complexity of economic fluctuations it is hardly surprising that simple theories fail.[17]

Section 6. Central Bank Discount Rates and Open Market Short-Term Rates

(11) Whatever the goals of central bank policy may have been at various times in the different countries, there is one frequently found among them: the official discount rate should be held above "the" open market rate. This expresses the desire to "control" the market and incidentally it attaches to the bank rate something of a punitive character. It is therefore of considerable interest to investigate the movements and the relative positions of the two rates for our countries. To some extent this has been done in the literature, but only sporadically and for short periods. Though the question seems exceedingly simple, we shall soon see that it has a number of perplexing aspects which we shall not be able to clear up satisfactorily in this chapter. The same type of question—

[17] One recalls the famous disclaimer of R. G. H. Hawtrey that there are no more monetary cycles since the end of the gold standard.

especially as dealt with in the later part of this section—reappears in Chapter IX where the intricate relationships of short-term and long-term rates are considered.

The next question is whether to expect cycles in series obtained by deducting the open market from the official rate. It is not at all easy to form an opinion a priori, either on the basis of our knowledge of the cyclical behavior of the constituent series, or on that of the significance or economic meaning of the new series.

However, since the variability of the discount rates is highest for the Bank of England and lowest for the Bank of France we may expect that the variations of their respective differentials will differ most from both basic cycles in Britain and in France repeat more faithfully the movements of the open market rate.[18] Since the latter are cyclical the difference will be cyclical too. The possible variants are familiar from the preceding chapters.

Charts 50 and 51 show three prewar and postwar European and the postwar New York series. Limiting ourselves to the pre-World-War-I period, a seemingly great randomness appears to prevail. But it is known that visual inspection can be a very unreliable guide, especially in determining cycles that are of complicated structure. So, although there are objections to smoothing of time series when looking for cycles, *twelve-month moving averages* were applied; in all instances cycles and other configurations appear.

Smoothing operations often tend to transpose cycles; sometimes they produce artificial cycles or exaggerate turning points which are merely summations of random factors in the basic series. Whether a transposition of peaks and troughs occurs here and how far it goes is hard to decide when the cycles are not well established in the first place. The cycles of the moving averages are compared with the reference cycles. These are themselves averages of an extremely high order into which, incidentally, the present series did not enter. The study showed so little correspondence that it must be considered a genuine disparity of movement and not the consequence of our taking the specific cycles of the smoothed curves. Statistical experience makes it clear that, even if a transposition of turning points had occurred, it cannot have been nearly as great as shown. We can thus claim confidently that these differentials and reference cycles do not vary together.

[18] This is especially true for the many years from June 1900 to February 1907 when the bank rate in France was constant! So the cycles of the differential will necessarily be those of the open market rate.

CHART 50

Differentials between Central Bank Discount Rates and the Open Market Short-Term Rates

Three European Series, Prewar, 1876–1914, and Postwar, 1925–1938

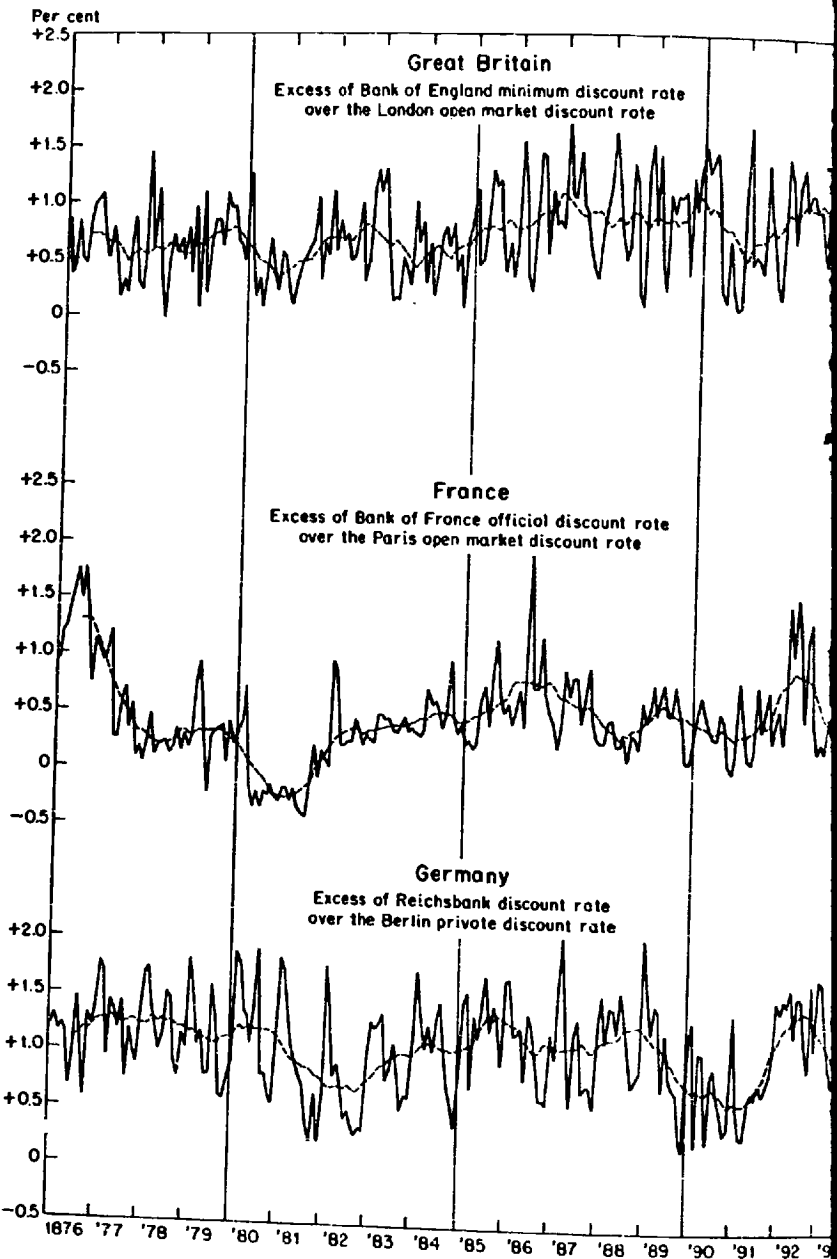


CHART 50, continued

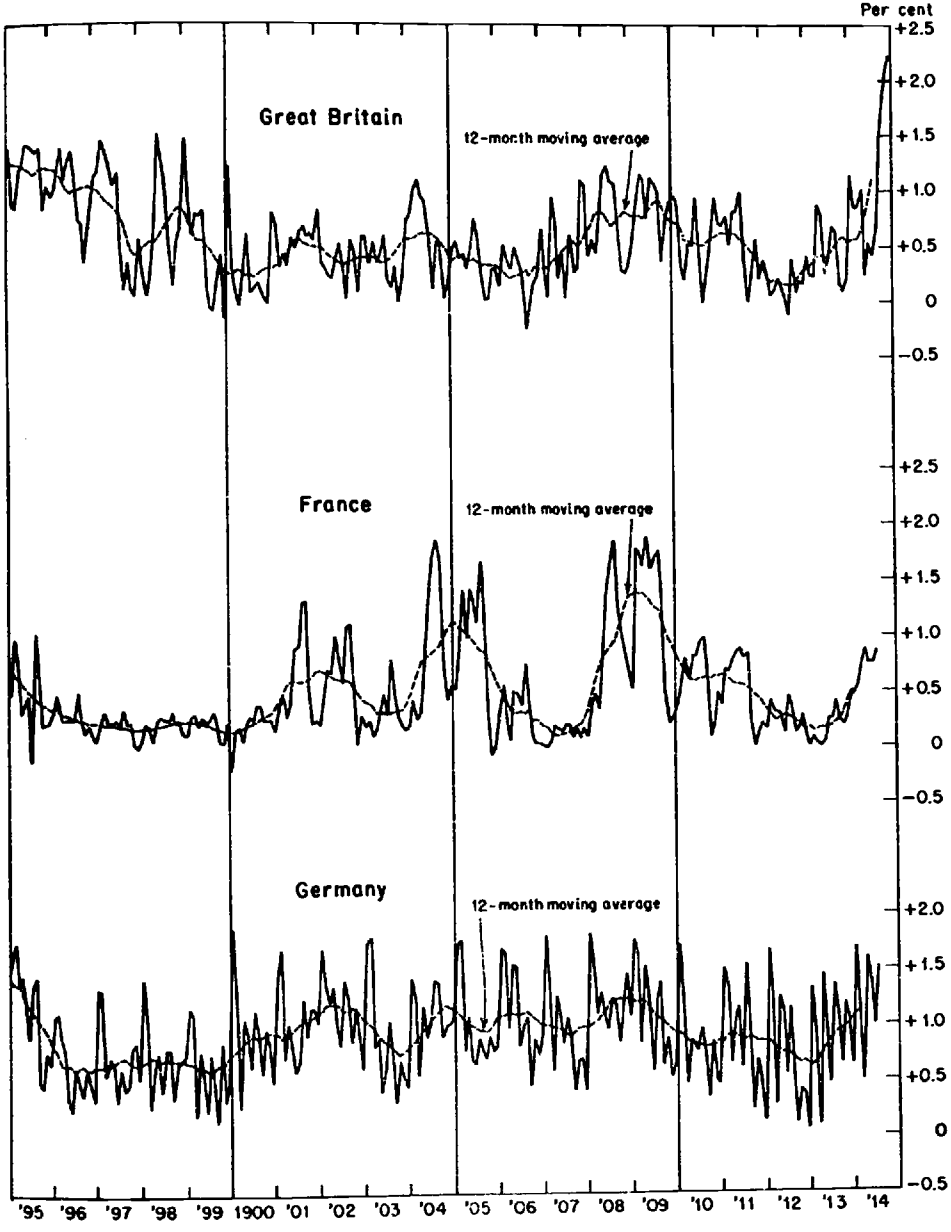
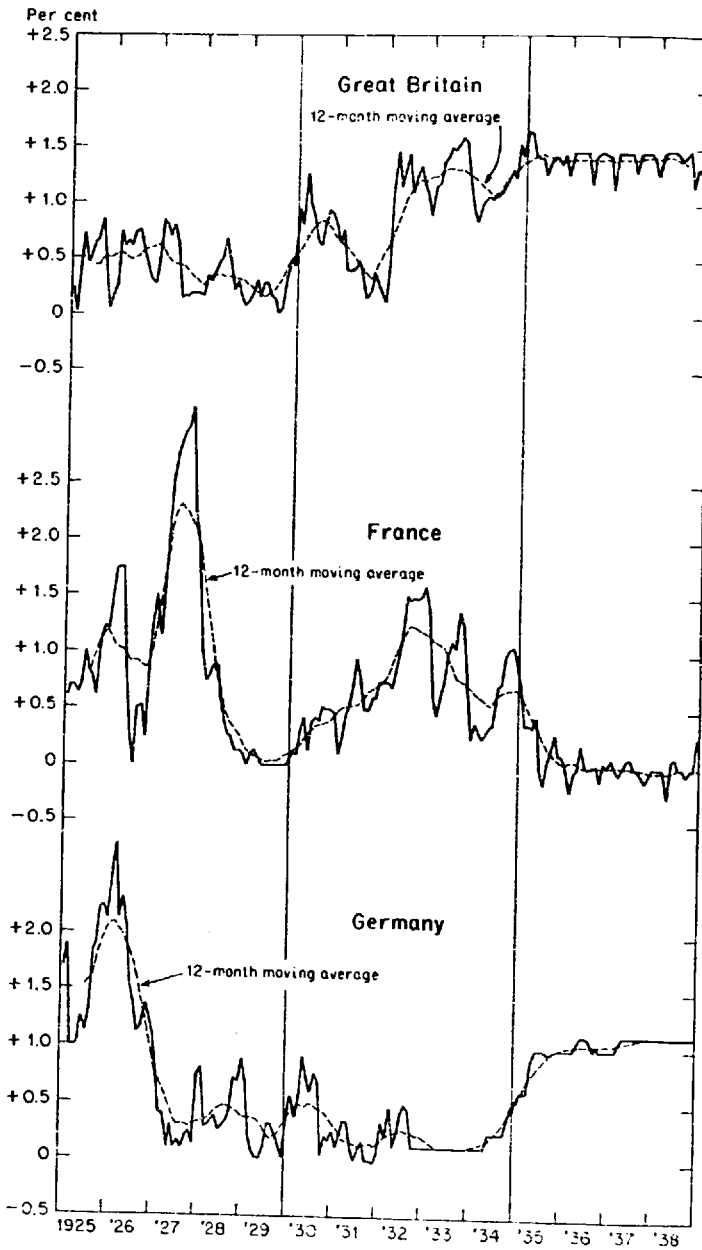


CHART 50, concluded

Differentials between Central Bank Discount Rates and the Open Market Short-Term Rates

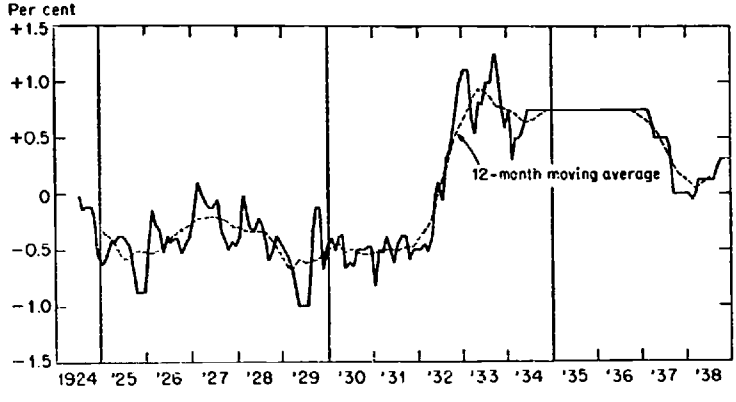


We *compare directly the official and open market rates.* Their specific cycles are known and together they give the statistics of Table 95. For Great Britain and Germany (pre-World-War-I) total correspondence is 81.5 and 80.6 per cent respectively; France scores only 52.7 per cent. In the interwar period two covariations

CHART 51

Differentials between Central Bank Discount Rates and the Open Market Short-Term Rates

New York, Postwar, 1924–1938



stand out: the American, using the commercial paper rate, with 83.3 per cent and the German with 81.0 per cent. The figures for Great Britain and France show negligible correspondence. The New York call money rate gives a far inferior result. This is not the first time this happens.[19] The period, January 1925–December 1931, comprises a larger part of the short era when the Federal Reserve authorities believed in stabilization, and the theory was widely held that the discount rate should fall precisely between that for bank acceptances as the lower and the commercial paper rate as the higher.[20]

[19] Others are found in Table 27. This does not necessarily support the view held by some economists that it was "the" short-term money rate *par excellence* on the New York market for business cycle analysis.

[20] This is found in many books of the periods, notably in W. R. Burgess, *The Reserve Banks and the Money Market*, rev. ed., 1936, p. 227; see also Chart 35 there. In the months before the 1929 collapse at the New York Stock Exchange the Federal Reserve rate is seen to stay below this lower limit. To attribute the excess of speculation and subsequent events largely to this mild and brief, though wholly unjustified, occurrence would be far fetched. Instead one might

TABLE 95

Phase Comparison of Specific Cycles of Central Bank Discount Rates and Open Market Interest Rates[a]

	SAME PHASE:			Different phase	SAME PHASE:			Different phase
	Expansions	Contractions	Total		Expansions	Contractions	Total	
	(MONTHS)				(PERCENTAGES)			
February 1878–July 1914, 438 months								
Great Britain	208	149	357	81	47.5	34.0	81.5	18.5
France	80	151	231	207	18.3	34.5	52.7	47.3
Germany	184	169	353	85	42.0	38.6	80.6	19.4
Postwar, January 1925–December 1931, 84 months								
Great Britain	14	28	42	42	16.7	33.3	50.0	50.0
France	1	43	44	40	1.2	51.2	52.4	47.6
Germany	35	33	68	16	41.7	39.3	81.0	19.0
United States[b]	43	27	70	14	51.2	32.1	83.3	16.7
United States[c]	30	21	51	33	35.7	25.0	60.7	39.3

[a] In the prewar period the central bank discount rates for Great Britain and Germany, and all the open market rates, are seasonally adjusted. The central bank discount rate for France had no seasonal trend. In the postwar period only the short-term interest rates are seasonally adjusted; the central bank rates had no seasonal trend.

[b] New York Federal Reserve Bank discount rate and New York commercial paper rate.

[c] New York Federal Reserve Bank discount rate and New York call money rate.

A particular interest attaches to the lead and lag relationship between the official discount rates and the private, open market rates. Central banks making decisive use of their discount rates during times of expansion would be expected to raise them with a view thereby to bringing the open market rate under control and letting their rates go down again after the open market rates have passed their peak. The statistics of Table 96 give the timing of these two series for all four countries, although for the United States naturally only for the time after World War I. They show that the open market rates lead at the peak quite persistently, the only exception in the over-all picture being England, where an

preferably think of the type of causes of speculative mania probably underlying the Tulip craze, John Law, and the South Sea bubble.

From 1933 on, the Federal Reserve rate, although repeatedly reduced, remained well above these two market rates and the seemingly important principle of policy was lost sight of.

TABLE 96

Timing of Central Bank Discount Rates Relative to Open Market Rates

1. United States

Turning dates in discount rates of Federal Reserve Bank of N.Y.	LEAD (−) OR LAG (+) RELATIVE TO CORRESPONDING TURN[a] IN:			
	Call money rates		*Commercial paper rates*	
			(*months*)	
T Nov. 1917	+24[b]	(11/15)	+18[b]	(5/16)
P Apr. 1921	+17[b]	(11/19)	+6	(10/20)
T Jan. 1923	+7	(6/22)	+5[b]	(8/22)
P Apr. 1924	+8[b]	(8/23)	+11[b]	(5/23)
T Jan. 1925	+4	(9/24)	+3	(10/24)
P July 1927	+17[b]	(2/26)	+9[b]	(10/26)
T Jan. 1928	+4	(9/27)	+2	(11/27)
P Oct. 1929	+7	(3/29)	+2	(8/29)
T Sept. 1931	+4	(5/31)	0	(9/31)
P Jan. 1932	+1	(12/31)	0	(1/32)

For footnotes see section 4 of Table 96.

average lead of the official rate of 1.6 months at the peak developed for the classical gold standard period. Regarding the trough, one would likewise expect a lead of the open market rates and our statistics bear this out in the average without exception.

On occasion lags of the official rates appear that are so long, e.g., 22 months in England and even up to 37 months in France, that doubt is raised whether such periods should be interpreted within the framework of the notions of "lead" or "lag." These require—unless the series compared with each other are in no way functionally related—that the activities be embedded into some common world where interaction is possible. This raises once more the issue of the speed of interaction between economic quantities, a factor that has had to be alluded to repeatedly in this study. Unfortunately too little is known in this area to go significantly beyond the immediate interpretation of the present data. In fact these problems have not even been put in the literature in a systematic manner. It is clear however that there are many other dangerous pitfalls; for example it may very well be that the peaks and troughs are not nearly as important as the *rapidity* with which they are approached in successive steps for each of the two series. This may furthermore be tied up significantly with the extent of the movements, especially

TABLE 96, continued

2. Great Britain

Turning dates in minimum rate of discount, Bank of England	*Lead (−) or Lag (+) relative to corresponding turn in open market rate*[a]	
	(*months*)	
T Jan. 1877	+3	(10/76)
P Sept. 1878	+1	(8/78)
T Oct. 1879	+1	(9/79)
P Feb. 1882	−17	(7/83)
T Oct. 1885	0	(10/85)
P Feb. 1887		
T Mar. 1888		
P Aug. 1890	+1	(7/90)
T Sept. 1892	0	(9/92)
P Aug. 1893	0	(8/93)
T Aug. 1896	+22	(10/94)
P Dec. 1899	0	(12/99)
T Mar. 1902	+5	(10/01)
P Apr. 1903	−1	(5/03)
T Apr. 1905	+6	(10/04)
P Dec. 1907	+1	(11/07)
T Dec. 1908	+3	(9/08)
P May 1910	+1	(4/10)
T Nov. 1911	+8	(3/11)
P July 1913	0	(7/13)
T June 1914	−8	(2/15)
P Dec. 1916	+4	(8/16)
T Oct. 1919	+10[b]	(12/18)
P Mar. 1921	+10	(5/20)
T June 1923	+1	(5/23)
P Mar. 1927	+22[b]	(5/25)
T Jan. 1929	+6	(7/23)
P Oct. 1929	0	(10/29)
T June 1931	+8[b]	(10/30)
P Jan. 1932	+1	(12/31)

For footnotes see section 4 of Table 96.

for a rising open market rate, and therefore with the desired severity of the policy measure.

Correlation coefficients for each pair of series are contained in Table 97, the postwar period extending to December 1938. These coefficients are directly comparable with each other, no special significance test for the differences being required. But caution in their interpretation is necessary for other reasons.

First, the prewar coefficients are very high, especially for England

TABLE 96, continued

3. France

Turning dates in discount rate, Bank of France	*Lead (−) or Lag (+) relative to corresponding turn in open market discount rate*[a]	
	(*months*)	
T Sept. 1878	+7	(2/78)
P Jan. 1882	0	(1/82)
T Aug. 1888	+26[b]	(6/86)
P Dec. 1888	+2	(10/88)
T Sept. 1898	+37[b]	(8/95)
P Jan. 1900	0	(1/00)
T Feb. 1907	+30[b]	(8/04)
P Dec. 1907	+4	(8/07)
T Aug. 1911	+27[b]	(5/09)
P Jan. 1914	+5	(8/13)
T July 1926	+8	(11/25)
P Nov. 1926	+3	(8/26)
T Sept. 1931	−10	(7/32)
P May 1934	+5	(12/33)
T Apr. 1935	+5	(11/34)
P Dec. 1935	0	(12/35)
T Dec. 1936	0	(12/36)
P July 1937	0	(7/37)

For footnotes see section 4 of Table 96. (*table continues*)

where $r = +0.93$. But this is not unreasonable, because strictly functional interdependence is almost postulated by current[21] monetary theory and banking practice. Even for France a high coefficient ($r = +0.74$) obtains, but even the dropping of the cyclical approach cannot prevent it from being again the poorest of the measurements. In general the arrangement of the coefficients is strikingly similar to that of Table 95.

Second, the postwar coefficients, now also including the United States, are in each individual case higher than the respective prewar coefficients. Two—those for the British and American rates—are even +0.99, a truly remarkable figure from many points of view. For Germany and France the values are +0.94 and +0.90, hardly less surprising. This requires therefore four brief comments:

[a] This is to be taken with a grain of salt. Both were current before 1914, doubtful in the 1920's, and no longer applicable for the greater part of the 1930's. This is not of great importance for us, since we deal essentially only with the phenomenological side.

TABLE 96, continued

4. Germany

Turning dates in discount rate, German Reichsbank		*Lead (−) or lag (+) relative to corresponding turn in open market discount rate*[a]	
			(*months*)
T Oct.	1876	+1	(9/76)
P May	1877	0	(5/77)
T July	1879	+2	(5/79)
P Feb.	1882	0	(2/82)
T Jan.	1888	0	(1/88)
P Feb.	1890	0	(2/90)
T Oct.	1892	+5	(5/92)
P Aug.	1893	0	(8/93)
T Dec.	1894	0	(12/94)
P June	1900	+3	(3/00)
T Sept.	1902	+2	(7/02)
P Oct.	1904	+14[b]	(8/03)
T Aug.	1905	+4	(4/05)
P Mar.	1907	−4	(7/07)
T May	1909	+6	(11/08)
P Sept.	1913	+7	(2/13)
T July	1914	+3	(4/14)
P Dec.	1923		
T May	1927	+10	(7/26)
P Oct.	1929	+5	(5/29)
T Sept.	1930	+1	(8/30)
P Aug.	1931	0	(8/31)

T = trough.
P = peak.
[a] Dates in parentheses are for corresponding turns.
[b] Lead or lag is greater than half the expansion or contraction phase for the open market rate in which the central bank rate's turning point falls.

(a) Such high correlation coefficients are rare when they are viewed properly, i.e., in the spirit of the theory of correlation.[22] We believe this to be the case; thus an almost perfect functional interdependence between the two series is made plausible. If the correlation of various official discount rates (cf. Table 93) had yielded similarly high coefficients, an interpretation would not have been easy, since it would have been necessary to assume that some discount rate really dominated that of another country, and there is no

[22] Otherwise we might have an instance of "proving too much." Whenever this happens in an essentially mathematical operation it is a clear indication that the argumentation is at fault.

TABLE 96, continued

5. Summary

United States

	FEDERAL RESERVE BANK OF NEW YORK			
	TIMING OF DISCOUNT RATE RELATIVE TO CALL MONEY RATE		TIMING OF DISCOUNT RATE RELATIVE TO COMMERCIAL PAPER RATE	
	1925–DEC. 1938		1925–DEC. 1938	
	At peaks	*At troughs*	*At peaks*	*At troughs*
Lead > 12 mos.				
Lead 7–12				
Lead 1–6				
Coincident			1	1
Lag 1–6	1	3	1	2
Lag 7–12	1		1	
Lag > 12	1			
Total	3	3	3	3
Average lead (−) or lag (+)	+8.3	+4.0	+3.7	+1.7

Great Britain

	TIMING OF MINIMUM RATE OF DISCOUNT, BANK OF ENGLAND, RELATIVE TO LONDON OPEN MARKET RATE			
	1876–JULY 1914		1925–DEC. 1938	
	At peaks	*At troughs*	*At peaks*	*At troughs*
Lead > 12 mos.	1			
Lead 7–12		1		
Lead 1–6	1			
Coincident	3	2	1	
Lag 1–6	4	5	1	1
Lag 7–12		1		1
Lag > 12		1	1	
Total	9	10	3	2
Average lead (−) or lag (+)	−1.6	+4.0	+7.7	+7.0

evidence of this. The drawback for the present case lies however in the high stability of all rates from 1931 on which might contribute unduly to this result. We have therefore added a computation covering only 1925–1931 and the results are (cf. Table 97) almost the same as those for the longer period.

TABLE 96, concluded

France

TIMING OF DISCOUNT RATE, BANK OF FRANCE, RELATIVE TO PARIS OPEN MARKET DISCOUNT RATE

	1876–JULY 1914		1925–DEC. 1938	
	At peaks	*At troughs*	*At peaks*	*At troughs*
Lead > 12 mos.				
Lead 7–12				1
Lead 1 to 6				
Coincident	2		2	1
Lag 1 to 6	3		2	1
Lag 7 to 12		1		1
Lag > 12		4		
Total	5	5	4	4
Average lead (−) or lag (+)	+2.2	+25.4	+2.0	+0.8

Germany

TIMING OF DISCOUNT RATE, GERMAN REICHSBANK, RELATIVE TO BERLIN OPEN MARKET DISCOUNT RATE

	1876–JULY 1914		1925–DEC. 1938	
	At peaks	*At troughs*	*At peaks*	*At troughs*
Lead > 12 mos.				
Lead 7 to 12				
Lead 1 to 6	1			
Coincident	4	2	1	
Lag 1 to 6	1	7	1	1
Lag 7 to 12	1			1
Lag > 12	1			
Total	8	9	2	2
Average lead (−) or lag (+)	+2.5	+2.6	+2.5	+5.5

(b) The correlation coefficients were computed for seasonally uncorrected data. The suspicion therefore prevails that a common factor, the seasonal variations, has produced an artificially high correlation if viewed from the needs of determining a deeper lying interdependence. The present case makes such an interpretation unlikely. The seasonal factors in the official and private discount rates are not sufficiently similar, although in some instances of the periods covered they have contributed to raise the correlation coefficients.

TABLE 97

Correlation between Central Bank Discount Rates and Short-Term Interest Rates, Seasonally Uncorrected Data

	r	CONFIDENCE LIMITS[a] Lower	Upper
January 1876–July 1914, 463 months			
Bank of England minimum discount rate—London open market rate	+0.93	0.91	0.94
Bank of France official discount rate—Paris market discount rate	+0.74	0.68	0.79
Reichsbank official bank discount rate—Berlin private discount rate	+0.91	0.89	0.93
January 1925–December 1938, 168 months			
Bank of England minimum discount rate—London open market rate	+0.99	0.99	0.99
Bank of France official discount rate—Paris market discount rate	+0.90	0.85	0.93
Reichsbank official bank discount rate—Berlin private discount rate	+0.94	0.91	0.96
New York Federal Reserve Bank discount rate—New York commercial paper rate	+0.99	0.99	0.99
January 1925–December 1931, 84 months			
Bank of England minimum discount rate—London open market rate	+0.96	0.93	0.98
Bank of France official discount rate—Paris market discount rate	+0.90	0.83	0.94
Reichsbank official bank discount rate—Berlin private discount rate	+0.89	0.81	0.94
New York Federal Reserve Bank discount rate—New York commercial paper rate	+0.98	0.96	0.99

[a] For confidence coefficient of 99%.

Table 11, giving the seasonal indexes for the short-term open market rates, should be compared with the discussion in Appendix A of this chapter. Before 1914 the central bank rates had seasonals with several interruptions (two consecutive years in England, four in Germany plus other, shorter ones); there were none in France, and they disappeared for all countries after World War I. The indexes of open market rates underwent several changes too, for Germany not less than four times between 1876 and 1912, and for all with not inconsiderable shifts. Although there is a rough over-all similarity of the seasonal movements of official and open market rates, it is

not very close and detailed. The highest and most suspect coefficients are obtained for the period 1925–1938. It is noteworthy however that the lowest coefficient, +0.74, refers to France 1876–1914, i.e., to the country where one series, that of the official rate, definitely had no seasonal variations. Even so the coefficient is exceedingly high, as correlation coefficients go.

(c) The great similarity of the coefficients is the more remarkable inasmuch as there were not only considerable differences in the financial organizations of these four countries but each underwent material changes over time. These differences were pointed out. Among them the fact that the British is a minimum and the German a maximum rate is one of the most significant.[23]

(12) (a) *Correlation of directions of change in discount rates of various central banks* (Table 98). The three prewar coefficients are extremely high, especially that correlating the Bank of England rate with the French rate, $C = 0.818$; but it derives from only 44 cases out of 463 months. The coefficients for the British–German and French–German rates are 0.746 and 0.666, all higher (with $p \leqq 0.001$) than any previously observed. The coefficients for the six postwar relationships are not included, because they are without exception insignificant, certainly in great contrast to the high prewar correspondence. Table 92 had *not* shown the same for the correlation coefficients that likewise do not take notice of cycles as such. But, unlike the present coefficient, they take *all* the data of each period into account including the long parallel (horizontal) stretches. Any direct comparison of C and r is of course out of the question, though an ordering according to rank is permissible.

The chief difference between the two noncyclical measurements is in regard to the postwar period: the coefficient C yields only insignificant values for 1925–1938 while at least two, if not even three, correlation coefficients are highly significant. Indeed those for the Bank of England and the Federal Reserve Bank of New York and of the Bank of England and the Reichsbank are substantially higher than any for the prewar period. During the latter the Bank of England and the Reichsbank, giving $r = +0.73$, are the best scoring group, while now this relationship ranks behind the noncyclical covariation of the British–French rates.

[23] If the actually charged rates properly weighted for their share in the total of bills discounted were used, the correlation for these two countries would go up; the 0.99 for Britain in the postwar period may indicate a lessening of the discrimination practiced in the nineteenth century; cf. p. 431 n. and Table 108.

TABLE 98

Measures of the Relationship between Central Bank Discount Rates and Open Market Rates, Covariation in the Direction of Movement, Seasonally Uncorrected Data

Type of data correlated	*Period*	*Country or pair of countries*	*N*	*Z*	*p*	*C*	*Rank according to C*
Changes in:							
Central bank discount rates	Feb. 1876–July 1914	Gt. Britain–Germany	150	131	$p < 0.001$	0.746	2
	Jan. 1876–July 1914	Gt. Britain–France	44	40	$p < 0.001$	0.818	1
	Feb. 1876–July 1914	France–Germany	36	30	$p < 0.001$	0.666	3
Central bank discount rate and open market rates	Jan. 1876–July 1914	Gt. Britain	265	232	$p < 0.001$	0.751	2
	Jan. 1876–July 1914	France	52	46	$p < 0.001$	0.769	1
	Feb. 1876–July 1914	Germany	204	168	$p < 0.001$	0.647	3
	Jan. 1925–Dec. 1938	Gt. Britain	32	30	$p < 0.001$	0.875	2
	Jan. 1925–Dec. 1938	France	51	49	$p < 0.001$	0.921	1
	Jan. 1925–Dec. 1938	Germany	41	36	$p < 0.001$	0.756	4
	Jan. 1925–Dec. 1938	United States[a]	40	37	$p < 0.001$	0.850	3
	Jan. 1925–Dec. 1938	United States[b]	36	30	$p < 0.001$	0.666	5

N = number of observations of changes. Zero changes in either or both items are not counted.

Z = Number of times the changes in the items showed the same sign.

p = Probability that an observed deviation from the expected value as great or greater is due to chance.

C = Coefficient of covariation.

[a] Change in New York Federal Reserve Bank discount rate correlated with change in New York commercial paper rate.

[b] Change in New York Federal Reserve Bank discount rate correlated with change in New York call money rate.

These differences are accounted for in the varying approach and procedure; although both are noncyclical and monthly, C is obtained from month to month comparisons, which naturally leave greater play to cyclical components. The correlation coefficients too are affected, if common factors, e.g., cycles, seasonal, etc., are contained in the series.

(b) *Change in the official rate correlated with a change in the open market short-term rate.* Section b of Table 98 corresponds to Table 95 for the cycles and to Table 97 for the correlation coefficients. Here we obtain good results for both periods. N is far larger than in the previous cases. There is a great difference in Z, the number of parallel movements. It is highest for Britain, as might be expected, and C is very significant with 0.751. In France $C = 0.769$, but Z is only 46; this goes to show that in the rare cases when the French official rate was changed, there was a close parallel movement with the open market rate. The interwar period however is really interesting in that it yields the highest coefficient yet found, $C = 0.921$ for France. For London and New York the results are also very good, if the New York commercial paper rate is taken while there is, as noted on other occasions (cf. footnote 25), a less satisfactory agreement with the New York call money rate.

Section 7. Discount Rate Differentials, Open Market Rate Differentials, and Exchange Rates

(13) In the same manner and for the same reasons that led to the formation of short-term interest rate differentials we form those for official discount rates. The motivation is if anything even stronger, since deliberate policy often strove to keep the discount rate above that of another country in order to defend the gold reserves of the country. The defense was in general only of the gold reserve of the central bank. The differentials were undoubtedly watched by the central banks and definitely become of signal importance whenever a change in the rate was caused, or indicated, for external reasons in the sense discussed above in section 2. But the attention paid was probably not continuous as is obvious at least from the French situation where this would hardly have served a good purpose. We cannot therefore expect as close an association between these differentials and the exchange rates as in the previous case, where a rudimentary mechanism set forces in motion to take care of changing conditions

by initiating flows of funds. The official rates—and hence their differentials—would become operative only when the private mechanism seemed to gain such momentum as to endanger the basis upon which it rested, or when it refused to work. There are however hardly any indications of such events in the pre-World-War-I period. For them to occur it would have been necessary to interfere with the mechanism by not allowing it to work. This happened only from 1931 on when exchange controls began to appear.

We shall deal with the statistics of this section only in the briefest manner. They are easily read and fall into the pattern established before. New questions of procedure do not arise and the qualifications to which the methods are subject were amply discussed.

There are four stages: (a) frequency distributions, (b) number and duration of cycles, (c) comparison of the new differentials with the old, (d) behavior of the new differentials in respect to the exchange rates. The information is contained in Tables 99 to 105.

(a) The *frequency distributions* of Table 99 are the direct outcome of those of the underlying universes by forming their differences. In particular their see-saw appearances are not surprising in view of the uncommon character of the basic distributions, for which however an excellent interpretation suggested itself. The customary measures are given again in the table, although there still is doubt—though less than in Tables 83 and 84—whether they sufficiently describe the distributions. The reader may therefore wish to rely more on the graphs, rather than to take standard deviations and coefficients of variation such as they are. Nevertheless this much may be said: all prewar and some postwar distributions show enormous, steep peaks which contain more than one fourth of the total observations (in one postwar case, Berlin over London, even more than one half). This would be remarkable under any circumstances, but is so especially when it obtains after forming differences.[24] In spite of this steepness the distributions are not as unsymmetrical as was previously the case.

Additional interesting information is found in Table 100, where are computed the percentages of all cases on which one of the two central bank rates forming a pair was higher. The same was carried out for the open market rates in Table 26, with which the present one should be compared. The generally lower level of rates in France is confirmed for the prewar period, while after World War I this

[24] Varying the class intervals would make comparatively little difference; this was true of the other cases too.

TABLE 99

Frequency Distribution of Central Bank Discount Rate Differentials, Prewar and Postwar, Seasonally Uncorrected Data

January 1876–July 1914

EXCESS BERLIN OVER LONDON		EXCESS PARIS OVER BERLIN		EXCESS PARIS OVER LONDON	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
−1.00 to −0.81	12	−3.8 to −3.7	1	−3.20 to −3.01	1
−0.80 to −0.61	2	−3.6 to −3.5	3	−3.00 to −2.81	7
−0.60 to −0.41	10	−3.4 to −3.3	3	−2.80 to −2.61	4
−0.40 to −0.21	9	−3.2 to −3.1	1	−2.60 to −2.41	2
−0.20 to −0.01	12	−3.0 to −2.9	12	−2.40 to −2.21	1
0.00 to 0.20	58	−2.8 to −2.7	7	−2.20 to −2.01	4
0.21 to 0.40	21	−2.6 to −2.5	18	−2.00 to −1.81	18
0.41 to 0.60	47	−2.4 to −2.3	8	−1.80 to −1.61	6
0.61 to 0.80	16	−2.2 to −2.1	5	−1.60 to −1.41	10
0.81 to 1.00	130	−2.0 to −1.9	71	−1.40 to −1.21	7
1.01 to 1.20	22	−1.8 to −1.7	14	−1.20 to −1.01	11
1.21 to 1.40	21	−1.6 to −1.5	37	−1.00 to −0.81	77
1.41 to 1.60	46	−1.4 to −1.3	7	−0.80 to −0.61	18
1.61 to 1.80	15	−1.2 to −1.1	14	−0.60 to −0.41	46
1.81 to 2.00	31	−1.0 to −0.9	135	−0.40 to −0.21	16

2.01 to	2.20	3	−0.8 to	−0.7	13	−0.20 to −0.01	21
2.21 to	2.40	5	−0.6 to	−0.5	54	0.00 to 0.20	112
2.41 to	2.60	2	−0.4 to	−0.3	6	0.21 to 0.40	15
2.61 to	2.80		−0.2 to	−0.1	6	0.41 to 0.60	61
2.81 to	3.00	1	−0.0 to	0.1	47	0.61 to 0.80	2
Total		463	0.02 to	0.3		0.81 to 1.00	23
			0.04 to	0.5	1	1.01 to 1.20	
			Total		463	1.21 to 1.40	
						1.41 to 1.60	
						1.61 to 1.80	1
						Total	463
Arithmetic mean		+0.81%			−1.23%		−0.37%
Median		+0.87%			−0.98%		−0.17%
Standard deviation		0.69%			0.82%		0.84%
Coefficient of variation		0.85%			−0.37%		−2.27
Mode		+0.99%			−0.57%		+0.23%
Relative skewness		−0.26			−0.80		−0.71

(table continues)

TABLE 99, continued

January 1925–December 1938

EXCESS PARIS OVER LONDON		EXCESS NEW YORK OVER BERLIN		EXCESS NEW YORK OVER LONDON	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
−3.60 to −3.21	4	−10.40 to −10.01	1	−3.40 to −3.21	2
−3.20 to −2.81	3	−7.20 to −6.81	3	−3.20 to −3.01	
−2.80 to −2.41	1	−6.80 to −6.41	1	−3.00 to −2.81	1
−2.40 to −2.01	2	−6.40 to −6.01		−2.80 to −2.61	
−2.00 to −1.61	8	−6.00 to −5.61		−2.60 to −2.41	3
−1.60 to −1.21	3	−5.60 to −5.21	11	−2.40 to −2.21	
−1.20 to −0.81	19	−5.20 to −4.81		−2.20 to −2.01	1
−0.80 to −0.41	12	−4.80 to −4.41	3	−2.00 to −1.81	
−0.40 to −0.01	1	−4.40 to −4.01	1	−1.80 to −1.61	
0.00 to 0.40	7	−4.00 to −3.61	2	−1.60 to −1.41	8
0.41 to 0.80	45	−3.60 to −3.21	9	−1.40 to −1.21	2
0.81 to 1.20	25	−3.20 to −2.81	25	−1.20 to −1.01	7
1.21 to 1.60	9	−2.80 to −2.41	57	−1.00 to −0.81	40
1.61 to 2.00	13	−2.40 to −2.01	7	−0.80 to −0.61	2
2.01 to 2.40	3	−2.00 to −1.61	22	−0.60 to −0.41	64

2.41 to	2.80	4	−1.60 to	−1.21	19	−0.40 to	−0.21	3
2.81 to	3.20	5	−1.20 to	−0.81	6	−0.20 to	−0.01	2
3.21 to	3.60	1	−0.80 to	−0.41	1	0.00 to	0.20	6
3.61 to	4.00	3	Total		168	0.21 to	0.40	6
Total		168				0.41 to	0.60	18
						0.61 to	0.80	
						0.81 to	1.00	1
						1.01 to	1.20	1
						1.21 to	1.40	
						1.41 to	1.60	1
						Total		168

Arithmetic mean	+0.37%	−2.77%	−0.58%
Median	+0.62%	−2.61%	−0.55%
Standard deviation	1.47%	1.34%	0.72%
Coefficient of variation	3.97	0.48	−1.24
Mode	1.12%	−2.97%	−0.49%
Relative skewness	−0.51	−0.36	−0.12

(table continues)

TABLE 99, concluded

EXCESS PARIS OVER NEW YORK		EXCESS PARIS OVER BERLIN		EXCESS BERLIN OVER LONDON	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
−2.80 to −2.41	2	−9.9 to −9.7	1	0.00 to 0.20	3
−2.40 to −2.01	1	−6.6 to −6.4	1	0.21 to 0.40	1
−2.00 to −1.61		−6.3 to −6.1	1	0.41 to 0.60	1
−1.60 to −1.21	14	−6.0 to −5.8		0.61 to 0.80	
−1.20 to −0.81	9	−5.7 to −5.5	2	0.81 to 1.00	10
−0.80 to −0.41	11	−5.4 to −5.2		1.01 to 1.20	5
−0.40 to −0.01	4	−5.1 to −4.9		1.21 to 1.40	3
0.00 to 0.40	25	−4.8 to −4.6	1	1.41 to 1.60	7
0.41 to 0.80	10	−4.5 to −4.3	2	1.61 to 1.80	4
0.81 to 1.20	16	−4.2 to −4.0	7	1.81 to 2.00	91
1.21 to 1.60	21	−3.9 to −3.7	1	2.01 to 2.20	1
1.61 to 2.00	12	−3.6 to −3.4	13	2.21 to 2.40	5
2.01 to 2.40	6	−3.3 to −3.1	6	2.41 to 2.60	15
2.41 to 2.80	19	−3.0 to −2.8	14	2.61 to 2.80	2
2.81 to 3.20	1	−2.7 to −2.5	8	2.81 to 3.00	3
3.21 to 3.60	9	−2.4 to −2.2	4	3.01 to 3.20	1

3.61 to	4.00	4	−2.1 to −1.9	11	3.21 to 3.40	1
4.01 to	4.40	3	−1.8 to −1.6	4	3.41 to 3.60	
4.41 to	4.80	1	−1.5 to −1.3	36	3.61 to 3.80	1
Total		168	−1.2 to −1.0	20	3.81 to 4.00	4
			−0.9 to −0.7	4	4.01 to 4.20	2
			−0.6 to −0.4	5	4.21 to 4.40	
			−0.3 to −0.1	3	4.41 to 4.60	2
			0.0 to 0.2	8	4.61 to 4.80	
			0.3 to 0.5	2	4.81 to 5.00	2
			0.6 to 0.8	1	5.01 to 5.20	
			0.9 to 1.1	3	5.21 to 5.40	
			1.2 to 1.4	2	5.41 to 5.60	
			1.5 to 1.7	6	5.61 to 5.80	1
			1.8 to 2.0	2	5.81 to 6.00	2
			Total	168	7.21 to 7.40	1
					Total	168

Arithmetic mean	+0.97%	−1.79%	+2.10%
Median	+1.00%	−1.48%	+1.91%
Standard deviation	1.55%	1.71%	1.01%
Coefficient of variation	1.60	0.96	0.48
Mode	1.06%	−0.86%	1.53%
Relative skewness	−0.06	−0.54	0.56

TABLE 100

Frequency of the Positive Central Bank Discount Rate Differentials

Rate of:	*Higher than rate of:*	(*Per cent*[a])
January 1876–July 1914, 463 months		
Bank of England	Bank of France	53.8
Reichsbank	Bank of England	81.4
Reichsbank	Bank of France	89.6
January 1925–December 1938, 168 months		
Bank of France	Bank of England	67.3
Reichsbank	Bank of England	98.8
Reichsbank	Bank of France	85.7
Bank of England	New York Federal Reserve Bank	80.4
Bank of France	New York Federal Reserve Bank	63.1
Reichsbank	New York Federal Reserve Bank	100.0

[a] Proportion of times differential between two central bank rates was positive.

role falls undisputedly to the rate of the Federal Reserve Bank of New York. The Reichsbank rate was then again in all instances higher, hardly surprising for a country that had passed through a large inflation and was (partially as a consequence) heavily indebted abroad. It is thus different in nature from the 100 per cent noted in Table 26 when the two New York market rates were in all cases higher than the Paris private rate. At the time this was an indication of high investment opportunity with accompanying higher risk in the United States as compared with saturation and an attitude of safety first in France. The private rates are to be understood only as representative of an entire level of interest rates. These data approximate the notion of an *international system of relative prices*. The relations are maintained for both the private and the official rates. In both Tables 100 and 26 the same ordering emerges for the period before 1914, although the number of occasions when the same rates are higher than the respective others are somewhat different. Such parallelism is noteworthy, especially since differences among magnitudes of various countries are involved and each difference may well refer to widely different absolute magnitudes.

(b) The *numbers of cycles* (Table 101) are small: four to seven for the prewar and only one (or two) in the postwar period. This excludes the postwar figures from serious consideration. Berlin–London has an average prewar duration of 96 months, by far the

TABLE 101

Number and Duration of Specific Cycles of Central Bank Discount Rate Differentials, Seasonally Uncorrected Data

Excess of:	NUMBER OF: Ex-pansions	Con-tractions	Full cycles	AVERAGE DURATION OF: Ex-pansions	Con-tractions	Full cycles	AVERAGE PER CENT DURATION OF SPECIFIC CYCLES: Ex-pansions	Con-tractions
				(MONTHS)				
				January 1876–July 1914, 463 months				
Berlin over London	5	5	4	51.6	33.4	96.0	60.7	39.3
Paris over London	7	6	6	37.7	26.3	67.5	58.9	41.1
Paris over Berlin	7	7	7	24.7	36.9	61.6	40.1	59.9
				January 1925–December 1938				
Berlin over London	2	1	1	16.0	21.0	42.0	43.2	56.8
Paris over London	2	2	1	34.5	33.0	24.0	51.1	48.9
Paris over Berlin	2	2	1	34.0	23.0	22.0	59.6	40.4
New York over London	2	1	1	24.0	33.0	64.0	42.1	57.9
Paris over New York	3	3	2	26.7	18.7	35.0	58.8	41.2
New York over Berlin	2	2	1	25.5	9.5	43.0	72.9	27.1

longest duration ever observed—a length completely incompatible with any reasonable intuitive interpretation that aims to connect the cycles with automatic short-term capital flows or to accord the latter a corrective influence. But this is not surprising, since these series do not describe anything automatic (in the sense of the "free interplay of market forces"); cf. Table 28.[25]

(c) The discount rate *differentials* may be compared with those of the *open market rates* (cf. Table 102). This gives fair to good covariation in the prewar period; it is best with 80.0 per cent for Paris–Berlin. While this is good for series not directly connected, it is not very high for the present series, which are so closely, almost functionally, associated within each pair. In this case the postwar period now yields better results than the prewar; Paris–New York shows even 100 per cent covariation; Paris–Berlin has now become the poorest pair. This general improvement for the postwar period reflects the fact that the postwar movements of the open market interest

[25] There are no "short cycles" in these series in the sense of the definition on page 286 ff. This accounts for the omission of the corresponding measures in the tables immediately following.

TABLE 102

Phase Comparison of Specific Cycles of Central Bank Discount Rate Differentials and Short-Term Interest Rate Differentials[a]

	Months covered[b]	SAME PHASE: Expansions	Contractions	Total	Different phase	SAME PHASE: Expansions	Contractions	Total	Different phase
		(MONTHS)				(PERCENTAGES)			
		1877–1914							
Berlin–London	429	175	102	277	152	40.8	23.8	64.6	35.4
Paris–London	429	186	107	293	136	43.4	24.9	68.3	31.7
Paris–Berlin	440	143	209	352	88	32.5	47.5	80.0	20.0
		1925–1931							
New York–London	84	29	32	61	23	34.5	38.1	72.6	27.4
Paris–New York	84	28	56	84	0	33.3	66.7	100.0	0
New York–Berlin	84	58	17	75	9	69.0	20.2	89.3	10.7
Berlin–London	84	24	46	70	14	28.6	54.8	83.3	16.7
Paris–London	84	12	50	62	22	14.3	59.5	73.8	26.2
Paris–Berlin	84	36	22	58	26	42.9	26.2	69.0	31.0

[a] Central Bank differentials do not have a seasonal trend. Short-term interest rate differentials are seasonally corrected.

[b] The following are the exact periods covered by the respective pairs: Berlin–London, Oct. 1878–July 1914; Paris–London, Oct. 1878–July 1914; Paris–Berlin, Nov. 1877–July 1914.

rates were increasingly subjected to controls. This brought them by necessity more in line with the already controlled official rates. Since this was a simultaneous process in many countries, it produces the above-mentioned results even for the differentials.

Table 103 leads to the fourth point (d). The correlation is shown for both the private differentials and the exchange rates. The data for the latter are repeated in Table 103 for convenience; in the pre-war period we now have only three pairs. Whatever differences we have so far noted for the discount rate differentials, they behave in regard to their average deviations from zero exactly like the open market rate differentials. Since the latter were found to have had signs negatively correlated with those of the exchange rates, the same necessarily holds also for the former.

(d) The covariation of the *central bank rate differentials* with the respective *exchange rates*[26] relates only to specific cycles, since the former show no short cycles. Table 104 is thus to be compared es-

[26] The pairing is again uniquely determined as in Chapter VI (p. 280).

TABLE 103

Sign Correlation between Differentials of Central Bank Discount Rates, Short-Term Interest Rates, and Exchange Rates

Average Deviation from Zero and Difference from Parity

	SHORT TERM INTEREST RATE[a] DIFFERENTIAL			CENTRAL BANK DISCOUNT RATE[a] DIFFERENTIAL			EXCHANGE RATE[b]		
	Paris	*London*	*Berlin*	*Paris*	*London*	*Berlin*	*Paris*	*London*	*Berlin*
January 1876–July 1914									
Paris	0	−	−	0	−	−	0	+	+
London	+	0	−	+	0	−	−	0	+
Berlin	+	+	0	+	+	0	−	−	0

January 1925–December 1938												
	Berlin	*Paris*	*London*	*New York*	*Berlin*	*Paris*	*London*	*New York*	*Berlin*	*Paris*	*London*	*New York*
Berlin	0	+	+	+	0	+	+	+	0	+	+	+
Paris	−	0	+	+	−	0	+	+	−	0	+	+
London	−	−	0	−	−	−	0	+	−	−	0	−
New York[c]	−	−	+	0	−	−	−	0	−	−	+	0
New York[d]			+									

January 1925–December 1931												
	Berlin	*New York*	*London*	*Paris*	*Berlin*	*New York*	*London*	*Paris*	*Berlin*	*New York*	*London*	*Paris*
Berlin	0	+	+	+	0	+	+	+	0	+	+	+
New York[c]	−	0	+	+	−	0	−	−	−	0	+	−
London	−	−	0	+	−	+	0	+	−	−	0	−
Paris	−	−	−	0	−	+	−	0	−	+	+	0
New York[d]			+									

[a] + = *average* difference of interest rates positive.
− = *average* difference of interest rates negative.
[b] + = more than 50% of exchange rate observations above parity.
− = more than 50% of exchange rate observations below parity.
[c] Commercial paper rate.
[d] Call money rate.

sentially with Tables 66 and 67, although Tables 70 and 71 should also be considered. The present differentials have no seasonals, but the exchange rates were taken in their corrected form. It will be recalled that the correspondence in the earlier case was none too good, though significant when specific cycles were used; we found that the high speed of adjustment between the forces represented by the movement of the series made a quicker reaction plausible. Thus we obtained much better results for short cycles and must now again

TABLE 104

Phase Comparison of Specific Cycles of Central Bank Discount Rate Differentials and Foreign Exchange Rates[a]

	Months covered[b]	SAME PHASE: Expansions	SAME PHASE: Contractions	SAME PHASE: Total	Different phase	SAME PHASE: Expansions	SAME PHASE: Contractions	SAME PHASE: Total	Different phase
		(MONTHS)				(PERCENTAGES)			
		1877–1914							
Berlin–London	414	81	82	163	251	19.6	19.8	39.4	60.6
Paris–London	401	140	77	217	184	34.9	19.2	54.1	45.9
Paris–Berlin	440	102	173	275	165	23.2	39.3	62.5	37.5
		1925–1931							
New York–London	84	16	21	37	47	19.0	25.0	44.0	56.0
Paris–New York	84	12	26	38	46	14.3	31.0	45.2	54.8
New York–Berlin	84	27	8	35	49	32.1	9.5	41.7	58.3
Berlin–London	84	15	48	63	21	17.9	57.1	75.0	25.0
Paris–London	84	16	26	42	42	19.0	31.0	50.0	50.0
Paris–Berlin	84	38	20	58	26	45.2	23.8	69.0	31.0

[a] Central Bank differentials do not have a seasonal trend. Foreign exchange rates are seasonally corrected.

[b] The following are the exact periods covered by the respective pairs: Berlin–London, Jan. 1880–July 1914; Paris–London, Feb. 1881–July 1914; Paris–Berlin, Nov. 1877–July 1914.

expect poorer ones. Only if the attitude regarding cycles be drastically changed might a higher correspondence result. This is carried out below when we come to Table 105.

Whether the approach be cyclical or not, the question of the degree of covariation is a central one. The banks of issue guard over the exchanges but they do not necessarily operate in the market continuously (under classical gold standard conditions) and they have several means of interfering. This and the discontinuity in the *use* of some means, together with the repetition of these conditions in the other countries (with which the differential is formed) make a high degree of covariation still less likely.

Actually the covariation shown in Table 104 is not conclusive in either direction, because some pairs fare better and others worse than they do in Tables 66 and 67. Paris–London is almost equally good for the prewar period in both cases, Paris–Berlin, now with 62.5 per cent of all months in the same phase, is markedly better than the 45.8 per cent in the former tables. The same pair scores 69.0 for the postwar period and 67.9 in the previous chapter. The

TABLE 105

Change in the Central Bank Discount Rate Differential Correlated with the Change in Exchange Rate: Covariation in the Direction of the Movements, Seasonally Uncorrected Data

Pairs of countries	*N*	Z	*p*	*C*	*Rank according to C*
January 1878–July 1914, 439 months					
Great Britain–France	320	188	$0.001 < p < 0.01$	0.175	3
Great Britain–Germany	301	198	$p < 0.001$	0.316	1
France–Germany	193	124	$p < 0.001$	0.284	2
January 1925–December 1931, 84 months					
Great Britain–France	35	22	$0.1 < p < 0.2$	0.258	3
Great Britain–Germany	43	25	$0.3 < p < 0.5$	0.162	4
France–Germany	40	19	$0.7 < p < 0.8$	0.050	5
Great Britain–United States	45	30	$0.04 < p < 0.05$	0.334	1-2
United States–Germany	49	16	$0.02 < p < 0.03$		6
United States–France	42	28	$0.04 < p < 0.05$	0.334	1-2

N = Number of observations of changes. Zero changes in either or both items are not counted.

Z = Number of times the changes in the items showed the same sign.

p = Probability that an observed deviation from the expected value as greater is due to chance.

C = Coefficient of covariation.

highest postwar value is reached by Berlin–London, 75.0 per cent, which was then only 63.1 per cent. All others are without significance. Three of the present six postwar figures are better than even those for the short cycles in the earlier case; this may serve as an illustration of the great difficulty of making significant measurements in this entire field; at least this is true for the present level of the statistical investigation.

The *sign correlation* of Table 105 is to be compared with Table 65. As before the postwar measures must be discarded, since the level of probability is quite unsatisfactory. The three prewar cases produce very low coefficients of covariation, the best of which would only take fourth place in Table 65. It should be remembered that this time Z is the number of cases when *none* of the series shows a zero change. This does not hamper the comparison as a look at the respective Z's will show. The present procedure was simply more rigorous.

Summary. Whatever influence central banks may actually have exercised or may have wished to exercise upon exchange rates, a comparison of the bank rate differentials with the exchanges discloses no intimate relationship. In this respect the results are significantly different from those obtained from a study of differentials of open market rates and exchange rates. There even a new "short" cycle emerged; here only very wide swings occurred in the differentials. Apparently the other means of policy, besides the discount rate, must be considered. But this is impossible to do except in a very rough manner because of the lack of information, which can never be made good. It is however likely that through a complex set of measures the banks have, from time to time, exercised such influence. Even then it is doubtful whether it was continuous and brought central banking policy and variations of the exchange rates in as close a contact as that between discount rates and the open market rates, which was itself not quite as intimate as might have been expected. But the central banks have influenced, in their complex ways, the domestic money supply and perhaps even its velocity, although they had only partial control over both. Variations in money supply influenced the domestic interest rates in the same direction and often the relative rates too. In the latter case desired capital movements would ensue with the corresponding variation of the exchanges. The possible combinations are very numerous; many of them are those generally mentioned in the literature, and it would certainly be desirable if one could really analyze them all together.

APPENDIX A

THE DISCOUNT RATES

(a) *Bank of England.* The bank is free to purchase (bankers' acceptances)[1] at rates above those officially announced, which thus is a *minimum rate.* Hence a lowering of the rate may lag considerably behind the *effective* decrease of the actually charged rates—which were often several different ones simultaneously, as is typical with monopolies. Similarly there were hidden increases in the effective rate while the official rate remained constant.

(b) *Bank of France.* The official rate is, as far as is known, the one at which actual purchases are made. These are restricted to prime bills with three signatures. This is an unusually restrictive device, since only a small (but unknown) percentage of all bills carries three. Hence there was in France only a small number out of the total number of bills eligible for discount or rediscount at the central bank.[2] This may in part have been one of the contributing factors to the notorious stability of the French discount rate; prices are frequently stable when there is no certainty. The British and more specifically the German practices were greatly admired by some French economists as late as 1905 and advocated for the Bank of France.[3] But the real test lies in the investigation of the difference between the official and the market rates of discount. If this difference is as a rule large, then the temptation and possibility to use differentiating, multiple rates was greater (cf. Table 85 for the actual differences). We see thus that the French practice was quite different from the British and to a still greater extent and in a different

[1] "Among ordinary bills of exchange . . . the Bank (of England) will only countenance bills bearing at least two good British signatures, one of which must be that of a British bank (in which case the bill is called a 'Bank Bill') or that of a leading merchant house (in which case the bill is called a 'fine trade bill'). The fact that a discount house can go to the Bank of England in the last resort only with bills of exchange which fall into these two classes (and, of course, Treasury Bills) makes the discount market prefer these two classes" (R. S. Sayers, *Modern Banking,* Oxford University Press, 1938, p. 52). Cf. also Sayers' valuable paper, "The Development of Central Banking after Bagehot," *Economic History Review,* Vol. IV, 1951, pp. 109–116.

[2] On the other hand the direct accessibility of the Bank of France for business led to its discounting of bills for as small amounts as five francs! See below, footnotes 5, 7, and 16.

[3] M. Patron, "The Bank of France in its Relation to National and International Credit," *Senate Document No. 494,* 1910, p. 36, footnote a.

direction also from the German. On the other hand the extensive use of the gold premium policy complicates the situation in another direction.

(c) *Reichsbank.* The official rate may be considered the effective rate with known[4] exceptions. These were due to the use by the Reichsbank of the so-called "private discount rate"—not to be confused with the open market discount rate which bears the same name. In order to distinguish the two we shall write "private" when the private rate of the Reichsbank is referred to. The official Reichsbank rate was a *maximum* rate, i.e., the "private" rate was always lower. The "private" rate could be applied, according to the statute of the bank, only when the money market was "very liquid," i.e., the official rate under 4 per cent. The behavior of these rates will be discussed below in Appendix B of this chapter, after this description of the nature of the data. The official Reichsbank rate was representative for a very large volume of business transactions; in 1907, for example, it was estimated that two-fifths of all the bills outstanding in Germany were held by the Reichsbank.[5] This is probably similar to conditions at the Bank of France. Both were in direct contact with industry and commerce without using any intermediary at all, whether banks, bankers, or bill brokers. In this practice they differed profoundly from the Bank of England, which only in the 1930's of this century began to change the nature of its operations.[6] The average per bill of bills discounted discloses this. In France, for example, 30 to 48 per cent of all bills discounted were for amounts of 5 to 10 francs only.[7] In Germany[8] about 30 per cent of bills discounted were below 200 marks, and only 3 per cent over 10,000 marks.

(d) *Federal Reserve Bank of New York.* The situation here is in

[4] The exceptions could be ascertained in 1912, but not with certainty during the period when they actually occurred, which is an interesting situation. While they were made there were reports that they happened, but apparently there was no continuous, quantitative knowledge. Writings on discount policy since 1912 seem to have neglected the point, although it is of great interest and of importance for the statistical evaluation of the earlier data.

[5] H. Schuhmacher, "Die Deutsche Geldverfassung und ihre Reform," in *Schmoller's Jahrbücher*, Vol. 32, 1908, reprinted in *Weltwirtschaftliche Studien*, 1911, p. 9. This estimate would indicate a total of 2,760 million marks bills outstanding in the yearly average for 1907; this was a year of great strain.

[6] For example, through its subsidiary, the Industrial Development Company. But this had nothing to do with the ordinary discount market.

[7] Patron, *op. cit.*, pp. 84–85. It is difficult to see how they could have three signatures!

[8] *Die Reichsbank 1876–1910, loc. cit.*, p. 153.

many ways more complicated than the discussion can convey at this juncture. On the other hand good descriptions of the involved technical and highly formalistic regulations exist,[9] as well as attempts to discover and describe the policy of the bank. The chief complication from the international viewpoint lies first in the fact, already mentioned, that this bank does not set a unique rate for the whole country, but gives us only one out of twelve. So there is here still another loss of uniqueness! Second, there is no complete autonomy of the bank regarding changes of the rate, formally (perhaps perfunctorily) dependent upon the approval of the Federal Reserve Board. But the latter factor is not important even if the board should completely determine the discount rate, since it would still be what it is. An average of the various discount rates of the twelve Federal Reserve banks was not considered, because of the overwhelming importance of the New York market.

Detailed regulations, several times amended, cover the eligibility of paper for discount. Originally, "commercial paper arising out of transactions related to an agricultural, industrial or commercial purpose" was to be admitted for discount. But the decline in eligible paper in the United States forced some revisions that provided for admission of longer-term paper. Also the Federal Reserve banks were more willing than before to take noneligible paper, though at differ-

[9] Cf., for example: "Under the original act, a Federal Reserve bank could rediscount only 'eligible' paper which met specific conditions as laid down in the [Federal Reserve] Act and interpreted by the Board in its Regulation A and rulings. The interpretations, it may be added, tended to be more liberal than consistent. Among the specific conditions for eligibility of paper is the requirement that it be negotiable. At time of discount by the Reserve Bank, the maturity of the paper must not exceed 90 days, excluding days of grace. However, paper drawn or issued for an agricultural purpose or based on livestock may have a maturity of 9 months (prior to 1923, 6 months). Sight bills of exchange drawn to finance shipment of non-perishable, readily marketable staple agricultural products, and secured by documents of title covering them, have been admitted since 1923, but may not be held by a Reserve bank for more than 90 days."

Other important conditions include the proviso that paper must arise out of actual commercial transactions, drawn (and "have been used or are to be used") for agricultural or commercial purposes, or both. Permanent and fixed investments are ruled out (W. H. Steiner and E. Shapiro, *Money and Banking*, rev. ed., New York, 1941, pp. 587–588).

". . . at present a Reserve Bank may make an advance to a member bank on its note secured by any collateral satisfactory to the Reserve Bank. In case the collateral is not of the kind described as eligible, however, the Reserve Bank must charge an extra ½ per cent or more of interest." (*The Federal Reserve System*, 2nd ed., Washington, 1947, p. 25.)

On the entire eligibility problem, cf. S. E. Harris, *Twenty Years of Federal Reserve Policy*, Harvard University Press, 1933, Part IV.

ent rates than that here considered. The decline of eligible paper is best shown in the percentage of total loans and investments. For the entire Federal Reserve System the percentage fell from 24.5 on June 30, 1920 to 7.2 on June 30, 1935; during the same period government securities bought increased more than fivefold.[10] These developments tend to reflect on the validity of a continuous statistical use of the discount rate. However this is of minor importance for us, since the New York rate only is included during the short postwar period, which as a whole has been given a somewhat inferior role in this work for reasons explained elsewhere.

[10] Cf. W. R. Burgess, *op. cit.*, p. 48. The reasons for the gradual decline of commercial paper in the United States are discussed there too. Further material is found in Neil H. Jacoby and R. J. Saulnier, *Business Finance and Banking*, National Bureau of Economic Research, 1947.

APPENDIX B

DISCRIMINATORY DISCOUNT RATES

Among the two most important parameters of central bank policy are the discriminatory discount rates and prices for gold. The *first* arises from the high degree of monopoly power of a central bank; it is likely, as elsewhere, to produce discrimination. Moreover the British and German discount rates are even defined as minimum and maximum rates respectively so that other rates than these must be expected. The *second* also derives from a quasimonopoly situation. While it would be desirable to discuss the gold policy here, the treatment originally given has been omitted for want of space.

The meaning of the subsequent discussion is illustrated by recalling Table 82. There it is seen that the "private" discount rates are essentially internal measures, while manipulations of the price of gold are externally conditioned. The rate of discount itself was found to be exposed to both kinds of forces and thus formed a class by itself. The discriminatory rates are British and German institutions, the gold premium is French, but manipulation of gold prices also occurs in London, as will be shown in detail on some other occasion. There are no such records for Germany; there are only—as elsewhere, e.g., in London—denials of the existence of the practice. All observations refer to the period before 1914. After World War I these manipulations seem to have ceased. The reason is beyond doubt the greater use of other more effective instruments and qualitative credit controls, finally topped by all devices of exchange control after the abandonment of the gold standard. These tendencies began to develop even before 1914, and the petering out of some of the measures in 1896 for Germany and about 1900 for France may have been due to the same developments.

In previous sections, notably in 6 and 7, it became clear that the study of the discount rates alone did not reveal nearly as much as the existing literature would have suggested. In particular it was hard to form any precise ideas as to the transmission of crises or cycles, although some descriptive material was found useful. Now we shall examine two of these rates in the light of the discrimination which they imply. The term discrimination is to be taken in the traditional economic sense: different prices are charged simultaneously to different customers for essentially the same com-

modity—in this case accommodation at the central bank. It is always associated with a strong element of monopoly which in the present case is certainly prevalent. However it would be incorrect to assume that the central banks had anything like a complete monopoly in these four countries. They did not everywhere enjoy even a legal monopoly for note issue; and as long as any international borrowing was possible they were only to a limited degree "lenders of the last resort."[11]

The German rate is a maximum, the British a minimum[12] rate, so that without a study of the deviations in the respective directions all statements about the published rates alone are incomplete. In spite of this and of the enormous volume of the transactions involved, as will be seen at least in the German case where the only material is available, oddly enough, very little attention has been given to discrimination in the literature or in statistical investigations.

Our previous studies in this chapter were always made with this limitation in mind. There is of course a genuine interest and an undeniable possibility in the investigation of *cyclical* behavior when (a) the amplitudes do not matter (except in their influence upon the determination of the cycle, depending on the latter's definition), and (b) the inclusion of discriminatory rates do not change the length of the individual cycles. Our study of differentials into which the official rates enter is of course affected. When and to what extent can be seen from the present section.

Since the *German data* are by far the most complete,[13] we begin with this case. The Reichsbank, during the years 1880–1896, excepting 1891 and occasional months in other years (cf. Table 106 and Chart 52), acquired bills of the same nature as those always bought at a rate below the official. The statute empowered the bank to do so under a few restrictive conditions.[14] When they became

[11] This is completely different when a full exchange control prevails. Then differential, i.e., monopolistic, discount rates are not nearly as important as other instruments of direct control, mostly involving the police, and also of a highly discriminatory nature.

The secrecy surrounding so many central bank operations is a typical by-product of the existence of monopoly elements.

[12] See, however, p. 429.

[13] This need not mean that discriminatory buying of bills was less important in London. The notorious secretiveness of the Bank of England and the lack of inquisitiveness of earlier British economists in this respect make it impossible to settle this issue satisfactorily.

[14] The chief one being that a (lower) private rate could be used only when the official discount rate did not exceed 4 per cent.

TABLE 106

Private Discount Rate of the Reichsbank, 1880–1896

(monthly data)

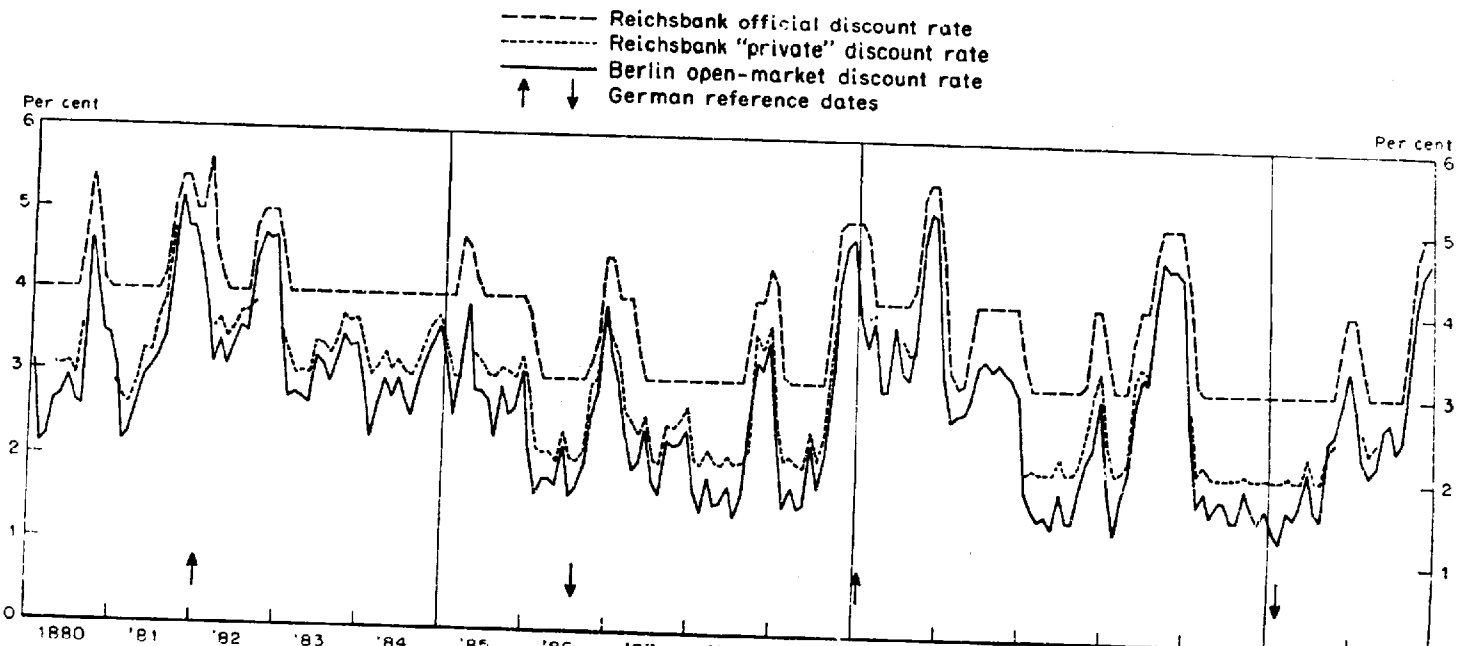
	1880	*1881*	*1882*	*1883*	*1884*	*1885*
January	[a]	2.87	[b]	3.50	3.29	3.34
February	[a]	2.69	[b]	3.27	3.00	3.00
March	[b]	2.59	3.55	3.00	3.11	3.00
April	3.07	2.90	3.66	3.03	3.27	[b]
May	3.05	3.26	3.42	3.00	3.06	3.29
June	3.09	3.24	3.55	3.40	3.19	3.20
July	2.92	3.67	3.75	3.38	3.05	3.02
August	3.65	3.88	3.75	3.25	3.00	3.00
September	[b]	4.74	3.87	3.42	3.22	3.12
October	[b]	[b]	[b]	3.74	3.50	3.06
November	[b]	[b]	[b]	3.67	3.65	3.00
December	[b]	[b]	[b]	3.68	3.76	3.27
	1886	*1887*	*1888*	*1889*	*1890*	*1891*
January	2.86	3.49	2.08	2.53	[b]	[b]
February	2.16	3.28	2.00	2.07	3.82	[b]
March	2.12	2.62	2.19	2.12	3.87	[b]
April	2.13	2.50	2.03	2.03	[b]	[b]
May	2.00	2.36	2.00	2.00	[b]	[b]
June	2.37	2.55	2.12	2.45	[b]	[b]
July	2.04	2.06	2.02	2.07	3.56	[b]
August	2.02	2.00	2.04	2.41	3.38	[b]
September	2.15	2.48	2.19	3.34	3.42	[b]
October	2.93	2.45	3.62	4.00	[b]	[b]
November	3.02	2.51	3.40	[b]	[b]	[b]
December	3.74	2.69	3.69	[b]	[b]	[b]
	1892	*1893*	*1894*	*1895*	*1896*	
January	2.00	2.41	2.78	2.00	[b]	
February	2.04	2.00	2.04	2.00	2.60	
March	2.00	2.04	2.17	2.05	2.33	
April	2.00	2.18	2.02	2.00	2.50	
May	2.00	3.12	2.01	2.00	[b]	
June	2.19	3.30	2.00	2.28	[b]	
July	2.02	3.24	2.00	2.01	[b]	
August	2.00	[b]	2.00	2.00	[b]	
September	2.13	[b]	2.06	2.35	[b]	
October	2.52	[b]	2.00	2.49	[b]	
November	3.00	[b]	2.00	[b]	[b]	
December	3.23	[b]	2.01	[b]	[b]	

Source: *Die Reichsbank 1876 bis 1910*, 1912, p. 202–205, monthly averages computed from daily quotations. These averages are weighted by the number of private quotations given in each month.

[a] No *definite* private rates.
[b] No private rates and no transactions.

CHART 52

Private Discount Rate of the Reichsbank, 1880–1896



Source: Data for private rate, Table 106; for official rate, NBER, B.C. series 13 and 15; for open market rate, NBER, B.C. series 13 and 18.

TABLE 107

Purchase of Bills below the Official Discount Rate at the Private Rate of the Reichsbank, 1880–1896[a]

(*yearly data*)

YEAR	*Total bills bought*	BILLS BOUGHT *Below official rate*	BILLS BOUGHT *As per cent of total bills bought*	*Earnings from bills bought below the official rate as per cent of earnings from all domestic bills*
	(*millions of marks*)			
1880	336	61	18.02	12.64
1881	338	58	17.04	13.39
1882	367	55	14.90	12.14
1883	362	125	34.46	29.45
1884	373	140	37.55	33.05
1885	365	127	34.76	28.39
1886	380	173	45.48	40.05
1887	436	228	52.33	42.05
1888	428	207	48.39	42.81
1889	507	213	42.03	31.20
1890	529	62	11.79	9.54
1891				
1892	537	228	42.36	33.84
1893	578	161	27.89	19.66
1894	545	269	49.40	36.13
1895	571	204	35.72	28.12
1896	644	68	10.58	7.59

Source: *Die Reichsbank*, 1912, pp. 132–133.

[a] During the years 1876 through 1879, 1891, and 1897 through 1914, bills were not purchased below the official discount rate. The average maturity of the bills bought was 76 days, the range 74 to 78 days.

operative the bank stopped buying; this happened in 1881–1882, 1885, 1889, 1890, 1891, 1893, and 1895, often only for a few months; then the official rate had always risen beyond 4 per cent, frequently beyond 4.5 per cent.

Chart 52 shows the data of Table 106 together with the official and the Berlin open market discount rates for the relevant period. In order to evaluate the "private" rate, it is necessary to know the volume of the transactions which it governed. The Reichsbank furnishes even this essential information, although only on a yearly basis. It is reproduced in Table 107. This states the total volume of bills bought at the two rates and, in the last column,

the earnings from the bills bought at the "private" rate is expressed as a percentage of the total profit realized from all domestic bills. It is also noteworthy that the average maturity of these preferentially treated bills was seventy-six days, another indication that the Reichsbank was acting as a competitor with the private banks where this was the average maturity of bills held. In England on the other hand, where the official rate was a minimum rate, higher discriminatory rates were accompanied or preceded (since the two need not coincide) by a shortening of the general maturity level of the bills discounted.[15]

The interpretation of Chart 52 is simple. We only mention these points: the "private" rate shows an almost perfect one-to-one correspondence of movement with the open market rate. It is in most instances higher than the latter, often only by a minute fraction of one per cent, sometimes more than 0.5 per cent. The times of greatest stringency are those when it was not applied at all and when sharp rises—often up to 2 per cent in two to three months—occurred. If the "real" Reichsbank rate were computed—with appropriate weights, taken from Table 107—from the official and the private it would not only be lower but also show very few, if any, zero changes. Our differentials would be influenced accordingly.[16] It is impossible to say whether the movements of the private rate were affected by external reasons too, but it is clear that they had their effects upon the international position of the Reichsbank like any other instruments of policy. One might expect that the "private" rate would rise or fall (sizably) before either the official or the open market rate. There are many instances where the private and the open market rate moved before the official rate. (Cf. also the discussion of Table 96.) The "private" rate was probably operated rather automatically, the bank endeavoring only to keep a more or less constant difference with the open market rate. Somewhat more discernment was apparently used in the amount of bills bought as Table 107 shows. From all this it is clear that the cycles of the "private" rate coincide well with those of the open market rate, especially if the discontinuities of the former are neglected or, rather, interpreted as especially sharp

[15] In France it was a frequent practice that in times of stringency the bank would take only long-term paper at the then existing high rates in order to discourage borrowing beyond the hampering influence of an increased rate or to avoid its rise. This goes to show that there is a great deal of freedom in the combination of the various instruments.

[16] The weights are only available on a yearly basis.

peaks. These would then be those of the official rate—a permissible interpretation no doubt.[17]

The volume of the transactions ranged from 10 to over 50 per cent of the total of all bills bought, and up to 42.8 per cent of all earnings from discounts were due to that part of the business of the Reichsbank. It is clear that in view of these magnitudes the study of the official rates must remain inconclusive. On the other hand the cyclical behavior will be found to coincide almost completely with that of the open market rates and their derivatives. The absolute level is of course a different one, but it disappears in these comparisons at any rate. We stress the significance of this "private" rate so much because it is a classical example of how vague the descriptions of central banking policy are when they rely exclusively—as most of them do—on the ("accurate") statistics of the official rate. It is difficult to say how many further instances of the same kind would be found elsewhere in economics, but the chances are high that they are numerous. One of the additional fields is given by the devious practices of central banks regarding the price of gold.

There is no evidence that the Reichsbank at the same time manipulated the price of gold—for sale or purchase—beyond what was already stated on p. 433. This reference is indicated here because the data on the Bank of England intermingle both, and for the Bank of France we have the gold premium policy.

Table 108 comprises all *available* information about the *rates charged by the Bank of England in excess of its official minimum rate.*[18] It contains only eleven entries, spread from 1890 to 1910. In Germany we had 16 years, or a total of 192 months (allowing for all discontinuities). It is very doubtful that there should not have been more instances in London, but it has not been possible to obtain further information, either of additional cases or of the duration of the rates above the minimum, etc. The dates are interesting: 1890 was the time of the Baring crisis, occurring after a business cycle peak; 1893 was a year of great crisis, shown in the reference cycle of the United States only, but in fact gripping all countries then moving downhill; 1899 is immediately before a British peak; 1901 falls into a brief expansion; the dates of 1906

[17] It is not necessary therefore to repeat our measures of covariation. Because of the almost perfect one-to-one correspondence, the same results would obtain as if the open market rate itself were taken.

[18] No data are available about the volume of business, or about the rates below the "minimum" rate and the size of that business.

TABLE 108

Discriminatory Discount Rate of the Bank of England

Date		*Minimum rate (per cent)*	*"Actual" rate (per cent)*
Sept.	1890	5	5½
Nov.	1890	6	6½, 7+
May	1891	3½	4
Aug.	1893	4	4½
Sept.	1899	3	3¾–4
Nov.	1899	5	6
June	1901	3	4
Sept.–Oct.	1906	4	4½
Aug.	1907	4	4½
Oct.	1907	4½	5–6
Oct.	1910	3	4

Source: *Economist.*

Gold Prices Charged or Paid by the Bank of England Beyond Its Statutory Buying Price

Feb.	1890	Buying rate raised to:	77s., 9½d.
May, June	1891		77s., 9½d.
Nov.	1892	Selling rate raised to:	78s., 1d.
Aug.	1896	Selling rate:	77s., 11d.
Sept.	1896	Selling rate:	78s.
Oct.	1897	Selling rate:	78s., ½d.
Apr.	1898	Buying rate:	77s., 9¾d.
Oct.	1898	Selling rate:	78s., 0½d.
Apr.	1899	Buying rate:	77s., 9¾d. (possibly higher)
Feb.–May	1903		77s., 9½d.
Oct.–Dec.	1903		77s., 10½d.
Mar.	1904		77s., 9½d.
June	1904		77s., 9¾d.
July	1904		77s., 9½d.
Fall	1909		77s., 9¼d. to 77s., 10d.
Feb.	1906		77s., 9½d.
Sept.	1906		78s., 1d.
Jan.–Sept.	1907		77s., 9¼d. to 77s., 10¼d.
Jan.	1908		77s., 9⅛d. to 77s., 9½d.
Apr.	1908		77s., 9⅞d.
Mar.	1910		77s., 9⅛d.

Source: R. S. Sayers, *Bank of England Operation.* Limits are set by: obligation to issue notes in exchange for gold at 77s., 9d. (buying rate); obligation to pay sovereigns in exchange for notes at par, 77s., 10½d. (selling rate). The above listing is illustrative and does not include all dates when prices exceeded these limits; there were in fact many others.

and 1907 relate no doubt to the latter year's crisis. October 1910 however is at the beginning of a long expansion. So we see, the dates shown in Table 108 are not unreasonable; but on the other hand the fact that they are related both to beginnings and ends of expansions makes it highly doubtful that these should have been the only instances.

In particular it is known that the Bank of England charged higher rates of discount for bills of arbitrageurs in order to punish them for their export operations. It is conjectured that this practice was discontinued because of public opposition.[19] However it complements the habit of either charging no interest or only a nominal interest rate to those who borrowed in order to import gold. As we know this was a standard practice of most central banks.

How much discounting was done at the higher "actual" rates is not known. But, as said before, the application of a higher rate (whether actual or not) often coincided with enforcing shorter maturity on bills so as to increase the risk that later discounts might only be possible at still higher (minimum or actual) rates, if at all.

Table 108 also contains the gold prices charged or paid by the Bank of England beyond its statutory buying price. We note here that the number of recorded discriminatory gold prices exceeds by not less than four times those for the "actual" discount rate. It is of course possible that the bank found it more convenient and speedy to change buying and selling prices of specified types of gold than "actual" discount rates; but we found no documentary evidence to support such a view.

The endeavor to attract or at least to hold gold by means other than the discount rate was common to all central banks, no matter how often denied. In Germany it was notorious that loans free of charge were made to importers of specie and direct obstacles were placed in the path of would-be exporters of specie. In France the gold premium policy served, rather successfully, the same purpose. All this should be discussed in the general framework of the gold problem as such, viz., when an effort is made to discover to what extent the flows of gold conformed to exchange rates and interest rate differentials, and, as vehicles of capital transfers, also transmitted business cycles.

[19] Cf. Landesberger, *op. cit.*, p. 25.