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CHAPTER V

THE INTERNATIONAL SOLIDARITY OF MONEY MARKETS

Section 1. Introduction

(1) The point has been reached where the interrelation of the various fields so far examined must be studied from a broader angle. This will not be possible, however, without going into some rather detailed argument.

We shall be mainly concerned with the famous hypothesis of the "international solidarity of money markets" which apparently was first enunciated by Lord Goschen in his *Theory of the Foreign Exchanges*, 1861. It has since been discussed in the literature in varying degree and for different purposes. It is in the main accepted by most economists as correctly expressing the interdependence of these markets, at least under a regime of the gold standard. Its detailed argument and implications, however, are not so well known among contemporary economists, although many of their statements imply very definite opinions which should be made explicit, especially as they often are related to proposals for reform of the monetary order.

The subjects of this and the following chapters are of central significance for any investigation concerned with the international spread of business cycles, even if it were dealing less centrally with their monetary and financial aspects. If we may use a simile: we are entering upon a discussion of the various gauges and measuring devices which (allegedly) show and control the state of activity of the international financial mechanism. Our problem is to find out whether these various devices—gold points, maximum differences of interest rates, etc.—are as accurate and as effective as generally believed.

Section 2. The Solidarity Hypothesis

(2) Without going into historical detail, we state the assumption of the international solidarity of money markets directly as follows:

When two (or more) countries are on the gold standard then there exist definite limits for the absolute differences between their short-term interest rates. The actual differences at a given moment de-

pend on the absolute stand of the exchange rates at the same moment, which in turn can vary only between the gold points of the currencies.

To illustrate: a creditor of country A investing his funds in country B has to take into account the risk he runs because of the possible depreciation of the exchange of B in terms of the currency of A. When both countries are on the gold standard the limits of this risk can be foreseen. The possible loss for the creditors of B in A will be greatest when the currency of A is at the gold export point in respect to B; then currency of B in terms of currency of A is at the most expensive of all possible prices. If the currency of A is at the gold import point, then currency of B in terms of currency of A is at the lowest of all possible prices. In the first case B's currency can only fall and presumably will do so more or less quickly; in the second it can only rise and presumably will do so more or less quickly.[1]

As a consequence in the first case, the rate of interest, which causes funds to be transferred from A to B, must at least be higher in B by as large a percentage as is necessary to compensate for this risk. In the second case the rate of interest should be lower in B than in A.

For exchange rates somewhere between the two gold points exactly the same considerations are valid. Thus we arrive at a scale of *permissible short-term interest rate differentials* which must fill continuously the entire widths between the gold points. Though the *absolute* levels of the interest rates in the two countries are *indeterminate,* there is nevertheless for each absolute position of the exchange rate *precisely one absolute* differential—or rather a definite range[2]—which is in agreement with the functioning of the gold standard.

When the interest rates of the two countries conform, then we say that their money markets are in a state of *solidarity;* when the

[1] The rapidity of adjustment is at least expected to be greater than the period for which the investment is made in B, whatever its absolute, but very likely high, rapidity.

As a matter of fact, gold movements not only took place when the exchange had reached the specie points, but also, in the opinion of the trade, they began often when the exchange was still as much as four or five points distant. This however must be taken with a grain of salt, since for the different individual operators, or for different *classes* of operators, there are (slightly) different gold points. In 1927, for example, American gold was even sold at a loss in London.

[2] Numerical examples will be given below in Tables 74 and 75; here we are concerned only about establishing the general relationship between the absolute stand of the exchange rate and the correlated interest rate differentials.

differentials do not conform with the respective absolute positions of the exchange rates, i.e., when they exceed the respective "permissible limits," then we say that they *violate* that solidarity as defined, i.e., the principles of the gold standard.

The reasons are obvious why the differentials should not exceed the permissible limits when the gold standard mechanism functions smoothly: the largest possible loss or largest possible gain, respectively, at each quotation of the exchange rate can be expressed as a percentage of the sum invested. The difference between the rates of interest in the two countries must be expected to fluctuate between these two rates of exchange rate risk, since an interest rate differential which would more than compensate the exchange rate risk would be expected immediately to induce a flow of funds which would tend to reduce the interest rate differential at least to its maximum permissible limit. It is only when the gold standard mechanism is not working according to expectations that other differentials can be observed. So we would here have an exact quantitative criterion of whether or not this mechanism functioned, and we would be able to identify the times when it broke down or was violated by government or other intervention from the outside, or when permanent new risks appeared—presumably of a structural nature,[3]

[3] To our knowledge the first statistical study of the relationship between exchange rates and short-term interest rate differentials is by George Clare. Investigating the "continental investment demand" in the chapter on foreign exchange of his *A Money Market Primer and Key to Exchanges*, London, 1891, Chart 15, Clare compares the interest rate differentials London minus Paris and the exchange rate London on Paris July through October for 1886–1888.

The first systematic discussion is in N. E. Weill, *Die Solidarität der Geldmärkte. Ein Studie über die Verschiedenheit der Gleichzeitigen Diskontsätze Verschiedener Länder*, Frankfurt, 1903. Weill compared for several European countries and the United States short-term interest rate differentials with the corresponding exchange rates and the risk margin (defined as the maximum gain or loss due to the fluctuation of the exchange rates between the gold points). He found that, except for certain periods when the explanation was obviously political events or the economic situation, the interest rate differentials never exceeded the risk margin. The statistical material compiled by Weill is heterogeneous, covering, for each pair of countries, different periods between 1880 and 1901; Weill sometimes used annual averages, sometimes monthly data, sometimes daily quotations.

Charts of daily interest rate differentials and exchange rates covering 1904–1907 only are published in two papers in the *Zeitschrift für Handelswissenschaftliche Forschung*, following the publication of Weill's book: Eugen Schmalenbach, "Der Kurs des Pfund-Sterling Wechsels," Vol. I, 1906–1907, pp. 241–256; and Walter Mahlberg, "Der Kurs des 'Frankenwechsels,'" Vol. III, 1908–1909, pp. 397–415. Hans Neisser, "Der Internationale Geldmarkt vor und nach

Section 3. Gold Points and Exchange Rates

(3) This first description of the solidarity hypothesis suffices at least to justify our next procedure, that is to say, the search for the gold points and the discussion of the significance attributed to them. It is clear that there still remain many aspects and implications of the hypothesis requiring examination. Besides the exchange risk—which would be taken care of by the above observations and rules—there is the ordinary business risk of investing in a foreign country. It is obvious that such risks may account for the fact that the various "permissible" interest rate differentials in some countries tend to stay at the maximum of the entire range of differentials that exists for each separate position of a given exchange rate, while for rates of other countries, where this risk is smaller, they fluctuate along its entire breadth.

(4) The gold standard is generally viewed as the monetary system with the greatest amount of freedom for the "automatic" forces of the various markets, chiefly—but not exclusively—the money markets. The gold points have an essential place in this picture, because we must envisage that the costs (in terms of money) of shipping gold either way between two countries are the sole results of the traditionally enumerated factors (cost of transportation, insurance, loss of interest[4] while gold is en route, handling fees, etc.) and in

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dem Kriege," *Weltwirtschaftliches Archiv*, Vol. 29, 1929, pp. 171–226, continued the two charts mentioned above to July 1914, and charted also the monthly averages of interest rate differentials and exchange rates for the sets, Berlin–London, 1900–July 1914, and Paris–London, 1880–1913. Neisser's interesting study is based on several more sets, for which he does not publish either the data or the charts. Neisser nevertheless summarizes his findings for each set. His investigations confirm the view of the authors mentioned above, namely, that except for certain disturbances, a close correlation between the movement of short-term interest rate differentials and the exchange rates existed all the time the world was on the gold standard. The authors mentioned above do not adjust their series for seasonal variations.

[4] The reader will note that we encounter here once more one of those intricate interdependencies that are typical in this field: the rate of interest enters significantly into the gold points, a low rate bringing them closer together, a high one driving them apart. On the other hand however this very same short-term rate is partly dependent on the width of the gold points, because from that depends how much the rate may be at variance with those of other countries for which, of course, the same interdependency holds. This is a good illustration of the typical circularity or implicitness so characteristic of most economic problems. Their correct mathematical formulation, let alone solution, is no mean task.

no way subject to government control or that of the central bank. If such control existed the movements of gold would cease to be the results of market forces only, and the gold standard in that country would not function automatically. The arguments against the system seem to be derived, without exception, from the assumption of its essentially, indeed fully, automatic character. This is often expressed in various ways, though all criticisms ultimately amount to precisely that. The criticisms are directed either against the theoretical model, or against the (true or alleged) actuality of the prewar and post-World-War-I periods (more frequently against the latter only, which however is presumably held to be equivalent with the former). Theoretical model and actual manifestation are for all practical purposes identified.

The first theoretical treatment of the interconnection of exchange rates goes back to R. Cantillon,[5] who even went so far as to describe covering operations due to seasonal variations in a manner as perfect as the far more famous exposition by Viscount Goschen,[6] published one hundred and thirty odd years later. But the theory was really set up by A. A. Cournot in 1838.[7] It was generalized to $r \geqq 3$ markets by H. E. Bray[8] in 1922, Cournot having treated only $r \leqq 3$.

Consider two centers[9] i and j and let C_{ij} be the rate of exchange between the currency of i and the currency of j. Then C_{ji} will be the reciprocal of C_{ij}:

$$C_{ij} = \frac{1}{C_{ji}} \quad . \tag{1}$$

If we have r currencies, excluding $i = j$, we have $r\,(r-1)$ permutations of the subscripts i and j. But because of equation (1) this

[5] *Essai sur la nature du Commerce*, 1734, London, 1755; republished by H. Higgs for the Royal Economic Society, London, 1931.

[6] *The Theory of the Foreign Exchanges*, 1861.

[7] *Recherches sur les Principes Mathématiques de la Richesse*, Paris, 1838, Chapter III, last English edition, Irving Fisher, editor, New York, 1927. Cournot returned to economic problems in these two later works: *Principes de la Théorie des Richesses*, Paris, 1863, and *Revue Sommaire des Doctrines Economiques*, Paris, 1877. The latter two works are particularly important for the theory of international trade because of their discussion of contemporary literature.

[8] H. E. Bray, "Rates of Exchange," *American Mathematical Monthly*, Vol. 29, 1922, pp. 265–371. Cf. also G. C. Evans, *Mathematical Introduction to Economics*, New York, 1930, Chapter VII.

[9] For the argument it is irrelevant whether these "centers" are in the same country or not. Here we assume of course the latter. The problem whether the theory of international trade is different *in kind* from that of internal trade is answered in the affirmative by Ricardo and Mill, in the negative by Cournot.

reduces to $r(r-1)/2$ independent ratios, i.e., in our case to six.

It is possible to reduce this number still further. This reduction is based on the simple consideration that the following must also be true in an ideal setup:

$$C_{ik} = C_{ij}C_{jk} \tag{2}$$

This "cross rate" expresses the fact that the ratio of, say, dollars to sterling in New York and London cannot differ (save for the costs of the operation) from, say, dollars to francs and francs to sterling. If this were not so it would pay to buy sterling not directly in New York but via Paris. The high degree of perfection and the closeness of all calculations referred to above make it highly improbable that differences, other than those for the transfer costs involved, could be maintained for any noticeable length of time. The number of relationships based on equation (2) is equal to $(r-1)(r-2)/2$. There were, however, $r(r-1)/2$ quantities C_{ij} and this number reduces to

$$\frac{r(r-1)}{2} - \frac{(r-1)(r-2)}{2} = r-1;$$

that is, in our case there are *three independent exchange rates* for the four countries. Obviously there is no cause to prefer C_{ij} over C_{ji}. It will depend on the convenience with which data can be collected. But what is the meaning of the dollar rising or the franc falling? Why should one representation rather than the other be preferred? If one studies the exchange rates from the point of view of one country only, no problem exists. But we want to study the exchange rates of several countries simultaneously and use a cycle approach. In that case an expansion should be distinguished from a contraction, but it is entirely arbitrary whether the same occurrence is called "expansion" or "contraction."

In A	A_1: A on B rising (falling)		B on A falling (rising)
	A_2: A on C rising (falling)	implies	C on A falling (rising)
	A_3: A on D rising (falling)		D on A falling (rising)
In B	B_1: B on A falling (rising)	$= -A_1$	
	B_2: B on C rising (falling)	implies	C on B falling (rising)
	B_3: B on D rising (falling)		D on B falling (rising)
In C	C_1: C on A falling (rising)	$= -A_1$	
	C_2: C on B falling (rising)	$= -B_2$	
	C_3: C on D rising (falling)	implies	D on C falling (rising)
In D	D_1: D on A $= -A_3$		
	D_2: D on B $= -B_3$		
	D_3: D on C $= -C_3$		

The minus sign expresses the respective inverse movement. For a larger number of countries the same regularity obviously obtains. By permutation we can put any of the four countries into any of the four positions A-D.

By A on B, A on C, etc. we mean how much currency of A has to be paid for a unit of currency of B,C. . . . This defines the above-mentioned reciprocal relationship and hence produces the inverse phase movements in B,C. . . . Foreign exchanges are quoted in the indicated way in all money markets except one, London. There quotations of foreign currencies indicate how much foreign currency is needed in order to buy, in London, one pound sterling. The rate of, say, dollar to sterling must therefore be the same in New York and London, i.e., not the reciprocal in one place of that of the other. Negligible differences[10] between the quotations in these two places are caused by differences in the costs of transfer or by imperfection of arbitrage, or both.

If one of the countries is Great Britain, our scheme can be reduced by simply transforming the London quotations into the others. The British notation is sometimes called in the literature "quantity notation" (since a particular fixed quantity, i.e., one pound sterling, is the measuring stick), as distinguished from the "price notation," which is the ordinary form of stating the amount of domestic currency needed for the purchase of a unit of the foreign currency.

The slight differences mentioned do not matter since they disappear completely, certainly under the gold standard. Our statistics are monthly values, computed on the basis of either daily or weekly data and any noticeable difference between the direct and the inverse quotation vanishes for all practical purposes; the great speed of arbitrage[11] operations easily takes care of that.

For the purposes of a study of cyclical behavior of exchange rates it is therefore not of real importance whether A on B or B on A inverted is taken as one and the same, or A on B series, e.g., when it is difficult or impossible to obtain A on B data for part of

[10] About the influence of differences in the life of bills traded upon this equalization and hence the need to define "par" accordingly, cf. section 4 below.

[11] This is an assumption only at present. There is every reason to believe that it is true. But we shall find that arbitrage working through three centers, which should not make any difference at all, does not fulfill this practical and theoretical condition. On the contrary a rather baffling behavior is revealed in many instances.

the period. The necessity of inversion[12] actually does not arise except in the interwar period where there is at any rate a far more considerable break in the behavior of the series, just as was noticed previously for other activities. Furthermore checks for periods where both forms of information are available have shown that differences are negligible. This is also concurred in by operators in the field of foreign exchange. If we were interested in exchange arbitrage operations between any two places directly, then there would be room for objections, but they do not apply here.

Each exchange rate series has at least three critical points: mint par, the upper, and the lower gold (or specie) points.[13] All are of importance when one desires to describe the behavior of the series historically or interpret them in regard to such notions as the equilibrium of the balance of payments. The gold points are traditionally understood to be the highest and lowest limits between which the actual data *can* possibly fluctuate, or—in a less stringent interpretation—*may* fluctuate without violating the principles of the gold standard.

The traditional view until recently was—as expressed by classical as well as by modern writers—that the balance of payments is in equilibrium only when the exchange rate is at mint parity. Since mint par is always *defined* without ambiguity, as the ratio between two amounts of metal and admixtures, we would indeed have an absolutely objective way of finding out when as complex an economic phenomenon as the balance of payments is in equilibrium or, more correctly, describes an equilibrium.

Under a gold standard the possible values of C_{ij} are supposed to have an upper and a lower bound in the gold import and gold export points, respectively. One specific value within this range, say $C_{ij}^{*} = 1/C_{ji}$, is called "mint par" and is what is customarily, though loosely, described as "parity." It is better, however, to use the term mint par, unless no misunderstanding is possible.[14] If the currencies

[12] The reason why we shall need a series A on B instead of B on A (which is of course the same economic relationship) lies in the connection these series find with a particular form of the interest rate differential. There we are also free to choose A-B or B-A. There is no inherent advantage in either form. But once an exchange rate has been chosen, only one form of a differential can be used with it and vice versa.

[13] The latest extensive discussion of gold points, in the framework of monetary theory, is to be found in John M. Keynes, *A Treatise on Money*, London, 1931; and in P. Einzig, *The Theory of Forward Exchange*, London, 1937.

[14] Mint par need not necessarily halve the distance between the gold points,

move toward one of the gold points, a correction by one of the two (or both) markets is indicated and will—under a free system—invariably take place with great speed. The assumption is furthermore that the rates cannot go beyond the specie points. Both statements—that adjustments will take place, e.g., by gold shipments, and that the bounds are not exceeded—are subject to empirical investigation.

The definition of parity needs to be expanded to allow for *time*. Mint par is rigorously defined as a ratio between two different quantities of the metal. But this ratio will apply in actuality only if no time elapses in the exchange. Similarly all other parities imply time. When telegraphic transfers can be made, the theoretical pars need not be corrected. In all other instances the prevailing rate of discount (for the type of credit instrument involved) and the length of the bill traded must be considered when determining whether actually $C_{ij} = 1/C_{ji}$. Since bills of very different lengths are simultaneously traded between two countries we have not only one scale of equivalent values of C_{ij} and $1/C_{ji}$ but as many as there are types of bills. Arbitrage, even between two places only, is therefore a vastly more varied and complicated activity than it may first seem to be. Finally variations in the price of gold transportation costs, etc., have to be taken into account. For our purposes it is sufficient to understand the influence of the gold price; we need not go into comparative detail.[15]

In determining whether currencies are quoted at par, allowance must therefore be made for the nature of the data. If they involve telegraphic transfers no adjustment is necessary; when they are quoted for sight drafts it would be. However, when using monthly averages, these adjustments become small and may cancel out; at any rate we have not attempted to introduce corrections. The reader will judge for himself whether this is justified. We shall later determine the number and significance of deviations of each exchange rate from parity. This will refer to mint par. The point is not without interest, because of the meaning given mint par by many economists in trying to determine whether a currency is in "equilibrium."

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since the cost of transportation of gold may be greater in one direction than in the other.

[15] A good illustration is to be found in W. A. Brown, Jr., *The International Gold Standard Reinterpreted*, Vol. I, p. 708 ff. where the London–New York rate is discussed for 1928 in regard to both the gold points and mint parity.

This leads over from the definition of parity to its use and thence to the *interpretation*. It is from the latter that it assumes its historic role because economists up to most recent times have sought to identify the *equilibrium rate of exchange* with mint par. This introduces a difficult and much disputed topic.

If this criterion be accepted, then we make the rather startling discovery—cf. Tables 41, 51, and 52 below—that none of the six balances of payments (which we do not know but of which we would thus know a decisive property) was in "equilibrium" except in rare cases, which are clearly the exceptions to whatever must have been their "normal" and perhaps typical "disequilibrium." Furthermore when mint par of the currency of a given country is observed, it is not necessarily simultaneously at mint par with a third or fourth country with which it also communicates. The significance of this will become apparent presently.

It is best to state the argument in the words of Jacob Viner: "In their discussion of the foreign exchanges, the writers on the theory of international trade with apparently almost complete unanimity expound a particular error of minor practical importance but revealing lack of due precision in exposition or thought. They hold that when the balance of payments is even, the exchanges will be at their mint par. The correct statement is that when the balance of payments is even, the exchanges will be somewhere *within* the export and import points. The mint par has significance only as a base point from which to determine the specie export and import points. Equilibrium between the amount of foreign bills demanded and offered is as likely to be reached at any one as at any other rate within the limits of the specie points. Except for the approximately fixed limits to the range of possible fluctuation of the exchanges under an international metallic standard, there is no basis for differentiating the theory of the foreign exchanges between two currencies having a common metallic standard, on the one hand, and between two currencies on different standards, on the other hand."[16]

[16] Jacob Viner, *Studies in the Theory of International Trade*, 1937, p. 379. Viner remarks in a footnote that he too had committed that error, but that he was in the "excellent company" of Ricardo, J. S. Mill, Bastable, Marshall, and Taussig. The error was pointed out by H. D. White, *The French International Accounts, 1880–1913*, 1933, p. 156. It will be noted that in the above quotation the wrong statement is replaced by a more plausible one, no proof being offered for it, probably because White, whom Viner quotes, is more specific and since the point is easily seen. It is however not correct when Viner attrib-

Section 4. The Statistics of Gold Points and Exchange Rates

We shall now turn to an examination of the *actual data on gold points* on whose basis we wish to examine the validity of the solidarity hypotheses. It will be carried out for the prewar and interwar periods. Although in general we relegated the postwar figures and their interpretation to a somewhat secondary role—once having established the great confusion of relationships—we shall now use some of our interwar figures more extensively.

The reason is chiefly a statistical one: it is extremely difficult to obtain *actual* values for prewar gold points, especially for the earlier years; it is also very difficult even for the postwar years.[17] But we obtained as complete information about the gold points involving New York as can reasonably be expected. These figures can be compared with the ordinary sources; and aside from the information they actually give, they serve as our most important control over the figures collected for the other periods and pairs of countries which we must accept, lacking really first-rate sources. It will be seen that we can thus obtain a picture of sufficient accuracy to deal with the solidarity hypothesis in a decisive way.

Table 33 contains the gold points of the six exchange rates for the prewar period. For the three rates involving London the most natural source is the *Economist*, which printed data beginning September 15, 1877. We begin with these data, which merit some lengthier discussion[18] since the *Economist* is such a widely used source of economic statistics and since the evaluation of its data will help in judging those from other sources where a control is more difficult.

The most noteworthy fact is the apparent *stability* of the gold points as reported by the *Economist* over almost forty years, as can be seen from Table 32. The reports appeared every week and these

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utes the change to White. The point was made by A. C. Pigou in, "The Foreign Exchanges," *Quarterly Journal of Economics*, November 1922, reprinted in *Essays in Applied Economics*, London, 1923, pp. 156–173. A recent discussion of the entire problem to which we shall refer again below is given by R. Nurkse, "Conditions of International Monetary Equilibrium," *Essays in International Finance*, No. 4, Princeton University Press, 1945.

[17] Cf. Keynes: "The precise magnitude of the stretch between the gold points deserves more scientific consideration than it has yet received," *op. cit.*, Vol. II, p. 331.

[18] The reader may pass on to p. 191, if the following discussion appears to be too detailed for his purpose, without losing the connection of the main argument.

TABLE 32

The *Economist's* Gold Points, 1877–1916

	BRITAIN–FRANCE (*francs*)		BRITAIN–GERMANY (*marks*)		BRITAIN–UNITED STATES (*dollars*)	
	Export Point	*Import Point*	*Export Point*	*Import Point*	*Export Point*	*Import Point*
Sept. 15, 1877	25.125	25.325	20.32	20.52	4.8275	4.89
Sept. 22, 1877	25.125	25.325	20.32	20.52	4.827	4.89
Oct. 25, 1879	25.125	25.325	20.33	20.52	4.827	4.89
Aug. 19, 1916	25.125	25.325	20.33	20.52	4.827	4.89

TABLE 33

Pre-World-War-I Gold Points

New York–London

Source[a]	*Gold export point London* (*$ per £*)	*Parity* (*$ per £*) *4.866*	*Gold import point London* (*$ per £*)
Economist[b]	4.827		
H. Deutsch 1910[c]			4.8762
Tate[d]	4.83		
O. Swoboda 1913[e]			4.8836
O. Swoboda 1901	4.84		
Economist			4.89
O. Haupt 1894[f]	4.845		
P. Einzig 1913[g]			4.89
O. Swoboda 1913	4.8495		
O. Haupt 1894			4.896
P. Einzig 1913	4.8509		
Tate			4.90
H. Deutsch 1910	4.8570		
Tate			4.90
Range	4.827–4.857		4.8762–4.90
Median	4.845		4.89

[a] Date following name of source refers to year for which quotation was made.

[b] *Economist*, Sept. 22, 1877–Aug. 19, 1916. Also quoted by N. E. Weill, *Die Solidarität der Geldmärkte*, 1903.

[c] Henry Deutsch, *Bullion, Coins, Bills, Stocks, Shares and Options*, 2nd ed., 1910, p. 23; 4.87 given by Palgrave's *Dictionary of Political Economy*, 1899, vol. II, p. 227.

[d] *Modern Cambist*, 23rd ed., 1893, p. 240.

[e] Otto Swoboda, *Arbitrage*, 14th ed., p. 711; 3.5% expenses included.

[f] Ottomar Haupt, *Arbitrages et Parites*, 8th ed., 1894, p. 485. Also quoted by O. Haupt, *Geld, Silber und Wahrung*, 1877, p. 144, no interest included.

[g] Paul Einzig, *International Gold Movements*, 1931, p. 148.

TABLE 33, continued

Source	Gold export point New York (M per $100)	Parity (M per $100) 419.79	Gold import point New York (M per $100)
		Berlin–New York	
O. Haupt 1894[a]	416.80		421.84
O. Swoboda 1901[b]	416.80		421.85
N. E. Weill[c]	416.80		421.85
Reichsbank[d]	416.80		
O. Swoboda 1913[e]	417.70		
Reichsbank			421.85
Range	416.80–417.70		421.875
Median	416.80		421.84–421.875
			421.85

[a] *Op. cit.*, p. 199.
[b] *Op. cit.*, p. 92.
[c] N. E. Weill, *Die Solidarität der Geldmärkte*, 1903, p. 74.
[d] *Die Reichsbank 1876–1910*, 1912, p. 212, Table 82.
[e] *Op. cit.*, p. 711; ⅜% expenses included.

Source	Gold export point New York (fc per $100)	Parity (fc per $100) 518.26	Gold import point New York (fc per $100)
		Paris–New York	
O. Swoboda 1901[a]	514.75		521.50
O. Haupt 1894[b]	514.80		521.56
O. Haupt 1877[c]	515.00		
O. Swoboda 1913[d]			522.10
C. Heiligenstadt[e]	515.07		522.402
O.Swoboda 1913	516.40		
Range	514.75–516.40		521.50–522.402
Median	515.00		521.83

[a] *Op. cit.*, p. 422; 4.5% expenses included; 4% premium at the Banque de France.
[b] *Op. cit.*, p. 555.
[c] *Op. cit.*, p. 144.
[d] *Op. cit.*, p. 711; 3% expenses included; 4% premium at the Banque de France.
[e] Carl Heiligenstadt, *Jahrbücher für Nattonalökonomie und Statistik*, 3rd series, vol. 5, 1893, graph opposite p. 242, 4% premium.

TABLE 33, continued

Berlin–London

Source	*Gold export Point London (M per £)*	*Parity (M per £) 20.43*	*Gold import point London (M per £)*
Tate[a]	20.31		
N. E. Weill[b]			20.495
Heiligenstadt 1890[c]			20.496
Economist 1877[d]	20.32		
H. Deutsch[e]			20.50
Economist 1879[f]	20.33		
Reichsbank[g]			20.50
N. E. Weill	20.335		
O. Swoboda[h]	20.34		20.505
O. Haupt 1894[i]	20.34		20.505
O. Swoboda 1913[j]	20.34		
Reichsbank[g]	20.34		
R. Winkler[k]	20.35		20.51
H. Deutsch	20.36		
O. Swoboda 1913			20.52
Heiligenstadt 1890	20.37		
Economist 1877			20.52
Economist 1879			20.52
Tate			20.53
Range	20.31–20.37		20.495–20.53
Median	20.34		20.505

[a] *Op. cit.*, p. 239.
[b] *Op. cit.*, p. 71; 20.49 given by O. Haupt, 1877, p. 144.
[c] Carl Heiligenstadt, *Jahrbücher für Nationalökonomie und Statistik*, 3rd series, vol. 4, 1892, p. 817. Average of figures translated from graph. See below, Table 62 and 63.
[d] *Economist*, Sept. 15, 1877–Oct. 25, 1879.
[e] *Op. cit.*, p. 21.
[f] *Economist*, Oct. 25, 1879–Aug. 19, 1916.
[g] *Die Reichsbank 1876–1910*, 1912, p. 212, Table 82.
[h] *Op. cit.*, p. 340; 2.25% expenses included; same export point given by Palgrave, *op. cit.*, p. 227; import point given as 20.52.
[i] *Op. cit.*, p. 199.
[j] *Op. cit.*, pp. 353–354; 2.25% expenses included.
[k] R. Winkler, *Geschichte der Arbitrage*, 1914, p. 46.

(*table continues*)

TABLE 33, continued

	Paris–London		
Source	*Gold export point London (fc per £)*	*Parity (fc per £) 25.225*	*Gold import point London (fc per £)*
O. Haupt 1877[a]	25.10		
H. C. Walter[b]			25.295
Tate[c]	25.11		
H. Deutsch[d]			25.30
Economist[e]	25.125		25.325
O. Swoboda 1913[f]	25.125		25.325
Tate			25.33
O. Swoboda 1901[g]	25.125		25.345
O. Haupt 1894[h]	25.127		25.345
O. Haupt 1877			25.35
H. Deutsch	25.14		
H. C. Walter	25.155		
Range	25.10–25.155		25.295–25.35
Median	25.125		25.3275

[a] *Op. cit.*, p. 144, no interest, courtage, or commission.
[b] H. C. Walter, *Foreign Exchanges and Foreign Debts*, 1926, p. 17.
[c] *Op. cit.*, p. 233.
[d] *Op. cit.*, p. 19.
[e] *The Economist*, Sept. 15, 1877–Aug. 19, 1916; same figures given by Palgrave, *op. cit.*, p. 227.
[f] *Op. cit.*, pp. 353–354; 1.5% expenses included.
[g] *Op. cit.*, p. 340; 1.5% expenses included; 4% premium at the Banque de France.
[h] *Op. cit.*, p. 486.

are all the changes. Such great stability throws into doubt the accuracy of the *Economist's* gold points. An almost complete stability has, to be sure, often been asserted by foreign exchange operators. But here it exceeds all expectations. On the other hand, in many books on foreign exchanges published during the same period and in the works dealing with the solidarity hypothesis, the gold points are freely used and apparently considered characteristic for actual operations of that period.

The *Economist* gives very little information concerning its figures; it is only pointed out that these are "the exchange points at which gold comes to or leaves the Bank of England."[19] Nothing is said as to the type of average these gold points are supposed to repre-

[19] Volume xxxv, 1877, p. 1091.

TABLE 33, concluded

	Berlin–Paris		
Source	*Gold export point Paris (M per 100 fc)*	*Parity (M per 100 fc) 81.00*	*Gold import point Paris (M per 100 fc)*
O. Swoboda 1901[a]	80.50		81.30
O. Haupt[b]	80.51		81.32
O. Swoboda 1913[c]	80.55		
Reichsbank[d]	80.60		
N. E. Weill[e]	80.77		81.35
Reichsbank[d]			81.40
O. Swoboda 1913			81.49
Range	80.50–80.77		81.30–81.49
Median	80.55		81.35

[a] *Op. cit.*, p. 93; 4% premium at the Banque de France; also quoted by O. Haupt, *Gold, Silber und Währung*, 1877, p. 144 (not including interest, courtage, or commission).
[b] *Op. cit.*, p. 200. [c] *Op. cit.*, p. 86.
[d] *Die Reichsbank 1876–1910*, 1912, p. 212, Table 82.
[e] *Op. cit.*, p. 58.

sent. Does each of these points represent an arithmetic mean of the cost of shipping various types of gold such as fine gold, standard gold, gold bars, gold coins? Or does point represent the actual arithmetic mean of all the Bank of England gold shipments of the week? Or are these the modal points where gold exports or imports are at the maximum volume? Since no information is given by the *Economist*—nor, as a matter of fact, by anyone else, e.g., by the many previous textbook writers on foreign exchange—no certain answer is possible.[20] Moreover it is a serious restriction of these figures that they refer only to the Bank of England, since the cen-

[20] Data appear also occasionally in the *Financial News* and in the *Commercial and Financial Chronicle*, and although these periodicals are generally valuable sources for economic statistics, we decided not to use their gold points. Some of them coincide with a few to be found in our tables and we do not duplicate entries. Many textbooks seem to have taken theirs from these two sources, although it may just as well have been the other way around.

We mention here finally that we consider throughout this discussion the gold export point of A as equivalent with the gold import point of B in the relation of the currencies A and B, although there are, conceivably, slight differences; however they are too fine to measure. When London is involved then there are instead of four gold points for a pair of countries only two because of the so called "quantity" quotation of the foreign exchanges there. But for each of the two notations there are then necessarily two observations.

tral bank can, besides manipulating the price of gold, obviously always ship at much lower cost than commercial banks or operators. Therefore the difference between these gold points may be narrower than that for the strictly commercial ones, thus giving the illusion that a much smaller interest rate differential is imposed upon the countries concerned than actually may have been the case. Since, as we shall see in detail (cf. page 269), even very small differences in the data have very considerable consequences, this is a most important observation.

In the September 15, 1877 issue, the *Economist* hints that the gold points it publishes are those supplied by Ernest Seyd, author—among other recognized publications—of a book entitled *Bullion and Foreign Exchange*, London, 1868. Because of its early publication it may be interesting to give some details from Seyd's book.

Seyd points out (page 386 ff.) that fine gold is shipped from the Bank of England to France when the exchanges are from 25.075 to 25.125 francs. However some shippers commence to export gold even at 25.10 to 25.15 francs. It is interesting to note that 25.125 francs is the *Economist's* export point, Britain to France. If one disregards the difference in time and assumes no changes in the costs of shipping gold between 1868 and 1877, one can conclude that the *Economist's* gold points are in all probability rough modal points at which the gold (fine gold) influx into, and efflux from, the Bank of England reached the maximum volume. As very rough modal points, the stability of the *Economist's* data becomes a little more plausible.

Seyd goes on to show that the gold points will vary with different forms of gold shipped. For American gold coins, the British-French export point would be about 25.10 francs. With refinable gold, it would be about 25.1218 francs. (This is due to the fact that gold refining was cheaper in France than in England.) For British sovereigns shipped, the exchange would be about 25.06 francs.

Seyd also points out that gold shipped from France to England cost about 25.368 francs if gold bars and 25.396 francs if Napoleons. He concludes that the gold export point range is from 25.10 to 25.125 and the gold import point range from 25.275 to 25.30 francs. The margin between the two gold exchange points is thus approximately one per cent of mint parity.[21]

Besides the data furnished by the *Economist* we use the computations in different handbooks prepared for cambists and banks.

[21] The figures for mint parity are given in Table 36 below.

There are various such works, many of which have appeared in numerous editions[22] and all of which were constantly used in practice. Generally there are no changes at all reported from one edition to another, but it was not possible to obtain continuous series of the many editions. As will be seen from Table 33 the differences of the data of different editions of the same work are as slight as those for different works, another indication of both the great stability and the merely representative, average character of the information given. Many checks have been made, whenever possible, by consultation of actual bank records in New York, which were scanned for gold shipments at various times, for different firms and changing amounts of gold shipped. In one instance the personal records of one of the principal figures in the American pre-1914 trade in gold—a manager of one of the largest banks—were found; there was an almost complete agreement with some of the figures contained in Table 33 at least as far as New York is concerned.[23]

This explains why in Table 33 there are sometimes few and sometimes many entries for the various countries; we have nevertheless thought it safe to indicate the *range* of the observations and to compute the *medians* which should be compared among each other as of equivalent value.

(5) Table 34 contains the gold points for the interwar period, and Table 35 the detailed figures for the gold points of New York with London, Paris, and Berlin.[24] We believe that this is the first authentic chronological table that has ever been made, showing gold points of actual transactions on a massive scale. These figures can be used for evaluation of those of the preceding two tables. The differences in the number of entries for the various pairs of countries in Table 34 is due to the same reasons given above for Table 33.

[22] Some of these works appeared simultaneously or successively in various languages, another indication of the widespread use they found among operators. One of the authors, O. Haupt, was himself intimately connected with the firm of Rothschild and engaged in this business. An important work is N. E. Weill, *Die Solidarität der Geldmärkte*, 1903.

[23] It is clear that a really thorough, and exceedingly expensive, study would have to use sampling techniques applied to bank archives in the chief centers. War has made this impossible; but our argument is not really affected by this lack, since we aim primarily at the construction of a measure of stress, as will be seen below in Chapter VII.

[24] It will be noted that there are gold points even beyond the date when a partner had given up the gold standard. This is only an apparent paradox: they describe costs and as such are independent of the monetary standard. The latter defines their *function*.

TABLE 34

Post-World-War-I Gold Points, 1925–1933

New York–London

Source	*Gold export point London* (*$ per £*)	*Parity* (*$ per £*) 4.866	*Gold import point London* (*$ per £*)
New York market, average[a]	4.85145		4.89021
New York market, range[b]	4.845–4.85423		4.88628–4.89002
W. F. Spalding[c]	4.8432		
P. Einzig 1930[d]			4.8873
W. F. Spalding[e]	4.84828[f]		
O. Swoboda[g]			4.88757
P. Einzig[h]	4.8488		
W. F. Spalding[e]			4.89233[h]
P. Einzig 1925	4.8491		
P. Einzig 1925			4.8949
P. Einzig[h]	4.8517		
W. F. Spalding[e]			4.9067
W. F. Spalding[e]	4.85312[i]		
P. Einzig 1930[d]	4.8534		
Median	4.850275		4.89127
Range[k]	4.8432–4.8534		4.8873–4.9067

[a] Average for period January 1926–May 1931 weighted by the number of months each quotation was valid.

[b] Extreme quotations during the same period; cf. Table 35 and footnote 25 in the text.

[c] W. F. Spalding, *A Primer of Foreign Exchange*, 1925, p. 36.

[d] Paul Einzig, *International Gold Movements*, 2nd ed., 1931, pp. 148–149. Date refers to year for which quotation was made.

[e] W. F. Spalding, *Dictionary of the World's Currencies and Foreign Exchanges*, 1928, p. 84.

[f] Otto Swoboda, *Arbitrage*, 1928.

[g] Paul Einzig, *Economic Journal*, March 1927, pp. 133–139.

[h] Paul Einzig, *Economic Journal*, Sept. 1927, pp. 480–483.

[i] Eight days, 4.5% interest.

[j] Seven days, 3.5% interest.

[k] The 1923 edition of Palgrave's *Dictionary of Political Economy* gives 4.827; it is disregarded as falling outside our period, referring indeed to a year prior to the reestablishment of the gold standard by Great Britain. For gold points beyond September 1931 cf. Table 35.

TABLE 34, continued

New York–Berlin

Source	Gold export point Berlin ($ per 100 RM)	Parity ($ per 100 RM) 23.81	Gold import point Berlin ($ per 100 RM)
New York market, average[a]	23.7290		24.0075
New York market, range[b]	23.64–23.7696		23.9331–24.02

[a] Average for period October 1926–May 1931 weighted by number of months each quotation was valid.
[b] Extreme quotations during the same period.

New York–Paris

Source	Gold export point Paris ($ per 100 fc)	Parity ($ per 100 fc) 19.30 (up to June 1928)	Gold import point Paris ($ per 100 fc)
New York market, average[a]	19.2022		19.3925
New York market, range[b]	19.1809–19.22		19.3563–19.41
		3.918[c] July 1928	
New York market, average[d]	3.9052		3.9405
New York market, range[e]	3.895–3.9089		3.9334–3.9509
Tate[f]	3.905		3.943
Median	3.9051		3.94175

[a] Average for period October 1926–June 1928 weighted by number of months each quotation was valid.
[b] Extreme quotations during same period.
[c] Parity changed June 25, 1928.
[d] Average for period July 1928–May 1933 weighted by number of months each quotation was valid.
[e] Extreme quotations during same period.
[f] Tate, *Modern Cambist*, 1929 ed., p. 121.

(*table continues*)

TABLE 34, continued

Berlin–London

Source	Gold export point London (RM per £)	Parity (RM per £) 20.429	Gold export point London (RM per £)
P. Einzig[a]	20.392[b]		
W. F. Spalding[c]	20.3894[d]		
W. F. Spalding	20.3862[e]		
P. Einzig	20.381[f]		
H. Deutsch[g]	20.378[h]		
W. F. Spalding	20.37474[i]		
H. Deutsch	20.37433[j]		
Handwörterbuch des Bankwesens[k]	20.3628		
P. Einzig, 1930[l]	20.3626[m]		
P. Einzig, 1930	20.3584[n]		
H. Deutsch	20.3558[n]		
Tate[o]	20.348		
W. F. Spalding[p]	20.33		
P. Einzig 1930			20.53
H. Deutsch			20.5042
Tate			20.497
Median	20.37433		20.487
Range	20.33–20.392		20.5006
			20.487–20.53

[a] Paul Einzig, *Economic Journal*, March 1927, pp. 133–139.
[b] To Berlin.
[c] W. F. Spalding, *Dictionary of the World's Currencies and Foreign Exchanges*, 1928, p. 85.
[d] To Cologne by air.
[e] To Bremen by steamer.
[f] To Cologne.
[g] Henry Deutsch, *Arbitrage in Bullion, Coins, Shares, etc.*, 1933, p. 35.
[h] Assumed gold is bought on open market.
[i] Four days; 5% interest.
[j] Two days; 6% interest.
[k] *Handwörterbuch des Bankwesens*, p. 235.
[l] P. Einzig, *International Gold Movements*, 1931, pp. 152–153; date refers to year for which quotation was made.
[m] To Bremen.
[n] Two days interest; 2.5%, airmail.
[o] *Op. cit.*, p. 178, example taken from *Financial News*, May 12, 1927.
[p] W. F. Spalding, *A Primer of Foreign Exchange*, 1925, p. 41; assumed 0.5% expenses.

TABLE 34, concluded

Paris–London

Source	*Gold export point London (fc per £)*	*Parity (fc per £) 25.2215 (up to June 1928)*	*Gold import point London (fc per £)*
W. F. Spalding[a]	25.125		25.325
		124.2134[b] July 1928	
H. Deutsch[c]			124.556
Tate[d]	123.925		124.55
P. Einzig, 1930[e]	123.9117		124.5275
H. Deutsch	123.60–123.716		
Median	123.8139		124.55
Range	123.60–123.925		124.5275–124.556

[a] W. F. Spalding, *A Primer of Foreign Exchange*, p. 40, assumed 0.4% expenses.
[b] Parity changed June 25, 1928.
[c] *Op. cit.*, pp. 36, 118.
[d] *Op. cit.*, p. 121.
[e] Paul Einzig, *International Gold Movements*, 2nd ed., 1931, p. 151. Date refers to year for which quotation was made.

Berlin–Paris

Source	*Gold export point Paris (RM per 100 fc)*	*Parity (RM per 100 fc) 16.447[a] (beginning July 1928)*	*Gold import point Paris (RM per 100 fc)*
H. Deutsch[b]			16.509[c]
H. Deutsch			16.495[d]
Handwörterbuch des Bankwesens[e]	16.399[f]		
Handwörterbuch des Bankwesens	16.393[g]		
H. Deutsch	16.3894[c]		
Median	16.393		16.502
Range	16.3894–16.399		16.495–16.509

[a] No data on gold points available before the parity change on June 25, 1928.
[b] *Op. cit.*, p. 164.
[c] Two days; 6% interest; airmail.
[d] Quoted by the author as generally assumed value of gold point.
[e] *Handwörterbuch des Bankwesens*, p. 235.
[f] By truck.
[g] By train.

TABLE 35

New York Market Gold Points, 1926–1933

New York–London
($ per £)

	1926							
Export	4.9002							
Mint par	4.86656							
Import	4.8450							
	1927							
	Apr. 22	Aug. 1	Nov. 29	Dec. 15			Yearly average	
Export	4.8997	4.89965	4.88865	4.88810			4.89403	
Mint par	4.86656							
Import	4.8497	4.85184	4.85184	4.85187			4.85131	
	1928							
	Jan. 24	Mar. 23	May 22	July 18			Yearly average	
Export	4.88808	4.88862	4.88904	4.88958			4.88883	
Mint par	4.86656							
Import	4.85242	4.85187	4.85144	4.85084			4.85164	
	1929							
	Mar. 11	Aug. 9	Nov. 1	Nov. 14			Yearly average	
Export	4.88958	4.89066	4.88958	4.88904			4.88972	
Mint par	4.86656							
Import	4.85084	4.84973	4.85084	4.85139			4.85070	
	1930							
	Jan. 10	Feb. 7	Mar. 14	May 2	June 20	Dec. 30	Yearly average	
Export	4.88929	4.88874	4.88821	4.88767	4.88713	4.88658	4.88794	
Mint par	4.86656							
Import	4.85115	4.85170	4.85226	4.85281	4.85336	4.85392	4.85253	
	1931							
	May 8		Oct. 16	Dec. 8		Average Oct.–Dec.		
Export	4.88628		4.87439	4.88855		4.88147		
Mint par	4.86656							
Import	4.85423		4.85201	4.85070		4.85136		
	1932							
	Feb. 26	June 23	Sept. 9	Nov. 1	Dec. 1	Yearly average		
Export	4.89254	4.89200	4.89200	4.89200	4.89200	4.89211		
Mint par	4.86656							
Import	4.85247	4.85303	4.85181	4.84667	4.84680	4.85016		
	1933							
	Mar. 3	Apr. 7	May 26			Yearly average		
Export	4.89308	4.89254	4.89200			4.89254		
Mint par	4.86656							
Import	4.84570	4.84625	4.84681			4.84625		

TABLE 35, continued

New York–Paris
($ per fc)

	1926 Sept. 29
Export	0.1941
Mint par	0.1930
Import	0.1922

	1927 Aug. 1	Dec. 15	Yearly average
Export	0.1941	0.19364	0.19387
Mint par	0.1930		
Import	0.1921	0.19213	0.19212

	1928 Jan. 24	Mar. 23	May 22	June 25	July 18	Average Jan.–Mar.	Average June–July
Export	0.193563	0.194072	0.194075	0.039509	0.039383	0.193259	0.039446
Mint par	0.192952			[b] 0.39179			
Import	0.192080	0.191813	0.191809	0.038950	0.039042	0.191901	0.038996

	1929 Mar. 11	Aug. 9	Oct. 24	Nov. 1	Nov. 14	Yearly average
Export	0.039382	0.039394	0.039384	0.039376	0.039371	0.039381
Mint par	0.039179					
Import	0.039041	0.039031	0.039041	0.039049	0.039054	0.039043

	1930 Jan. 10	Feb. 7	Mar. 14	May 2	June 20
Export	0.039371	0.039367	0.039363	0.039358	0.039357
Mint par	0.039179				
Import	0.039053	0.039058	0.039063	0.039067	0.039069

	Sept. 25	Dec. 24	Yearly average
	0.039343	0.039339	0.039357
	0.039079	0.039084	0.039068

	1931 Feb. 6	May 5	May 8	Oct. 16	Dec. 8	Yearly average
Export	0.039338	0.039338	0.039334	0.039352	0.039352	0.039343
Mint par	0.039179					
Import	0.039084	0.039084	0.039089	0.039071	0.039061	0.039078

	1932 Feb. 26	June 23	Nov. 1	Dec. 1	Yearly average
Export	0.039438	0.039432	0.039432	0.039432	0.039434
Mint par	0.039179				
Import	0.039066	0.039071	0.039032	0.039033	0.039051

	1933 Mar. 3	Apr. 7	May 26	Yearly average
Export	0.039441	0.039436	0.039432	0.039436
Mint par	0.039179			
Import	0.039024	0.039028	0.039032	0.039028

TABLE 35, concluded

New York–Berlin
(*$ per RM*)

	1926 Sept. 29					
Export	0.2402					
Mint par	0.2382					
Import	0.2364					
	1927					
	May 2	*Aug. 1*	*Dec. 15*			*Yearly average*
Export	0.2401	0.2402	0.2396			0.2400
Mint par	0.2382					
Import	0.2365	0.2371	0.2371			0.2369
	1928					
	Jan. 24	*Mar. 23*	*Apr. 6*	*May 22*	*July 18*	*Yearly average*
Export	0.239495	0.239535	0.239511	0.239467	0.239507	0.239503
Mint par	0.238213					
Import	0.237128	0.237465	0.237489	0.237449	0.237409	0.237388
	1929					
	Mar. 11	*Aug. 9*	*Nov. 1*	*Nov. 14*		*Yearly average*
Export	0.239507	0.239587	0.239626	0.239587		0.239577
Mint par	0.238213					
Import	0.237385	0.237306	0.237267	0.237307		0.237316
	1930					
	Jan. 10	*Feb. 7*	*Mar. 14*	*May 2*	*June 20*	
Export	0.239587	0.239547	0.239507	0.239468	0.239428	
Mint par	0.238213					
Import	0.237307	0.237348	0.237388	0.237438	0.237468	
					Dec. 24	*Yearly average*
Export					0.239389	0.239487
Mint par						
Import					0.237508	0.237410
	1931					
	Feb. 6	*May 8*	*Oct. 16*	*Dec. 8*		*Average*
Export	0.239389	0.239331	0.239438	0.239438		*Feb.–May* 0.239360 *Oct.–Dec.* 0.239438
Mint par	0.238213					
Import	0.237626	0.237696	0.237586	0.237468		0.237661 0.237527
	1932					
	Feb. 26	*June 23*	*Nov. 1*	*Dec. 1*		*Yearly average*
Export	0.239647	0.239617	0.239617	0.239617		0.239625
Mint par	0.238213					
Import	0.237499	0.237529	0.237292	0.237299		0.237405
	1933					
	Mar. 3	*Apr. 7*	*May 26*			*Yearly average*
Export	0.239654	0.239647	0.239617			0.239639
Mint par	0.238213					
Import	0.237261	0.237269	0.237299			0.237276

[a] England went off the gold standard September 1931.
[b] Effective June 25, 1928.

The detailed figures for the New York gold points[25] are computed to five and even six decimals; some of those in the other tables, too, go to five decimals. This is a further indication that very fine adjustments are sometimes needed and meaningful. It also shows that the question how stable the gold points were over a long period is dependent upon the degree of fineness of the required information. If we go only to two decimals, most gold points will be stable (see especially Table 35). But when we find divergence in the information up to that comparatively low degree of accuracy, pertaining to the same year or period, then we may assume that this shows real differences in information, sample, type of shipper, rounding of figures, means of transportation used (truck, rail, air), place of destination, or acceptance of gold, etc.

Considering that gold transactions cover such a wide variety of forms with no information available as to their relative significance for the total, the best alternative is to take the averages and the ranges of the data. The medians seem most suitable in the present case and we consider them simply as our gold points for the two periods. It will be seen that we are sufficiently well informed to decide in a broad sense the main issues raised by the solidarity hypothesis. This is enhanced by the observations about the period for which short-term investments were made (cf. Chapter III).

(6) We shall keep the discussion of our various gold points to the barest minimum since we are not primarily interested in them, but in their applications. However these few comments suggest themselves. Table 35 shows the great stability of gold points for the postwar years, although it comprises a period of many major changes in international financial relations, such as, e.g., the easy money policy, the great stock exchange collapse in October 1929, the various reparation crises, etc. The changes in interest and freight rates were apparently too minor to affect the costs of shipment significantly.

(7) We now turn to the *exchange rates* and discuss first the *fre-*

[25] The New York data on gold points, 1926–1933, come from an impeccable source which, however, cannot be disclosed. The transactions at these gold points were large and probably as frequent as gold shipments shown by American import and export statistics. It is likely that other gold points were also found in New York at that period, but it is exceedingly improbable that they were narrower than those of Table 35. So whatever bias there may be, if any, in our choice of these figures, it is in the direction of stating the most unfavorable situation for those who might want to argue that the gold points were not far enough apart. In other words these figures give the best possible factual basis for testing Lord Keynes' assertions (to be taken from Tables 74 and 75).

quency distributions (Tables 36 and 37 and Charts 9 to 11) since they are likely to produce information about their basic structure as distinguished from their cyclical behavior. We use seasonally uncorrected data (cf. section 9); the reasons need not be repeated since they are essentially the same as those given in Chapter IV for interest rates and their differentials. The series are of uneven length, ranging from 463 to 329 months for pre-World-War-I and of 66 months for 1925–1931, and 55 months for those involving France; it might therefore be questioned whether the resulting measures are strictly comparable. But the numbers are in any case very large for the main period, so that there is little doubt as to the direct comparability. The post-World-War-I numbers are (with the stated exception) equal but small, so that while they are comparable among each other, they should not be interpreted too freely when compared with those before the war. The mint parities are noted in each case; the gold points can be found in Tables 33 and 35. In view of the great differences in the "fineness" of the quotations, the class intervals cannot be the same, but those chosen seem essentially satisfactory.[26]

We shall not discuss the distributions to any great extent, but they will be used again below in section 7. The graphs 9 to 11 contain, superimposed for those series where it was possible to compute them, also the distributions of the "derived" exchange rates, i.e., those obtained for the same pair via a third market. They will be discussed *loc. cit.* The chief caveat regarding the distributions must be with respect to the evaluation of their skewness. Excepting Berlin–New York (prewar) all are considerably skewed, as the coefficient χ shows. The sign is arbitrary because the rate could just as well have been presented for the respective other currency than for that chosen, with the result that we would have a mirror image of the present graphs. There is no way of choosing between them; but each one leads, *mutatis mutandis*, to the same interpretation. The skewness, especially if measured from parity as we shall do presently, expresses of course "weakness" or "strength" of one

[26] Frequency distributions of exchange rates have occasionally been determined for various reasons. Cf. especially F. C. Mills, *Statistical Methods Applied to Economics and Business*, New York, 1924, pp. 105 ff. But the purpose there is entirely didactic. He shows the distribution of the London–New York rate, 1882–1913 (384 months) with a larger class interval (of 0.050) than ours. Statistics, approaching distributions, but without their customary measures, are found in H. D. White, *The French International Accounts*, Cambridge, 1933, p. 158 for the New York–Paris rate.

TABLE 36

Frequency Distribution, Exchange Rates, Prewar, Seasonally Uncorrected Data

PARIS–LONDON (OCT. 1877–JULY 1914) (*fc per £*)		BERLIN–LONDON (OCT. 1877–JULY 1914) (*M per £*)	
Class	*Frequency*	*Class*	*Frequency*
25.090–25.105	5	20.320–20.329	4
25.106–25.121	8	20.330–20.339	12
25.122–25.137	24	20.340–20.349	12
25.138–25.153	31	20.350–20.359	19
25.154–25.169	41	20.360–20.369	11
25.170–25.185	45	20.370–20.379	21
25.186–25.201	46	20.380–20.389	21
25.202–25.217	33	20.390–20.399	22
25.218–25.233	42	20.400–20.409	27
25.234–25.249	32	20.410–20.419	21
25.250–25.265	29	20.420–20.429	24
25.266–25.281	15	20.430–20.439	30
25.282–25.297	32	20.440–20.449	24
25.298–25.313	16	20.450–20.459	52
25.314–25.329	20	20.460–20.469	40
25.330–25.345	8	20.470–20.479	26
25.346–25.361	5	20.480–20.489	27
25.362–25.377	5	20.490–20.499	19
25.378–25.393	3	20.500–20.509	19
25.394–25.409	1	20.510–20.519	7
25.410–25.425	1	20.520–20.529	3
		20.530–20.539	0
		20.540–20.549	0
		20.550–20.559	1
Total	442	Total	442
Mint par	25.225 fc		20.430 M
Arithmetic mean	25.220 fc		20.431 M
Median	25.212 fc		20.439 M
Mode	25.196 fc		20.455 M
Standard deviation	0.0644 fc		0.0487 M
Coefficient of variation	0.0025		0.0024
Skewness	+0.37		−0.49

(*table continues*)

TABLE 36, continued

BERLIN–PARIS (JAN. 1876–JULY 1914) (*M per 100 fc*)		PARIS–NEW YORK (JAN. 1879–JULY 1914) (*fc per $1*)	
Class	*Frequency*	*Class*	*Frequency*
80.30–80.34	2	5.120–5.124	1
80.35–80.39	4	5.125–5.129	3
80.40–80.44	3	5.130–5.134	3
80.45–80.49	10	5.135–5.139	1
80.50–80.54	8	5.140–5.144	9
80.55–80.59	6	5.145–5.149	10
80.60–80.64	11	5.150–5.154	25
80.65–80.69	17	5.155–5.159	41
80.70–80.74	13	5.160–5.164	48
80.75–80.79	15	5.165–5.169	34
80.80–80.84	25	5.170–5.174	42
80.85–80.89	22	5.175–5.179	33
80.90–80.94	28	5.180–5.184	26
80.95–80.99	32	5.185–5.189	27
81.00–81.04	30	5.190–5.194	22
81.05–81.09	38	5.195–5.199	26
81.10–81.14	48	5.200–5.204	16
81.15–81.19	36	5.205–5.209	15
81.20–81.24	31	5.210–5.214	11
81.25–81.29	26	5.215–5.219	12
81.30–81.34	20	5.220–5.224	10
81.35–81.39	20	5.225–5.229	8
81.40–81.44	9	5.230–5.234	2
81.45–81.49	7	5.235–5.239	0
81.50–81.54	2	5.240–5.244	2
Total	463	Total	427
Mint par	81.00 M		5.183 fc
Arithmetic mean	81.01 M		5.178 fc
Median	81.06 M		5.174 fc
Mode	81.13 M		5.166 fc
Standard deviation	0.2525 M		0.0224 fc
Coefficient of variation	0.0031		0.0043
Skewness	−0.48		+0.54

TABLE 36, concluded

NEW YORK–LONDON (JAN. 1879–JULY 1914) ($ per £)		BERLIN–NEW YORK (MARCH 1887–JULY 1914) (M per $100)	
Class	*Frequency*	*Class*	*Frequency*
4.8160–4.8199	1	416.2–416.5	2
4.8200–4.8239	2	416.6–416.9	7
4.8240–4.8279	3	417.0–417.3	13
4.8280–4.8319	5	417.4–417.7	23
4.8320–4.8359	1	417.8–418.1	26
4.8360–4.8399	13	418.2–418.5	29
4.8400–4.8439	14	418.6–418.9	32
4.8440–4.8479	14	419.0–419.3	40
4.8480–4.8519	20	419.4–419.7	41
4.8520–4.8559	20	419.8–420.1	38
4.8560–4.8599	22	420.2–420.5	30
4.8600–4.8639	29	420.6–420.9	18
4.8640–4.8679	44	421.0–421.3	12
4.8680–4.8719	42	421.4–421.7	13
4.8720–4.8759	41	421.8–422.1	1
4.8760–4.8799	41	422.2–422.5	1
4.8800–4.8839	38	422.6–422.9	2
4.8840–4.8879	29	423.0–423.3	0
4.8880–4.8919	23	423.4–423.7	1
4.8920–4.8959	13		
4.8960–4.8999	10		
4.9000–4.9039	1		
4.9040–4.9079	1		
Total	427	Total	329
Mint par	$4.866		419.8 M
Arithmetic mean	$4.8687		419.3 M
Median	$4.8714		419.3 M
Mode	$4.8735		419.3 M
Standard deviation	$0.01648		1.27 M
Coefficient of variation	0.0034		0.0030
Skewness	−0.29		0

TABLE 37

Frequency Distribution, Exchange Rates, Postwar, Seasonally Uncorrected Data

PARIS–LONDON (JAN. 1927–JULY 1931)[a] (*fc per £*)		BERLIN–LONDON (JAN. 1925–JULY 1931) (*RM per £*)	
Class	*Frequency*	*Class*	*Frequency*
122.50–122.59	1	20.04–20.05	1
123.10–123.19	1	20.06–20.07	2
123.20–123.29		20.08–20.09	
123.30–123.39		20.10–20.11	
123.40–123.49		20.12–20.13	
123.50–123.59		20.14–20.15	1
123.60–123.69	4	20.16–20.17	
123.70–123.79	1	20.18–20.19	
123.80–123.89	9	20.20–20.21	
123.90–123.99	9	20.22–20.23	
124.00–124.09	13	20.24–20.25	
124.10–124.19	9	20.26–20.27	
124.20–124.29	7	20.28–20.29	
124.30–124.39	1	20.30–20.31	
		20.32–20.33	
		20.34–20.35	4
		20.36–20.37	13
		20.38–20.39	13
		20.40–20.41	15
		20.42–20.43	14
		20.44–20.45	6
		20.46–20.47	4
		20.48–20.49	3
		20.50–20.51	3
		20.52–20.53	
		20.54–20.55	
		20.56–20.57	
Total	55	Total	79
Mint par	25.2215 fc up to June 24, 1928 124.2134 fc beginning June 25, 1928		20.429 RM
Arithmetic mean	123.96 fc		
Median	124.03 fc		20.429 RM
Mode	124.11 fc		20.40 RM
Standard deviation	0.28 fc		20.42 RM
Coefficient of variation	0.002		0.078 RM
Skewness	−0.54		0.004
			−0.38

TABLE 37, continued

BERLIN–PARIS (JAN. 1927–JULY 1931)[a] (*RM per 100 fc*)		PARIS–NEW YORK (JAN. 1927–JULY 1931)[a] (*fc per $*)	
Class	*Frequency*	*Class*	*Frequency*
16.38–16.39	2	25.250–25.274	1
16.40–16.41	8	25.275–25.299	
16.42–16.43	2	25.300–25.324	
16.44–16.45	13	25.325–25.349	
16.46–16.47	10	25.350–25.374	
16.48–16.49	12	25.375–25.399	3
16.50–16.51	2	25.400–25.424	5
16.52–16.53	4	25.425–25.449	4
16.54–16.55		25.450–25.474	5
16.56–16.57	1	25.475–25.499	6
16.58–16.59		25.500–25.524	6
16.60–16.61		25.525–25.549	8
16.62–16.63		25.550–25.574	5
16.64–16.65		25.575–25.599	8
16.66–16.67		25.600–25.624	4
16.68–16.69	1		
Total	55	Total	55
Mint par	16.447 RM		
Arithmetic mean	16.463 RM		25.504 fc
Median	16.463 RM		25.517 fc
Mode	16.454 RM		25.534 fc
Standard deviation	0.049 RM		0.073 fc
Coefficient of variation	0.003		0.003
Skewness	+0.18		−0.41

[a] Owing to the erratic behavior of these rates before January 1927 the distribution was made for the period following it.

(*table continues*)

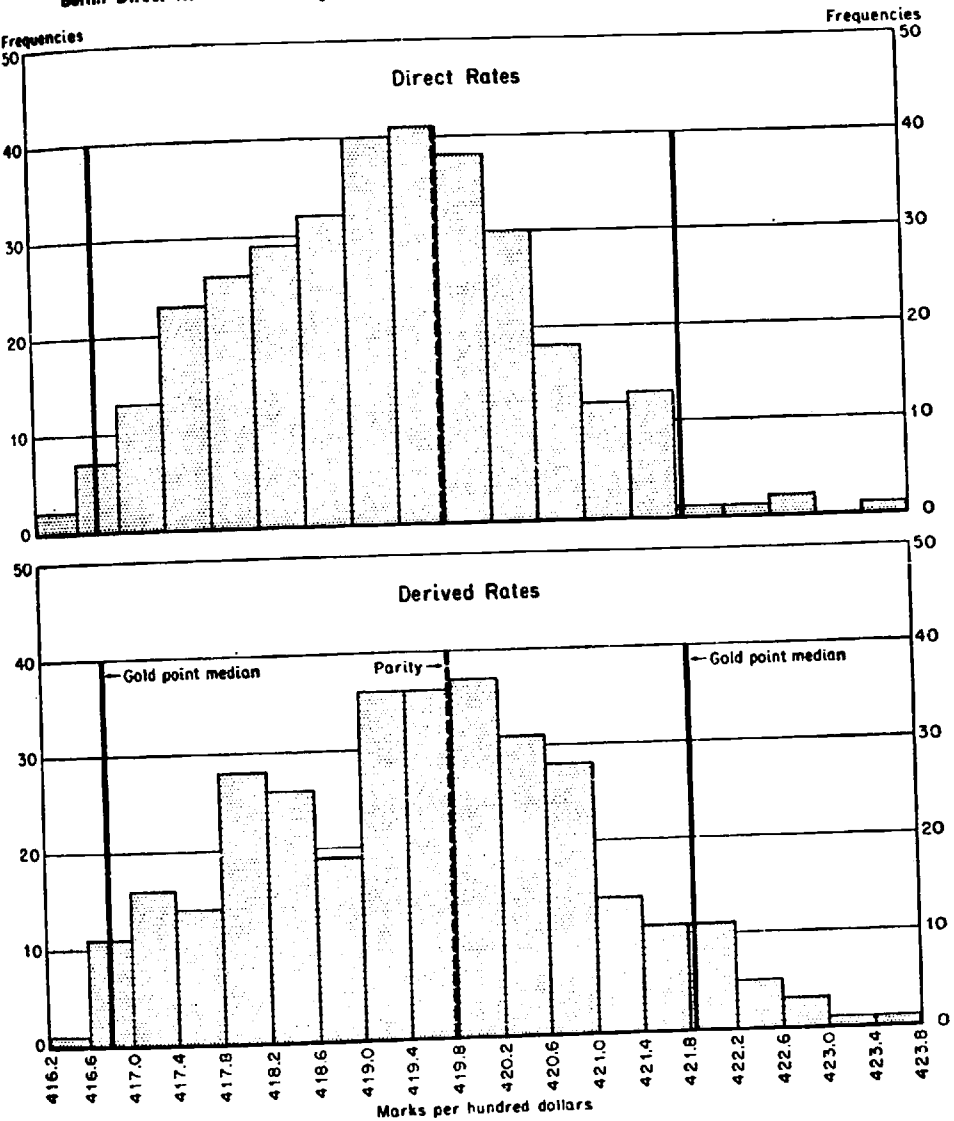
TABLE 37, concluded

NEW YORK–LONDON (JAN. 1925–JULY 1931) ($ per £)		BERLIN–NEW YORK (JAN. 1925–JULY 1931) (RM per $)	
Class	*Frequency*	*Class*	*Frequency*
4.7720–4.7759	1	417.4–417.7	1
4.7760–4.7799	1	417.8–418.1	3
4.7800–4.7839	1	418.2–418.5	2
4.7840–4.7879		418.6–418.9	5
4.7880–4.7919		419.0–419.3	9
4.7920–4.7959	1	419.4–419.7	8
4.7960–4.7999		419.8–420.1	22
4.8000–4.8039		420.2–420.5	12
4.8400–4.8439	1	420.6–420.9	4
4.8440–4.8479	2	421.0–421.3	2
4.8480–4.8519	14	421.4–421.7	5
4.8520–4.8559	12	421.8–422.1	4
4.8560–4.8599	16	422.2–422.5	1
4.8600–4.8639	13	422.6–422.9	
4.8640–4.8679	3	429.4–429.7	1
4.8680–4.8719	4		
4.8720–4.8759	3		
4.8760–4.8799	2		
4.8800–4.8839	5		
Total	79	Total	79
Mint par	$4.866		420.0 RM
Arithmetic mean	$4.8558		420.1 RM
Median	$4.8578		420.0 RM
Mode	$4.8609		419.8 RM
Standard deviation	$0.0195		1.46 RM
Coefficient of variation	0.004		0.003
Skewness	−0.26		+0.21

CHART 9

Frequency Distributions, Prewar

Berlin Direct Rate of Exchange on New York and Derived Rate via London, 1887–1914



Source: Tables 38 and 47.

CHART 10

Frequency Distributions, Prewar

Paris Direct Rate of Exchange on New York and Derived Rate via London, 1878–1914

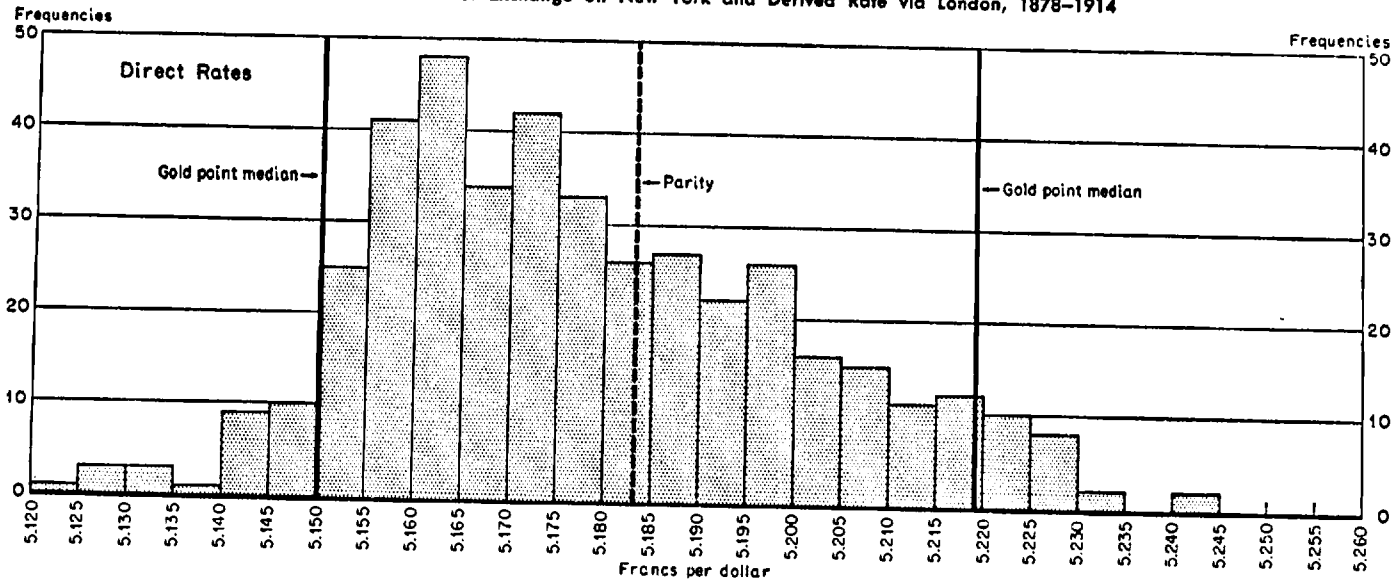
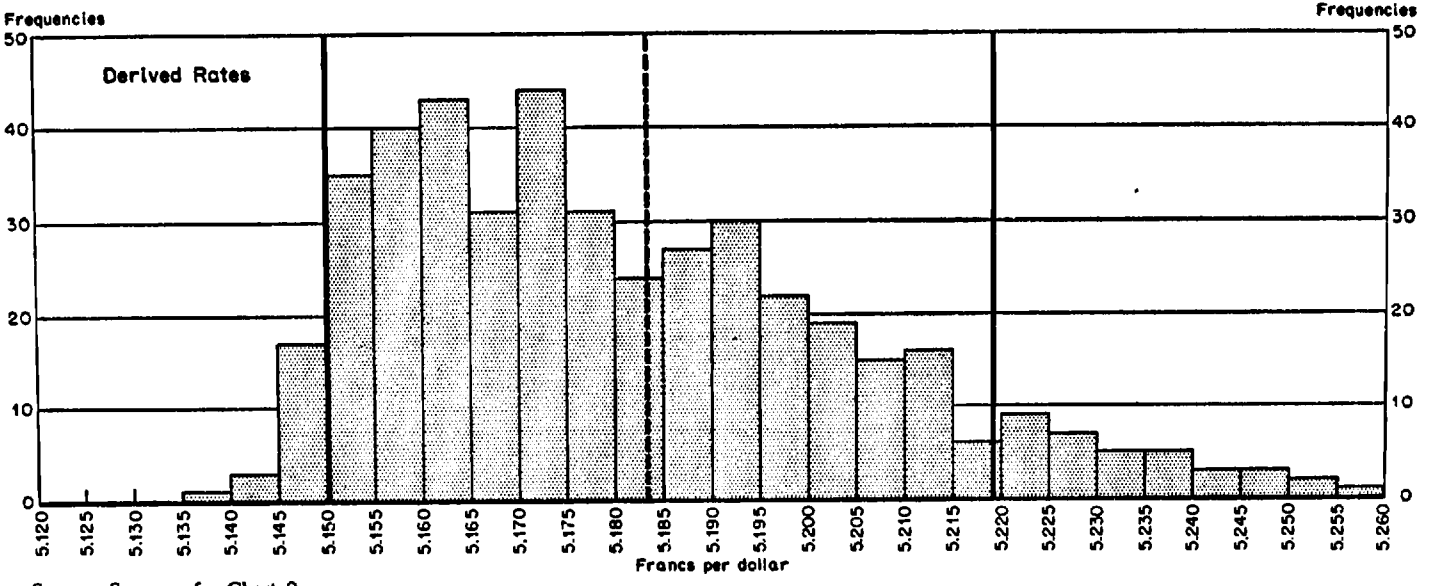


CHART 10, concluded



Source: Same as for Chart 9.

CHART 11

Frequency Distributions, Prewar

Berlin Direct Rate of Exchange on Paris and Derived Rates via London and New York, 1878–1914

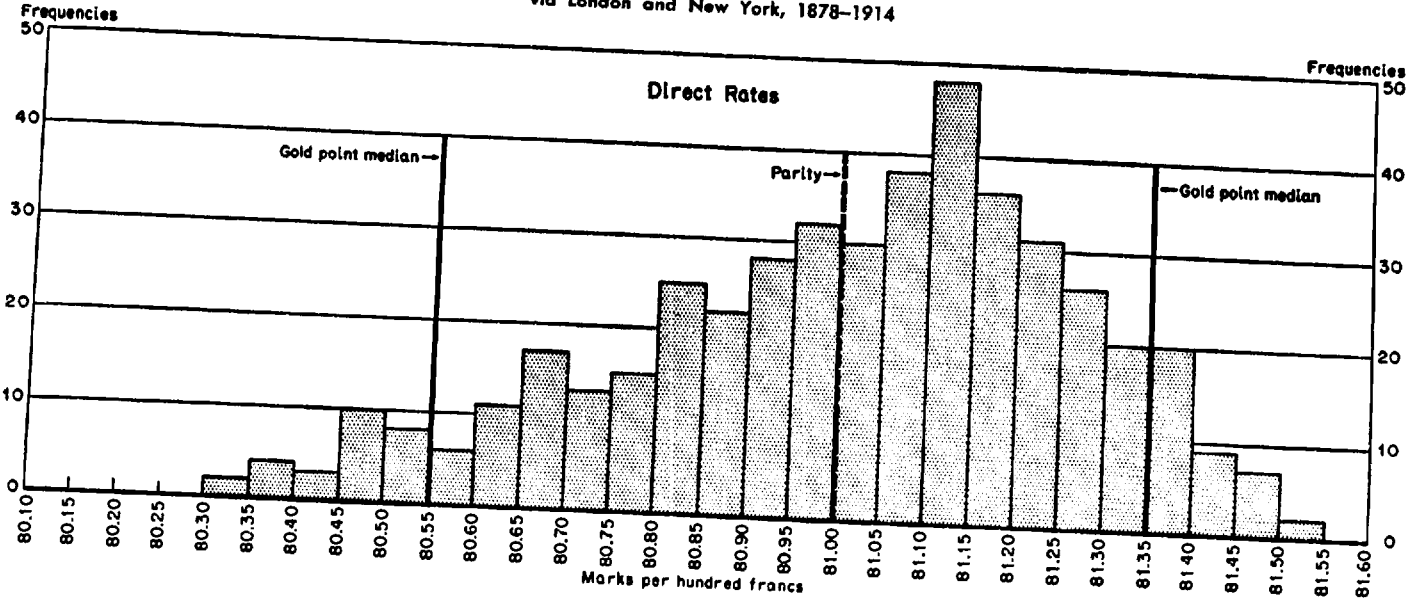
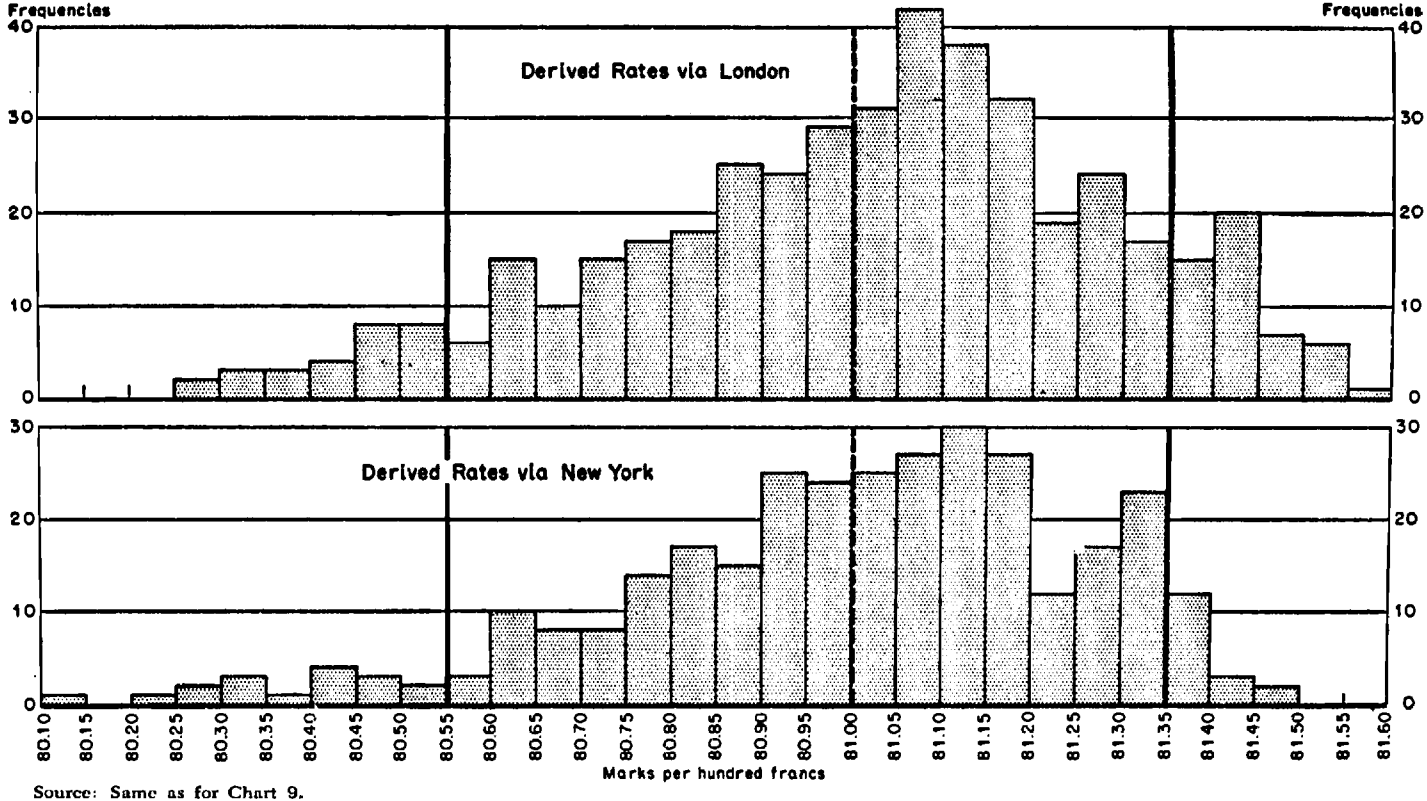


CHART 11, concluded



Source: Same as for Chart 9.

of the currencies. The extent to which the mean deviates from mint par is also an indication of how often or rarely that value was assumed, which is of importance for part of the discussion of an equilibrium rate. The coefficient of variation is everywhere small; it is greatest for Paris–New York. In general the distributions are of frequently encountered forms and offer none of the peculiarities that will be observed later (cf., e.g., Tables 83, 84, 86).

The role of parity (mint par) was noted before. Examining the distributions, it is evident that the peaks do not, as a rule, occur at this value but on either side of it. This shows clearly that mint par—speaking now of the period before 1914 only—was rarely encountered. It is in each case contained in an entire class of many more rates, hence the actual parity itself occurs—exactly—only in rare instances. If we stretch the notion of parity to an entire (arbitrary) class interval[27] containing the exact value, the results are not impressive. These intervals show frequencies of only slightly over 10 per cent of all data for New York–London and Berlin–New York, in the other instances the percentages are even less though they refer to apparently more highly integrated markets. If the balance of payments were out of equilibrium in over 90 per cent of all months it would be a poor showing indeed.

If we take the accurate value of mint par, the showing is correspondingly worse. Tables 38 and 39 give the dates when the infrequent event occurred and their percentages in terms of the total number of observations. They are absurdly small and deprive the idea of an "equilibrium" thus defined of all value from a practical and theoretical point of view. At any rate an identification of an average with "normal" leads to very different results. In that sense we also note that the distribution of the dates when mint par was reached is in no way significant as far as domestic business cycles are concerned. Futhermore there is *not one single instance when either before or after World War I the currency of any of the four countries was simultaneously on mint par against the respective three others.* If mint par were the equilibrium rate then a country would also have to be in equilibrium in regard to all others with which it trades.[28]

We may, however, review the skewness of the distributions in

[27] In order to allow for a statistical concept of it and to do away to some extent with the varying fineness of scale.

[28] It could be objected that they are averages and that it is asking too much that the underlying daily or weekly figures should average out for three values simultaneously to parity. This is true, but inspection of the figures entering into

TABLE 38

Exchange Rates on Parity and Number of Occurrences, Prewar, Seasonally Uncorrected Data

PARIS–LONDON *Jan. 1878–July 1914*	BERLIN–LONDON *Jan. 1878–July 1914*	NEW YORK–LONDON *Jan. 1878–July 1914*	BERLIN–PARIS *Jan. 1876–July 1914*	PARIS–NEW YORK *Jan. 1876–July 1914*	BERLIN–NEW YORK *Mar. 1887–July 1914*
Dec. 1881	May 1884	July 1879	Mar. 1879	Nov. 1888	Oct. 1891
Dec. 1882	Oct. 1888	May 1881	Jan. 1884	Sept. 1902	Sept. 1896
Dec. 1885	Feb. 1889	Feb. 1899	Feb. 1890	Aug. 1912	Oct. 1903
July 1887	Mar. 1893	Oct. 1901	June 1894		June 1905
Nov. 1895	Mar. 1894	Oct. 1902	July 1901		Jan. 1910
Jan. 1907	Sept. 1895	Oct. 1905	Oct. 1904		Nov. 1911
	Oct. 1895	Dec. 1905	Oct. 1910		Dec. 1911
	Dec. 1895	Oct. 1907	Aug. 1913		May 1912
	May 1896	Feb. 1910	Oct. 1913		May 1913
	Jan. 1899	Feb. 1911			Mar. 1914
	Apr. 1899	Apr. 1911			Apr. 1914
	Apr. 1901	Sept. 1911			July 1914
	Nov. 1901				
	Sept. 1904				
	Apr. 1908				
	June 1911				
	June 1913				
	Totals				
6	17	12	9	3	12
	Percentage of observations				
1.4	3.9	2.7	1.9	0.6	3.6

order to measure the "firmness" and "weakness" of the four currencies in a conventional way. It is the habit of money markets to call a currency weak when it is (persistently) below mint par and strong in the opposite case; or, in terms of the gold points, it is weak (strong) when it nears the gold export (import) point. In this sense we obtain the figures of Table 40 by simply counting the number of months when a currency was below parity without weighting the quotations according to extent or persistency of the deviation. This is shown as a percentage of the total observations; Table 41 gives the result of chi-square test applied to them in order to take into account the influence of the differences in the size of the samples.

the averages shows that it does not happen then either. A so-called equilibrium rate (holding in all three directions) would then describe a very unstable equilibrium, lasting only for a day or so. This is hardly what is looked for.

TABLE 39

Exchange Rates on Parity[a] and Number of Occurrences, January 1925–December 1931

(*84 months*)

PARIS–LONDON	BERLIN–LONDON	NEW YORK–LONDON	BERLIN–PARIS	PARIS–NEW YORK	BERLIN–NEW YORK
Apr. 1929	Feb. 1926	July 1926	Dec. 1929	Apr. 1930	Dec. 1925
	July 1926	July 1930	Jan. 1930		Feb. 1926
	Aug. 1927		June 1930		Aug. 1926
	Sept. 1927				Sept. 1926
	Feb. 1928				Sept. 1929
	May 1931				Mar. 1931
					Apr. 1931
		Totals			
1	6	2	3	1	7
		Percentage of observations			
1.2	7.1	2.4	3.6	1.2	8.3

[a] There are no seasonals in the exchange rates in the post-World-War-I period.

There are two immediate comments: (a) before 1914 the dollar was weak in all three possible cases; after 1925 sterling was weak in its three relations; according to the 1925–1931 observations, the dollar was weak against Berlin only; (b) the percentages differ from one period to the other, and "weak" currencies tend to be weaker after 1914 than before this date.

(a) The pre-1914 weakness of the dollar is in all three cases greater than that of the other three. This uniform weakness can probably be linked to the debtor position of the United States, the vacillations of American monetary policy, the nationwide discussion of bimetallism, the great violence of American crises. Since the United States was a debtor country, its treasury notes were often offered in Europe, especially in Paris; but currency weakness is not an inevitable consequence of a debtor position. The weakness of sterling in Paris is also noteworthy. Both these relationships should be compared with those of the interest rates discussed in Chapters III and IV, with which there are great similarities.[29] It is difficult not to see a systematic connection between the behavior of these two fields. Indeed we shall get a strong indication of it in a later part of the investigation.

In the 1925–1931 period sterling showed a weakness very much

[29] Cf. especially Table 28 and the attendant discussion on pp. 137–138.

TABLE 40

Weakness in Exchange Rates, Prewar and Postwar

EXCHANGE RATE	PREWAR PERIOD[a]		POSTWAR PERIOD			
			JAN. 1925–DEC. 1931		JAN. 1925–DEC. 1938	
	Weak currency	*Per cent of observations*	*Weak currency*	*Per cent of observations*	*Weak currency*	*Per cent of observations*
Paris–London	sterling	57.2[b]	sterling	54.8	sterling	66.7[c]
Berlin–London	mark	56.0	sterling	72.6[c]	sterling	86.3[c]
New York–London	dollar	58.0[c]	sterling	81.0[c]	sterling	58.5
Berlin–Paris	franc	56.7[b]	franc	52.4[d]	franc	57.1[d]
Paris–New York	dollar	65.6[c]	franc	61.9	dollar	56.5
Berlin–New York	dollar	66.6[c]	dollar	53.6	dollar	61.3[c]

[a] See Table 38 for periods covered.
[b] Significant; see Table 41.
[c] Highly significant; see Table 41.
[d] Period covered for this pair: July 1928–December 1931; July 1928–December 1938.

like the prewar weakness of the dollar. This will hardly surprise the student of postwar finance. Having stabilized in 1925 after a sharp appreciation of sterling, Britain was unable to carry out the implied deflation or to maintain a high volume of activity. Thus the value of the pound was under considerable internal pressure. To this must be added the tendency to export capital to high interest countries, notably Germany and the rest of Central Europe. Thus the weakness of sterling and dollars in Berlin is particularly interesting, and also shows—since the dollar was weak there even before 1914 for entirely different reasons—what caution is necessary in interpretation. Now there is no doubt that both, especially the dollar, were "sounder" than the Reichsmark, which had just emerged from an enormous inflation and was the currency of a country faced with a huge reparation debt. But it was also the heyday of large Anglo-American loans to Germany, both short-term and long-term. As a consequence these currencies were in great supply in Berlin and the Reichsmark was in demand in New York and London. This shows that the currency of the lending country may fall, depending, of course, on the use made of the loan. In this

TABLE 41

Exchange Rates Above and Below Parity, Significance of Percentages, Seasonally Uncorrected Data

			Number of observations	Expected number of observations	Chi-square test	Probability of chance deviation
		Prewar				
Jan.	1878–July 1914	London–Paris				
		Weak[a]	248	216	9.333	$0.001 < p < 0.01$
		At parity or firm[a]	191	223		
Jan.	1878–July 1914	Berlin–London				
		Weak	229	210	3.295	$0.05 < p < 0.10$
		At parity or firm	210	229		
Jan.	1878–July 1914	New York–London				
		Weak	263	214	21.891	$p < 0.001$
		At parity or firm	176	225		
Jan.	1876–July 1914	Berlin–Paris				
		Weak	258	227	8.305	$0.001 < p < 0.01$
		At parity or firm	205	236		
Jan.	1876–July 1914	New York–Paris				
		Weak	302	230	44.788	$p < 0.001$
		At parity or firm	161	233		
Mar.	1887–July 1914	New York–Berlin				
		Weak	213	158	36.836	$p < 0.001$
		At parity or firm	116	171		
		Postwar, January 1925–December 1931[b]				
		London–Paris				
		Weak	46	41	1.191	$0.2 < p < 0.3$
		At parity or firm	38	43		
		London–Berlin				
		Weak	61	39	23.166	$p < 0.001$
		At parity or firm	23	45		
		London–New York				
		Weak	68	40	37.418	$p < 0.001$
		At parity	16	44		
		Berlin–Paris				
		Weak	20	19	0.096	$0.7 < p < 0.8$
		At parity or firm	22	23		
		Paris–New York				
		Weak	52	41	5.765	$0.01 < p < 0.02$
		At parity or firm	32	43		
		New York–Berlin				
		Weak	45	38	2.354	$0.1 < p < 0.2$
		At parity or firm	39	46		

TABLE 41, concluded

	Number of observations	*Expected number of observations*	*Chi-square test*	*Probability of chance deviations*
Postwar, January 1925–December 1938[c]				
London–Paris				
Weak	112	83	20.027	$p < 0.001$
At parity or firm	56	85		
London–Berlin				
Weak	145	81	90.648	$p < 0.001$
At parity or firm	23	87		
London–New York				
Weak	96	83	4.024	$0.02 < p < 0.05$
At parity or firm	72	85		
Paris–Berlin				
Weak	72	59	5.386	$0.02 < p < 0.05$
At parity or firm	54	67		
New York–Paris				
Weak	95	83		
At parity or firm	73	85	3.429	$0.05 < p < 0.10$
New York–Berlin				
Weak	103	80	12.623	$p < 0.001$
At parity or firm	65	88		

[a] Weakness and firmness apply to currency of country or first named city.
[b] Period covered for Berlin–Paris: July 1928–December 1931.
[c] Period covered for Berlin–Paris: July 1928–December 1938.

case, Germany did not buy primarily, say, investment goods in the United States and England, which would have prevented the weakening of the pound and the dollar. Instead financial operations dominated industrial expansion.

(b) We discuss the differences in the percentages together with the chi-square test as shown in Table 41. The difference between the percentages in Table 40 for prewar and post-World-War-I is large enough in most cases to be immediately significant; therefore we need deal no longer with that table but with Table 41.

The chi-square test was used in measuring the significance of the observations of weakness or firmness in the exchange rates. It was assumed that the actual observations of the rates on parity would be the same as the expected observations. Therefore in computing the expected observations of weakness and firmness the number of observations of the rates on parity was deducted from

the total number of observations; then it was assumed that half the expected exchange rates would be weak and half firm and the significance of the observed rates from these expected rates was measured.[30] This might perhaps be interpreted as an acceptance of mint par as the equilibrium rate, but this is not our intention. We take it simply as a point of departure, following the habit of money markets.

It is necessary to state which probability level may be considered satisfactory for chi square. This is to a high degree arbitrary, but in the absence of a deeper theory one should be guided by statistical practice in such cases. A probability $p \leqq 0.01$ is generally found sufficiently low, and where it occurs data may be accepted as significant; but $p \leqq 0.001$ is still more desirable, making its occurrence highly significant. These are the levels we shall admit in this study.[31] Our concentration on the probability value of chi square makes it unnecessary to deal with chi square separately.

Applying this to the chief period, i.e., that before 1914, we see immediately that the dollar weakness is indeed the most outstanding phenomenon with $p < 0.001$ in all three previously discussed instances. The weakness of sterling in Paris is also far from accidental.

For 1925–1931 two values give again $p < 0.001$. The significant two are the weaknesses of sterling in New York and Berlin, each one of a different character from the other, as we have mentioned. None of the others, including the weakness of the franc against the dollar, complies with our standard.

Taking 1925–1938, there are three values with $p < 0.001$, especially the sterling weakness in Berlin having chi square $= 90.648$, the highest of the entire series. But it must be ruled out together with the (lesser) dollar weakness there. This is because of the German exchange control and its previously mentioned conse-

[30] It might be repeated that "weakness" refers to those times when the rates are between parity and the gold export point and "firmness" when they are between parity and the gold import point. Also, if the currency is weak for one country of a pair, the other is obviously firm. But both could be weak or firm regarding a third country. Recall, however, that there are only *three* independent rates. The chi-square test is applied on the assumption that the observations, i.e., the exchange rates, are independent in successive months. Since the successive observations are probably positively correlated, the probabilities attached to the values of chi square are underestimated.

[31] The levels chosen must clearly be in close correspondence with the accuracy of the basic data and the kind of relationships dealt with.

quences. There remains only the sterling weakness in Paris; but it cannot be accepted either, the franc having been part of the gold bloc while the pound was devalued in September 1931. Without consideration of the historical background the statistics alone might lead to erroneous interpretation.

Summarizing we find that, to the extent to which "weakness" is acceptably defined by using the conventional form of a deviation from par, currencies will be "weak" for at least two entirely different reasons: because of a debtor position and when the country is in gross unbalance, showing continued difficulties in preserving its gold reserves, flight of capital, or inability to deflate its price levels; or when it is a large capital exporter and its currency becomes available in great quantities in a few centers because of the use of the loans.

The discussion of the frequency distributions should be greatly extended, especially by dissecting the period before World War I into shorter intervals and making distributions for these. This device will actually be used in another field (cf. Table 88). But the present distributions are not of a singular character; furthermore new light will be thrown on them in the study of the "derived" or "cross" rates of exchange whose histograms were already shown in the charts above.

Section 5. Seasonal Variations

(8) The *seasonal variations* of exchange rates[32] are often quite marked and depend according to a widespread view mostly on those of foreign trade, especially when agricultural countries are involved at least on one side. Table 42 and Chart 12 give the indexes for the periods covered up to 1914. There are no apparent seasonal variations after World War I, either for the shorter gold and gold exchange standard period, or for the years beyond. So whatever seasonal influences were then still exercised on the exchanges by foreign trade—and they certainly existed—were effectively nullified by central banks and, to some extent, by forward exchange operations. This can, of course, only be said for the short period of comparatively stable rates, while those beyond it either showed

[32] Limitations imposed upon the interpretation of seasonal variations of series showing relations as the exchange rates are discussed in the correlated case of the interest rate differentials (see Chapter IV).

TABLE 42

Seasonal Indexes of Exchange Rates

MONTHS	PARIS ON LONDON					BERLIN ON LONDON				BERLIN ON PARIS		
	1879–1884	*1885–1890*	*1891–1897*	*1898–1904*	*1905–1914*[a]	*1878–1884*	*1885–1893*	*1894–1905*	*1906–1914*[a]	*1877–1890*	*1891–1906*	*1907–1914*[a]
Jan.	99.86	100.09	99.90	99.93	99.96	99.75	99.95	100.01	100.06	99.93	100.09	100.11
Feb.	99.96	100.10	100.00	99.99	100.07	100.07	100.10	100.14	100.13	100.10	100.16	100.04
Mar.	100.09	100.08	100.01	100.01	100.06	100.19	100.11	100.12	100.01	100.06	100.09	99.87
Apr.	99.98	99.87	99.91	100.03	100.02	100.06	100.05	100.11	100.01	100.10	100.17	100.01
May	99.89	99.83	100.03	100.03	99.99	100.07	100.12	100.10	99.98	100.16	100.12	99.98
June	99.96	99.74	100.00	100.02	100.01	100.11	99.97	99.94	99.90	100.12	99.98	99.91
July	99.97	99.79	99.93	99.94	99.95	100.13	99.99	99.93	99.91	100.14	100.00	99.95
Aug.	100.03	100.01	100.08	100.07	99.98	100.21	100.12	100.02	99.96	100.13	99.93	99.96
Sept.	100.19	100.18	100.16	100.12	99.92	100.09	100.01	99.93	99.87	99.89	99.78	99.93
Oct.	100.13	100.15	100.02	99.94	99.96	99.82	99.93	99.88	100.01	99.78	99.86	100.11
Nov.	100.00	100.09	99.96	99.94	100.07	99.72	99.85	99.93	100.15	99.79	99.93	100.11
Dec.	99.93	100.08	99.98	99.99	100.01	99.75	99.81	99.89	100.03	99.80	99.89	100.11
Total Deviations	0.89	1.55	0.62	0.55	0.48	1.89	1.01	1.00	0.78	1.62	1.26	0.79

TABLE 42, concluded

MONTHS	PARIS ON NEW YORK			BERLIN ON NEW YORK		NEW YORK ON LONDON			
	1876–1887	*1888–1900*	*1901–1914*[a]	*1887–1901*	*1902–1914*[a]	*1879–1886*	*1887–1894*	*1895–1904*	*1905–1914*[a]
Jan.	100.07	99.98	99.93	99.96	100.03	99.97	99.96	100.00	100.04
Feb.	99.77	99.94	99.99	100.08	100.10	100.27	100.09	100.03	100.06
Mar.	99.82	99.96	99.97	100.09	100.02	100.20	100.18	100.02	100.02
Apr.	99.64	99.72	99.94	99.93	100.01	100.28	100.21	100.10	100.01
May	99.42	99.79	99.91	99.94	99.96	100.43	100.24	100.15	100.03
June	99.57	99.73	99.90	99.82	99.86	100.34	100.17	100.12	100.04
July	99.81	99.74	99.93	99.85	99.91	100.14	99.99	100.11	99.99
Aug.	100.14	100.05	100.02	100.05	100.00	99.83	99.92	100.02	99.98
Sept.	100.41	100.30	100.17	100.20	100.03	99.68	99.82	99.86	99.88
Oct.	100.52	100.35	100.05	100.09	100.05	99.64	99.80	99.77	99.95
Nov.	100.44	100.24	100.07	100.05	100.06	99.60	99.79	99.89	100.03
Dec.	100.38	100.20	100.13	99.93	99.97	99.61	99.83	99.93	99.97
Total Deviations	3.93	2.28	0.87	1.13	0.60	3.33	1.78	1.10	0.46

[a] No seasonal indexes for the postwar period.

CHART 12

Seasonal Indexes of Exchange Rates, Prewar, 1876–1914

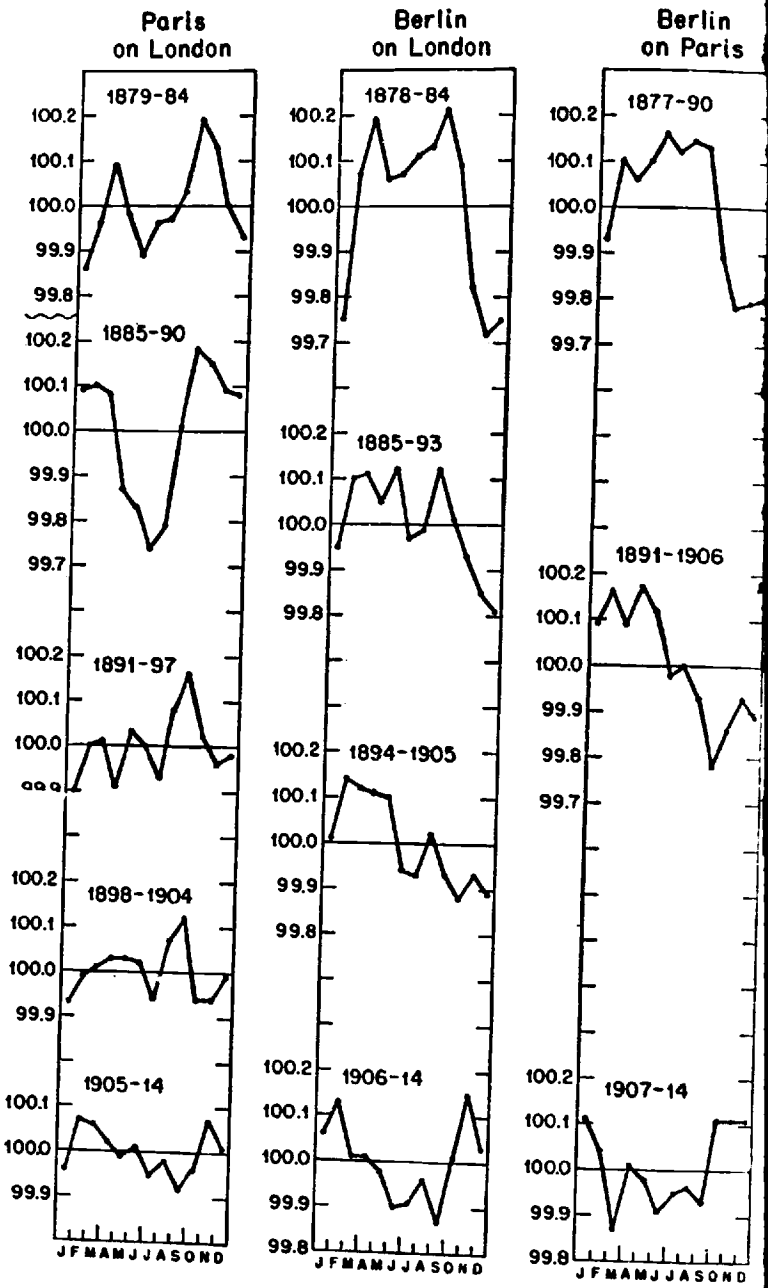
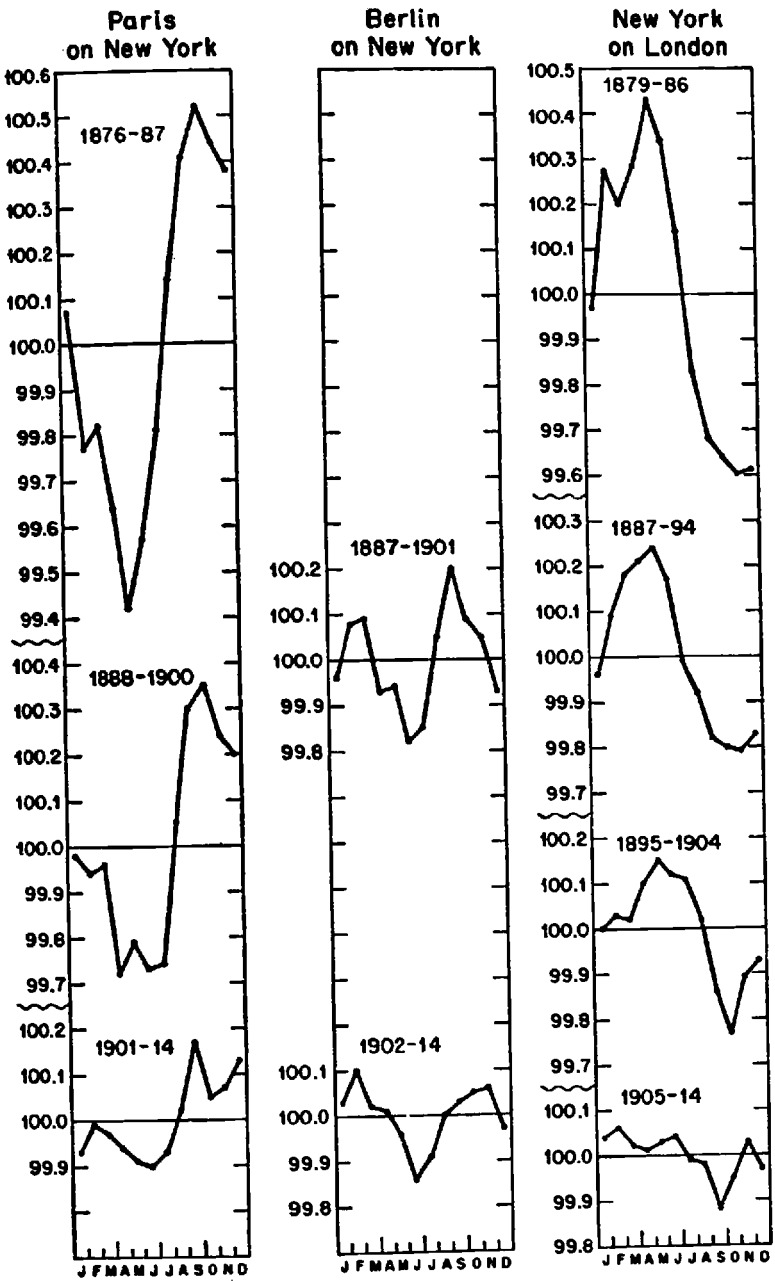


CHART 12, concluded



Source: Table 42.

fluctuations which were hundreds of times the amplitudes of the former, or entirely artificial rates whose stability is meaningless and need not be considered.

The seasonal variations before 1914 deserve a few remarks. To begin with, foreign exchange rates have often been studied from the point of view of their seasonal behavior and some noteworthy early studies have been produced which sometimes had an influence beyond the field of foreign exchanges by drawing attention to, and actively influencing the study of, statistical methods of dealing with seasonal fluctuations. We make our comments best in the form of a number of separate observations.

First, the seasonal indexes have changed fairly frequently. The total deviations show everywhere the same unmistakable tendency, allowing for a single exception for the early and brief period 1877–1884 for Paris–London. Whether there were many or few changes in the indexes, every new index shows smaller total deviations than the preceding, with a very considerable drop over the whole series of indexes for each exchange rate. The largest deviations originally involved New York. It is known that the central banks in the European countries long before 1914 considered it their duty to work toward diminishing seasonal fluctuations in the exchanges. Among the European countries these fluctuations were milder because their countries were more involved in highly diffused industrial trade with one another, which is less influenced seasonally than agricultural trade. The latter originated, then, very largely from the United States—as well as from many other overseas countries, e.g., Argentina, exercising a strong influence.

Second, it was noted above on p. 138 that in spite of great instability of the seasonal indexes of short-term interest rate differentials, there was a steady decline of their seasonal fluctuations throughout the years. This was in turn associated with the basic drop in seasonal fluctuations of the constituent interest rates. Since we are set to examine the interdependence of interest rates and exchange rates, this correspondence is of considerable significance and a second indication of possibly a functional connection between these two fields.[33] The interdependence has not yet been established; it is only the preliminary acceptance of the mechanism of short-term capital movements as a heuristic device.

A similar development in the over-all nature of seasonal indexes

[33] The first one was mentioned in the discussion of Table 41, also relating to the interest rates.

of two different categories of economic activity does not prove per se an interrelation either between these activities or between their seasonal characteristics. In this case, however, there is a connection via the risk factor that is associated with capital movements. When the attraction of a higher interest rate abroad appears, it is important to know whether this differential is of a seasonal nature and whether the exchange rate between the countries has a parallel or contrary seasonal movement. The amplitudes of both seasonals are therefore of considerable importance. The operators, carrying out shifts of substantial amounts of capital, took these small variations into account.[34]

The interdependence referred to is on the seasonal level first of all, and it is not certain that it extends beyond it. The interlocking of seasonal variations will occupy us especially in dealing with discount rates (cf. Chapter VIII, section 4). It is a much more extended phenomenon that has been curiously neglected in business cycle studies even on the purely domestic level.[35] Because of the great stability of these fluctuations its study may lead to rather definite quantitative information of a type not yet gained in the more difficult field of the larger and less stable business cycles and other fluctuations.

Third, what were the typical seasonal changes? In order to avoid misinterpretations, the reader must recall that the first place name in Table 42 shows the currency which must be paid in order to obtain a unit (or units) of the other currency. So if the seasonal index falls, it means that less has to be paid, i.e., that the currency of the first place stiffens, while the other falls; *mutatis mutandis*, when the index rises. With this in mind we observe the following:

The last three exchange rates on Table 42 and Chart 12 show clearly that the dollar used to stiffen quite uniformly from August until the end of the year. This was attributed to the shipment of American agricultural products to Europe, but as noted before it was a more universal phenomenon related to autumnal shipments from overseas. Their financing extended over several months, hence the prolongation of the weakness beyond the harvest shipping periods. The shapes of the seasonals involving the dollar are rather stable, even while the above-mentioned decline in the total deviations was taking place.

[34] For further details on this point see section 7.

[35] See, however, S. Kuznets, *Seasonal Variations in Industry and Trade*, National Bureau of Economic Research, 1933.

Not so with the exchange rates involving the three European currencies only. The relations of the mark to the franc and to sterling are not dissimilar; this can be seen when comparing the shift from strength of the mark in October to December, to weakness in these months during 1906–(1907)–1914. The relationship between the franc and sterling is the least clearly defined and the most unstable, since there are not less than five indexes to cover 1877–1914. It would require a very detailed study to reveal their deeper significance, a study which is not within our province. The parallelism between both these currencies on the one hand and the dollar on the other suggests that there is less reason to expect well-defined and stable seasonal variations from the trading relationships of the two financially highly developed countries than there is for their overseas connections. Therefore the seasonals here seem to be much more of an induced than an autonomous character.

Section 6. Forward Rates of Exchange

(9) Forward rates of exchange—so-called "futures"—belong to large fields of economic activities of high importance. While forward transactions in grains, cotton, some metals, etc. have been studied in considerable detail for many decades, forward exchange rates are as a whole insufficiently explored. Interest in them was revived largely due to Lord Keynes and P. Einzig;[36] the latter's voluminous work discusses extensively and competently large parts of the preceding literature, besides containing some original investigation. Our discussion will be limited to the interwar gold standard period of the countries concerned.

There are three series: New York–London, Berlin–London, for

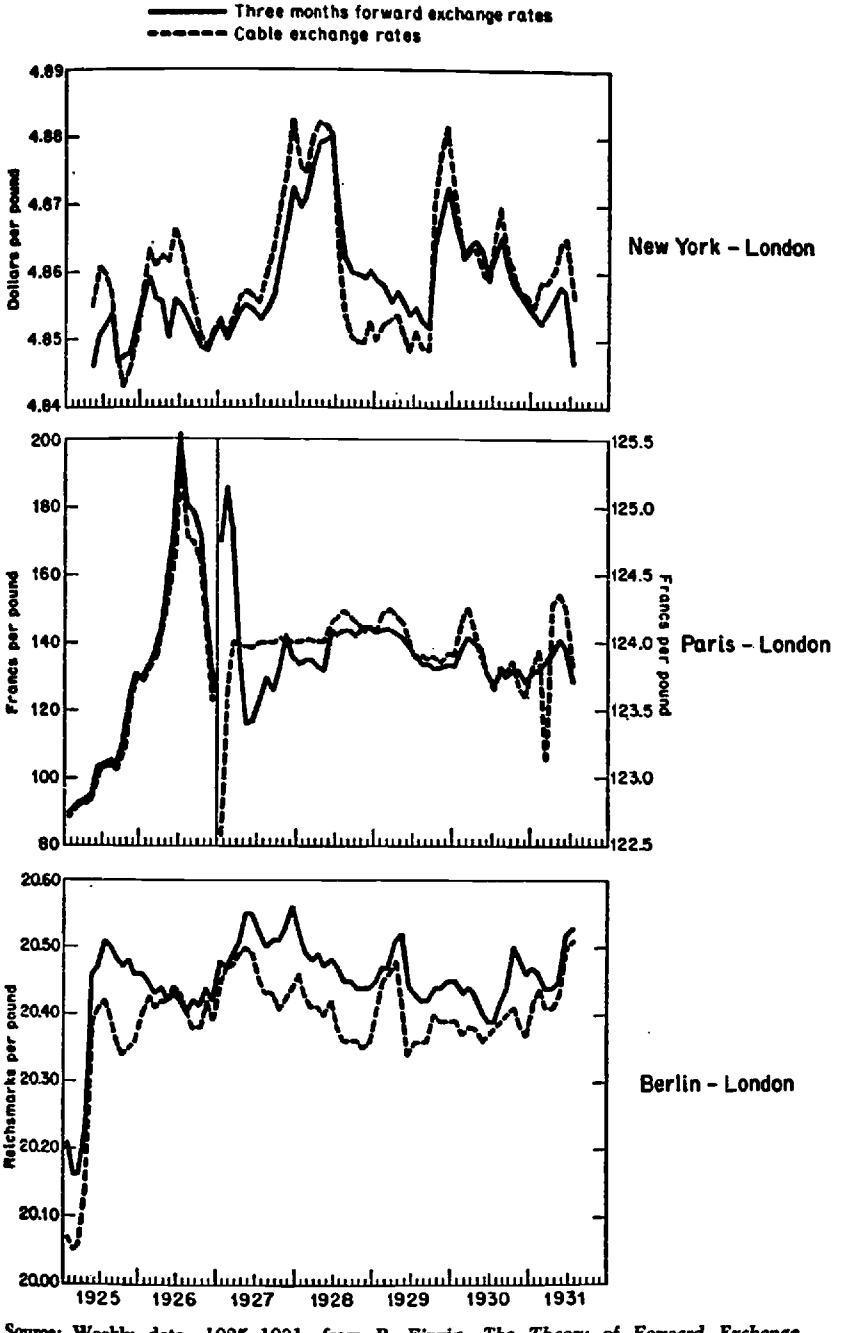
[36] J. M. Keynes, *A Tract on Monetary Reform*, London, 1923, and his contributions to the Reconstruction number of the *Manchester Guardian*, 1922; and P. Einzig, *The Theory of Forward Exchange*, London, 1937.

We mention further: G. Demaria, *I Saggi di Riporto e di Deporto della Lira Italiana a Londra dal 1921 and 1928*, Milan, 1928; the *Monetary Review*, League of Nations, Economic Intelligence Service, 1936–1937, pp. 42–51, which contains a brief explanation of forward rates and statistics for 1931–1937 with a running historical commentary.

J. Casamajor, *Le Marché à Terme des Changes en France*, 2nd ed., Paris, 1925, describes French conditions; German practices are described, more from the business aspect, by J. Vogel, *Das Devisentermingeschäft*, Berlin, 1924, and by C. A. Fisher, *Das Devisentermingeschäft in seinen Beziehungen zur Währung und Wirtschaft*, Berlin, 1928. More recent writers follow mostly Keynes and Einzig.

CHART 13

Three Months Forward and Cable Exchange Rates, New York–London, Paris–London, Berlin–London, 1925–1931



Source: Weekly data, 1925–1931, from P. Einzig, *The Theory of Forward Exchange*, London, 1937.

TABLE 43

Frequency Distribution, Three Months Forward Exchange Rates, Postwar

NEW YORK–LONDON JAN. 1925–JULY 1931 ($ per £)		BERLIN–LONDON JAN. 1925–JULY 1931 (RM per £)		PARIS–LONDON JAN. 1927–JULY 1931[a] (fc per £)	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
4.7720–4.7759	2	20.16–20.17	2	122.80–122.89	1
4.7760–4.7799		20.18–20.19		123.40–123.49	2
4.7800–4.7839	1	20.20–20.21	1	123.50–123.59	1
4.7840–4.7879		20.22–20.23	1	123.60–123.69	2
4.7880–4.7919		20.24–20.25		123.70–123.79	6
4.7920–4.7959	1	20.26–20.27		123.80–123.89	17
4.7960–4.7999		20.28–20.29		123.90–123.99	7
4.8000–4.8039		20.30–20.31		124.00–124.09	12
4.8400–4.8439		20.32–20.33		124.10–124.19	4
4.8440–4.8479	5	20.34–20.35		124.20–124.29	
4.8480–4.8519	9	20.36–20.37		124.30–124.39	
4.8520–4.8559	24	20.38–20.39	2	124.40–124.49	
4.8560–4.8599	14	20.40–20.41	3	124.50–124.59	
4.8600–4.8639	8	20.42–20.43	12	124.60–124.69	
4.8640–4.8679	5	20.44–20.45	19	124.70–124.79	1
4.8680–4.8719	4	20.46–20.47	13	124.80–124.89	1
4.8720–4.8759	3	20.48–20.49	9	124.90–124.99	
4.8760–4.8799	2	20.50–20.51	8	125.00–125.09	
4.8800–4.8839	1	20.52–20.53	6	125.10–125.19	1
		20.54–20.55	2		
		20.56–20.57	1		
Total	79	Total	79	Total	55
Arithmetic mean	$4.8542		20.45 RM		123.92 fc
Median	$4.8555		20.45 RM		123.89 fc
Mode	$4.8581		20.45 RM		123.83 fc
Standard deviation	$0.0183		0.071 RM		0.32 fc
Coefficient of variation	0.004		0.003		0.003
Skewness	−0.21		0		+0.28

[a] Owing to the erratic behavior of these rates before January 1927, the distribution was made for the period following it.

January 1925 to July 1931. The data are computed from P. Einzig's[37] weekly data, which are in the usual form of stating premiums or discounts. By applying these to the spot rates we expressed the forward rates in the manner of the latter. They are shown to-

[37] His data are in turn extracted from a circular of the Anglo-Portuguese Colonial and Overseas Bank Ltd. Other sources are the usual financial journals, but those used by Einzig seem to be the most satisfactory.

TABLE 44

Frequency Distribution, Excess Spot Exchange Rate Over Three Months Forward Exchange Rate

NEW YORK–LONDON JAN. 1925–JULY 1931 ($ per £)		BERLIN–LONDON JAN. 1925–JULY 1931 (RM per £)		PARIS–LONDON JAN. 1927–JULY 1931 (fc per £)	
Class	*Frequency*	*Class*	*Frequency*	*Class*	*Frequency*
−0.0100 to −0.0076	6	−0.14 to −0.13	3	−2.25 to −2.01	1
−0.0075 to −0.0051	3	−0.12 to −0.11	4	−2.00 to −1.76	
−0.0050 to −0.0026	8	−0.10 to −0.09	15	−1.75 to −1.51	1
−0.0025 to −0.0001	10	−0.08 to −0.07	10	−1.50 to −1.26	
0 to +0.0025	20	−0.06 to −0.05	17	−1.25 to −1.01	
+0.0026 to +0.0050	11	−0.04 to −0.03	11	−1.00 to −0.76	1
+0.0051 to +0.0075	10	−0.02 to −0.01	14	−0.75 to −0.51	
+0.0076 to +0.0100	9	+0.00 to +0.02	5	−0.50 to −0.26	
+0.0101 to +0.0125	2	Total	79	−0.25 to −0.01	8
Total	79			0 to +0.25	36
				+0.26 to +0.30	6
				+0.51 to +0.75	2
				+0.76 to +1.00	
				Total	55
Arithmetic mean	$0.0015		0.06 RM		+0.053 fc
Median	$0.0016		0.06 RM		+0.118 fc
Mode	$0.0018		0.06 RM		+0.221 fc
Standard deviation	$0.0051		0.04 RM		0.427 fc
Coefficient of variation	3.40		0.67		+8.06
Skewness	−0.06		0		−0.39

gether in Chart 13 and as to be expected there is a high degree of covariation in general; it will be described in the proper place.

First, however, there are the three frequency distributions of Table 43. Comparing with Tables 36 and 37 we see that the differences from the mint par are exceedingly small, often a matter of third and fourth decimals only. This gives certainly a good idea of the narrow calculations of the market which lie behind these data. The same is seen from Table 44 showing the excess of the spot over the forward rate in the same cases. There, in addition, the very small degree of skewness, even its absence in the Berlin–London case, are noteworthy and could support an argument as to the random character of these differences—probably not a permissible inference.

Table 45 contains the *correlation coefficients* of the three pairs.

TABLE 45

Correlation between Three Months Forward Exchange Rates and Spot Exchange Rates

PAIR	PERIOD COVERED	r	CONFIDENCE LIMITS[a]	
			Lower	*Upper*
New York–London	Jan. 1925–July 1931	+0.97	0.95	0.98
Berlin–London	Jan. 1925–July 1931	+0.88	0.80	0.93
Paris–London	Jan. 1925–July 1931	−0.02	—	—
Paris–London	July 1927–July 1931	+0.82	0.65	0.91

[a] For confidence coefficient of 99%.

The a priori expectation is, of course, for high correlation. The measurements of Table 46 make the explicit assumption that the individual observations are independent of each other. We obtain there C, a coefficient of covariation, which measures the correspondence of the direction of movement of two time series. Table 46 gives the largest $C = 0.765$ with $0.01 < p < 0.02$, a none too satisfactory level. It applies to Paris–London, January 1925 to July 1931. The same series, restricted to January 1927 to July 1931 comes out last. In the omitted months, judging from Table 46, there was perfect correspondence in direction of change. The remaining two, computed for 1925–1931, are not very satisfactory

TABLE 46

Change in the Spot Exchange Rate Correlated with the Change in the Forward Exchange Rate, Covariation in the Direction of Movements

Period	*Pairs of Countries*	*N*	*Z*	*p*	*C*	*Rank according to C*
Jan. 1925–July 1931	New York on London	77	64	$0.02 < p < 0.05$	0.662	3
Jan. 1925–July 1931	Berlin on London	56	47	$0.02 < p < 0.05$	0.679	2
Jan. 1925–July 1931	Paris on London	68	60	$0.01 < p < 0.02$	0.765	1
Jan. 1927–July 1931	Paris on London	45	37	$0.02 < p < 0.05$	0.644	4

N = Number of observations of changes. Zero changes in either or both rates are not counted.
Z = Number of times the changes in the exchange rates 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 variation.

either. This may be due to the basic assumption of randomness,[38] to the existence of lags,[39] or to a rougher kind of correspondence than the fine month-to-month covariation.

Section 7. Derived and Arbitrage Rates of Exchange

(10) A set of computed time series, substituting not improperly for direct information that is lacking, may be expected to yield data about international financial crises and the rise and fall of tensions in general. These are two groups of series called "derived" or "cross," and "arbitrage" exchange rates. They compare the direct exchange rate between two countries in various ways with the exchange rate an arbitrageur might consider in using a third market. Sterling can be bought directly in Paris (or equivalently by selling francs in London) but also via New York or Berlin. The latter operation is evidently more expensive, time consuming, and risky and will only be carried out if there is an advantage connected with it. This could be the case, if with proper allowance for costs either (taking New York only) the dollar in Paris or sterling in New York sells cheaper than corresponds to the existing market ratio of sterling to francs in New York.

The intercommunication between all markets, briefly described in section 1, is, of course, an indispensable assumption and prerequisite. It existed during the entire period, except from the summer of 1931 on for Germany when exchange control was introduced there. Under such a regime no equalization within the limits to be observed under free conditions need be expected; it is common knowledge that currencies were then off such limits. But even the quotations themselves are then subject to doubt. We return to this point later.

The method used in *computing the derived series* can best be described by using an example. For deriving the series Berlin–Paris via New York the following three series were used (seasonally uncorrected): Berlin–New York (units: M per $100); Paris–New York (units: fc per $1); and Berlin–Paris (units: M per 100 fc).

[38] When fast economic processes yield frequent data and these are averaged over long periods, i.e., long in relation to the speed of reaction, then successive averages can be considered as independent of each other, even when they follow in monthly intervals.

[39] Lags are briefly studied in Chapter IX, section 6. In general, however, we avoid them since the qualitative determination of specific cycles tends to make them uncertain concepts when several time series compared with each other. It is somewhat different regarding lags with reference cycles.

Dividing Berlin–New York by Paris–New York (on a monthly basis), making the proper correction for the different decimal places, gives the derived exchange rate Berlin–Paris (M per 100 fc) via New York. This series is compared with the direct exchange rate Berlin–Paris by subtracting the direct (actual) exchange rate from the derived exchange rate.

The number of derived foreign exchange rate series that could be computed was determined by the units of the six direct exchange series. For the prewar period the six direct foreign exchange rate series were the following:

New York on London	unit: $ per £
Berlin on London	unit: M per £
Paris on London	unit: fc per £
Paris on New York	unit: fc per $1
Berlin on New York	unit: M per $100
Berlin on Paris	unit: M per 100 fc

From these six series it was possible to derive only the following four series:

Berlin on Paris via New York	unit: M per 100 fc	(Jan. 1888–July 1914)
Berlin on Paris via London	unit: M per 100 fc	(Jan. 1878–July 1914)
Paris on New York via London	unit: fc per $1	(Jan. 1878–July 1914)
Berlin on New York via London	unit: M per $100	(Mar. 1887–July 1914)

For the post-World-War-I period (uniformly January 1925–July 1939) it was possible to derive the following five exchange rate series from the direct series:

Paris on New York via London	unit: fc per $1
Berlin on Paris via New York	unit: RM per 100 fc
Berlin on Paris via London	unit: RM per 100 fc
Berlin on New York via Paris	unit: RM per $100
Berlin on New York via London	unit: RM per $100

The series Berlin on Paris via New York was made possible by inverting New York on Paris and New York on Berlin, getting the corresponding units in cents, and then dividing the second new series by the first one. It should be noted that those series containing London as one of the pair could have been derived if the necessary inversions of the exchange rates were made. For example the series London on Berlin via Paris could have been derived by inverting London on Paris and dividing into Berlin on Paris.[40]

[40] None of the series used are corrected for seasonal variations. We need not give a detailed justification for this choice, since the reasons are obvious. There may be a difference in considering A on B via C and B on A via C. We take only one direction into account.

The differentials between the derived and actual exchange rate series, called "arbitrage series," are plotted on Charts 14 and 15. For each of the two periods the scales were determined by making them comparable to the ratios of the parities for the exchange rates involved. This is not quite the case for the series Paris on New York via London. Here the scale is two-thirds the relative scale of the other series in the prewar period, but comparable to the other scales in the interwar period. This means that the amplitude of differentials plotted is slightly smaller than it might otherwise be for this series.

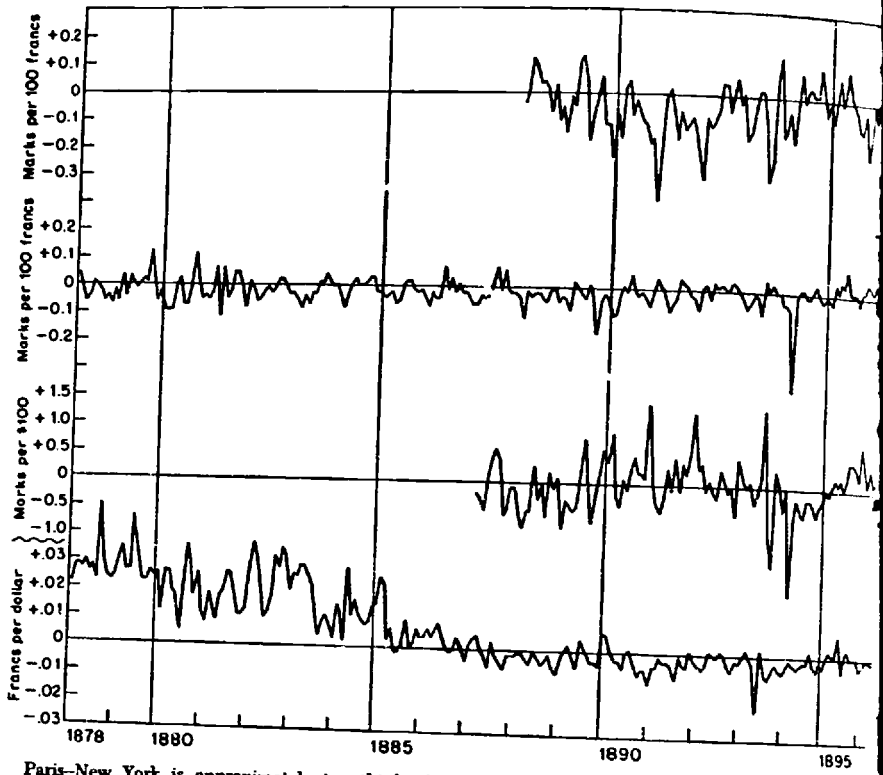
The prewar and post-World-War-I periods were made comparable by adjusting the scales in those cases where there was a parity change from one period to the next; otherwise the scales are the same inasmuch as the same units are used for the derived series of the two periods.

There is one other point which should be kept in mind in regard to the graphs of these series; that is, that the fineness of the differentials (the number of digits used) was determined for each series by the number of digits quoted in the original series. Therefore when these differentials are plotted the changes in some cases seem to be more marked than in others. For example this is true for the two series for Berlin on Paris where, excluding the zero possibility, the smallest differential is 0.01 RM per 100 fc which is a large difference relative to the parity—16.42 RM per 100 fc—and correspondingly the plotting of this difference is relatively large compared to a unit change of some of the other series. If the original series were quoted with one more digit then the differential may have proved to be 0.006 RM per 100 fc. All this means is that the two mentioned series show more abrupt changes in the differential than do the other series, due to the rounding off. This is an insignificant matter and should not affect the comparisons of the various differentials.[41]

[41] The rounding off of figures even in relatively simple mathematical and statistical computations is in general, however, far from innocuous. This is not duly considered, as a rule, in many economic applications. In a highly theoretical field, for example, that of numerically solving equations of the Walras-Pareto type, the decision whether or not the determinant vanishes is not possible without using great numerical detail of a kind usually not available in the required quality.

In the present instance questions of this type fortunately do not seem to arise. They are treated in O. Morgenstern, *On The Accuracy of Economic Observations, loc. cit.*, especially section 6 and the technical literature quoted there.

CHART 14 Arbitrage Series, Differences between Derived and Actual

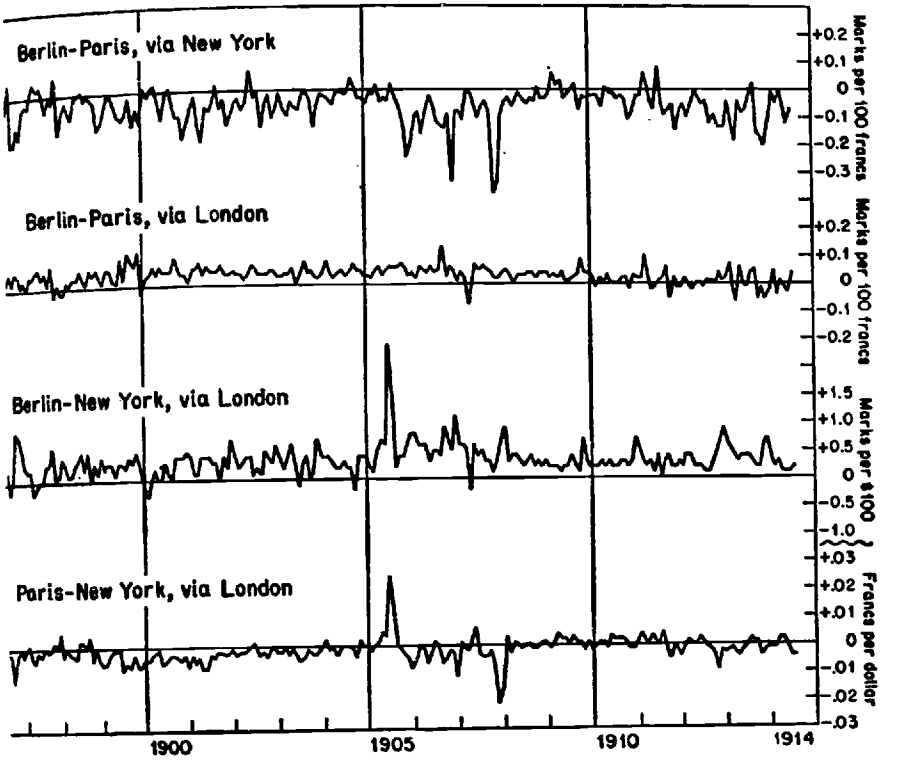


Paris–New York is approximately two-thirds the relative scale of the three other series.

The monthly time intervals are so large, relative to the speed with which reactions in this sphere of activity are assumed to take place, as to obliterate all possible differences due to the slight variations in the underlying series regarding sight, short, and cable drafts and transfers; no problem whatsoever arises for the period after World War I when all quotations are for cable transfers uniformly. We can therefore dismiss the thought that any sizeable number of deviations from the permissible range around zero had to do with a (theoretical!) imperfection of the data.

This conclusion seems justified in spite of the fact that after World War I, during the few months of universal gold standard in all four countries (end of 1927 until fall of 1931), the five series behaved almost perfectly in the sense of expectations while there

Exchange Rates, Monthly, Prewar, 1878–1914 (seasonally unadjusted data)



Source: For explanation of derived rates, see the accompanying text.

were hardly any such phases for all series simultaneously for a similar number of months before 1914.

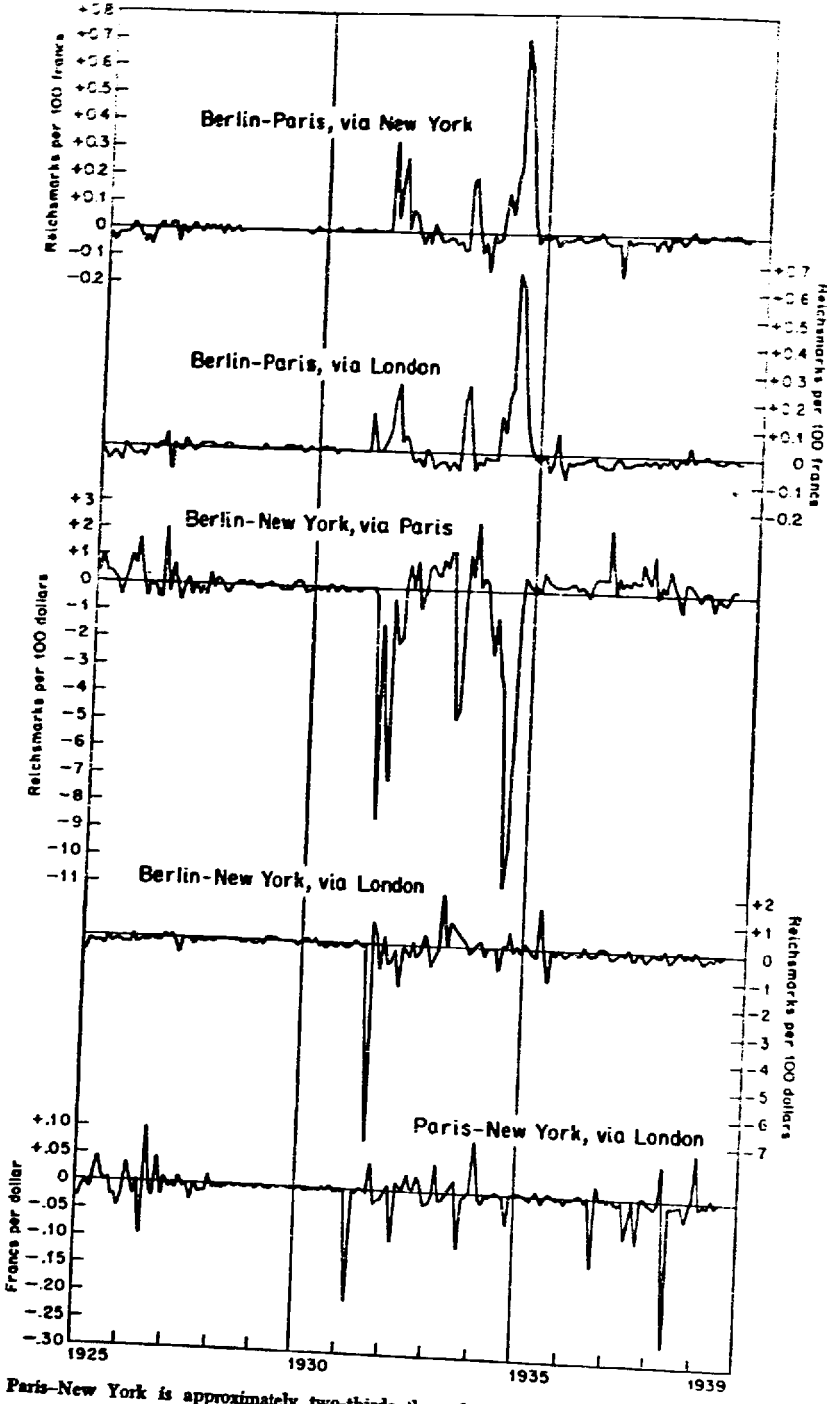
(11) The subsequent brief discussion of the *derived series* falls into two parts: *first*, we examine their stable properties as revealed by the frequency distributions, and *second*, we determine a certain class of deviations in order to correlate them—roughly—with other, similar ones indicative of aforementioned international disturbances.

In order to avoid misunderstandings we point out that the frequency measures are made for the derived series themselves, so that these distributions can be directly compared with those of the direct (spot) exchange rates given in section 4 and with those of the forward rates of section 6 of this chapter.

To elucidate the character of the derived rates more fully, the

CHART 15

Arbitrage Series, Differences between Derived and Actual Exchange Rates, Monthly, Postwar, 1925–1939



Paris–New York is approximately two-thirds the relative scale of the four other series.

Source: Same as for Chart 14.

pre-World-War-I period is shown as a whole and then broken up into two parts, the second for all series uniformly of 223 months, while the first varies from 96 to 216 months due to the known differences in coverage of the basic data (see the appendix to this chapter and Table 47). All measures for the entire series can,

TABLE 47

Frequency Distribution, Derived Exchange Rates, Prewar, Seasonally Uncorrected Data

	BERLIN–PARIS VIA LONDON (*M per 100 fc*)		
	Jan. 1878–July 1914	*Jan. 1878–Dec. 1895*	*Jan. 1896–July 1914*
CLASS	*Frequency*	*Frequency*	*Frequency*
80.25–80.29	2	2	
80.30–80.34	3	3	
80.35–80.39	3	3	
80.40–80.44	4	4	
80.45–80.49	8	8	
80.50–80.54	8	8	
80.55–80.59	6	6	
80.60–80.64	15	15	
80.65–80.69	10	10	
80.70–80.74	15	12	3
80.75–80.79	17	12	5
80.80–80.84	18	13	5
80.85–80.89	25	18	7
80.90–80.94	24	16	8
80.95–80.99	29	17	12
81.00–81.04	31	17	14
81.05–81.09	42	19	23
81.10–81.14	38	17	21
81.15–81.19	32	10	22
81.20–81.24	19	5	14
81.25–81.29	24	1	23
81.30–81.34	17		17
81.35–81.39	15		15
81.40–81.44	20		20
81.45–81.49	7		7
81.50–81.54	6		6
81.55–81.59	1		1
Total	439	Total 216	Total 223
Arithmetic mean	81.01 M	80.85 M	81.17 M
Median	81.05 M	80.88 M	81.18 M
Mode	81.13 M	80.94 M	81.20 M
Standard deviation	0.269 M	0.233 M	0.192 M
Coefficient of variation	0.003	0.003	0.002
Relative skewness	−0.45	−0.39	−0.16

(*table continues*)

TABLE 47, continued

	BERLIN–PARIS VIA NEW YORK (*M per 100 fc*)		
CLASS	*Jan. 1888–July 1914* Frequency	*Jan. 1888–Dec. 1895* Frequency	*Jan. 1896–July 1914* Frequency
80.10–80.14	1	1	
80.15–80.19	0	0	
80.20–80.24	1	1	
80.25–80.29	2	2	
80.30–80.34	3	3	
80.35–80.39	1	1	
80.40–80.44	4	4	
80.45–80.49	3	3	
80.50–80.54	2	2	
80.55–80.59	3	2	1
80.60–80.64	10	8	2
80.65–80.69	8	4	4
80.70–80.74	8	5	3
80.75–80.79	14	9	5
80.80–80.84	17	5	12
80.85–80.89	15	3	12
80.90–80.94	25	11	14
80.95–80.99	24	4	20
81.00–81.04	25	8	17
81.05–81.09	27	7	20
81.10–81.14	30	6	24
81.15–81.19	27	4	23
81.20–81.24	12	2	10
81.25–81.29	17	1	16
81.30–81.34	23		23
81.35–81.39	12		12
81.40–81.44	3		3
81.45–81.49	2		2
Total	319	Total 96	Total 223
Arithmetic mean	81.00 M	80.80 M	81.09 M
Median	81.03 M	80.82 M	81.10 M
Mode	81.09 M	80.86 M	81.12 M
Standard deviation	0.252 M	0.264 M	0.192 M
Coefficient of variation	0.003	0.003	0.002
Skewness	−0.36	−0.23	−0.16

TABLE 47, continued

	BERLIN–NEW YORK VIA LONDON (*M per $100*)		
CLASS	*Mar. 1887–July 1914*[a] *Frequency*	*Jan. 1878–Dec. 1895 Frequency*	*Jan. 1896–July 1914 Frequency*
416.2–416.5	1	2	
416.6–416.9	11	11	
417.0–417.3	16	19	1
417.4–417.7	14	16	2
417.8–418.1	28	28	9
418.2–418.5	26	19	10
418.6–418.9	19	13	14
419.0–419.3	36	18	25
419.4–419.7	36	12	31
419.8–420.1	37	9	31
420.2–420.5	31	13	29
420.6–420.9	28	10	28
421.0–421.3	14	9	14
421.4–421.7	11	11	9
421.8–422.1	11	8	10
422.2–422.5	5	3	5
422.6–422.9	3	6	3
423.0–423.3	1	4	1
423.4–423.7	1	2	1
423.8–424.1		2	
424.2–424.5		1	
Total	329	Total 216	Total 223
Arithmetic mean	419.5 M	419.3 M	420.0 M
Median	419.5 M	418.9 M	420.0 M
Mode	419.5 M	418.1 M	420.0 M
Standard deviation	1.43 M	1.90 M	1.16 M
Coefficient of variation	0.003	0.005	0.003
Skewness	0	+0.63	0

[a] This period was chosen instead of 1878–1914 in order to have the distribution comparable to the "spot" prewar series.

(*table continues*)

TABLE 47, concluded

CLASS	PARIS–NEW YORK VIA LONDON (*fc per $1*)		
	Jan. 1878–July 1914 Frequency	*Jan. 1878–Dec. 1895* Frequency	*Jan. 1896–July 1914* Frequency
5.135–5.139	1	1	
5.140–5.144	3	3	
5.145–5.149	17	11	6
5.150–5.154	35	15	20
5.155–5.159	40	18	22
5.160–5.164	43	13	30
5.165–5.169	31	9	22
5.170–5.174	44	19	25
5.175–5.179	31	12	19
5.180–5.184	24	9	15
5.185–5.189	27	12	15
5.190–5.194	30	15	15
5.195–5.199	22	10	12
5.200–5.204	19	9	10
5.205–5.209	15	13	2
5.210–5.214	16	10	6
5.215–5.219	6	6	
5.220–5.224	9	6	3
5.225–5.229	7	6	1
5.230–5.234	5	5	
5.235–5.239	5	5	
5.240–5.244	3	3	
5.245–5.249	3	3	
5.250–5.254	2	2	
5.255–5.259	1	1	
Total	439	Total 216	Total 223
Arithmetic mean	5.180 fc	5.186 fc	5.175 fc
Median	5.175 fc	5.183 fc	5.172 fc
Mode	5.165 fc	5.177 fc	5.166 fc
Standard deviation	0.024 fc	0.029 fc	0.018 fc
Coefficient of variation	0.005	0.006	0.003
Skewness	+0.62	+0.31	+0.50

of course, be compared directly with the original series and such a comparison gives a good idea how well the indirect series approximate the originally given ones.

In comparing the derived with the spot rates (Table 36) an examination of the two constituent frequencies of each series is of interest. Both together add up to the frequency of the whole series. The averages and other measures for the entire series come very close to the same measures of the direct exchange rates, as

one would expect. The three derived series, Berlin–Paris, Paris–New York, and Berlin–New York (all via London), are of the same length (1878–1914) and therefore broken into almost equal parts (216 and 223 months). Thus the very significant result (which however also obtains for the fourth, Berlin–Paris via New York) is of interest: the dispersion is markedly lower for the second part of the whole period than for the first. This is best seen by comparing the coefficients of variation[42] which in each case are substantially lower for the later than for the earlier half-period. Since these series coincide for all other practical purposes with the direct exchange rates, the observation holds for these too.

The meaning of this is immediate: greater stability of exchange rates prevailed in the second period, and since this is observed in all four cases it expresses a greater stability of international financial relations to the extent that these relations are carried on through exchanges. This would be their bulk at any rate. The decline in the extent of fluctuations is not dissimilar to that of the absolute maximal interest rate differentials, studied in section 3 of the preceding chapter.

Table 48 contains the distribution of Berlin–New York via London for 1925–1931, the only one made for the interwar period. Comparison with the direct rate (Table 37) shows very high similarity with a smaller standard deviation, but the same coefficient of variation. This sample shows that the post-World-War-I relation of the derived to the direct rates is not different and we need not go further into this matter.

(12) We now turn to the *arbitrage series proper*, i.e., the difference between the derived and direct exchange rates. They are presented in Charts 14 and 15. Although these differences were very small and seemingly insignificant, they are of considerable interest. This pertains to both their frequency distributions and their time sequences; as mentioned there may even be cycles involved or other significant properties helping in identifying international tensions or crises.

The charts are easy to read: each series is centered around a *zero line* which indicates that there was zero difference between the direct and derived rates. This is taken to mean that it was

[42] It will be noted that the standard deviations and the coefficients of variation for the spot rates are equal to or lower than those for the corresponding derived rates. This greater spread among the derived rates probably resulted from the added cost of going through a third center.

TABLE 48

Frequency Distribution, Derived Exchange Rates, January 1925–July 1931, Seasonally Uncorrected Data

BERLIN NEW YORK VIA LONDON (*RM per $100*)	
Class	*Frequency*
417.4–417.7	1
417.8–418.1	3
418.2–418.5	2
418.6–418.9	5
419.0–419.3	9
419.4–419.7	11
419.8–420.1	27
420.2–420.5	4
420.6–420.9	3
421.0–421.3	3
421.4–421.7	5
421.8–422.1	5
422.2–422.5	1
Total	79
Arithmetic mean	419.9 RM
Median	419.9 RM
Mode	419.9 RM
Standard deviation	1.07 RM
Coefficient of variation	0.003 RM
Skewness	0

indifferent how the respective other currency was bought, directly or via the third place.[43] Clearly this is not exactly so since we do not know anything about the costs, especially nothing about their possible changes and perhaps even seasonal or cyclical variations. When the curve is above the zero line, then the derived rate was higher than the direct rate and accordingly, when it fell below, it was lower than the direct one or, in other words, it was profitable to buy via the intermediate market. So when the curve was above the zero line the balancing flow of funds would be restricted to the two countries directly involved; its direction would of course depend upon the actual position of the rate and upon the short-term unbalance of the moment. When the curve was below the

[43] As already stated we assume that by selling, say, dollars in London or sterling in New York we obtain the same result. This need not be exactly true, but is for all reasonable statistical purposes (cf. section 9 and footnote 40).

zero line, a flow among three countries would be a distinct possibility[44] but no certainty.

Flows to and from the third country are induced only as distinguished from the autonomous flows arising in the first case. The amounts involved may in each case be very large but we lack data on that point.

What are the reasons for larger oscillations or other kinds of deviations from a *true zero*—this being the difference[45] between the two rates where no profit can be made by interchanging the three currencies involved? Certainly not variations in costs, risk factors, and the like. The only plausible interpretation aside from the rejection of the data as inaccurate—for really free and unhampered markets, such as existed before 1914 and for a few years after World War I—is that demand and supply of the currencies could not be absolutely equated as between the three centers. In other words, "tips" or "excesses" of demand or supply remained which had to be settled by securities, gold, and even other commodities. This is, however, a condition that does not square with the theory of foreign exchanges of which the basic principles were expounded in section 3.

Still worse, the continuation of a difference from the true zero over a number of weeks and months would run counter even to the crudest conceptions of the working of an international monetary mechanism, no matter what the standards involved may be. We must except only regimes of exchange control. Then deviations are not only possible, but bound to appear, and when they are absent, it would indicate wrong or falsified statistics.

Therefore we ask: are there such permanent differences? And where is the true zero? The latter question must be answered first. Unfortunately it cannot be determined with accuracy and we can only make some guesses. These, however, can be backed by suggestive observations. Consider first the post-World-War-I period (Chart 15). In three cases (Berlin–Paris via London, Berlin–Paris via New York, Paris–New York via London) our *empirical zero* clearly coincides with the true for the years during which all four gold standards were operating; there were then hardly any deviations at all.[46] Those that occurred are therefore true deviations too.

[44] Assuming that it was a deviation from the "true" zero (see below).
[45] It may be a narrow *zone* of positive and negative values.
[46] This depends of course also on the unit of measurement. Therefore this

It should be recalled that this highly perfect equalization falls into a period when forward rates for each currency were also available. This offered two or more additional avenues of equalizing and they may have contributed to the high degree of perfection. Outside the period quoted but still after 1914, the deviations are enormous compared with anything found before 1914, yet forward rates existed. Whatever stabilizing influence the latter may have they do not by themselves assure equalization of cross rates of exchange.

Before 1914—and perhaps even after 1931—we find no such behavior of the data. With the exception of the six and a half years 1908–1914 for Paris–New York via London no series oscillates for any length of time around the empirical zero shown on the graphs. Instead they stay either above or below it, often for years on end, though still undergoing variations. This would suggest seeking the true zero for these periods in an average of the deviations themselves and to measure the latter from it. But this is made difficult if not impossible by the curious fact that, e.g., Berlin–Paris via London has up to about 1894 an average below zero, then for approximately sixteen years above, and finally oscillates around the empirical zero. There is no information of any kind available that would make this behavior plausible; in particular we do not know whether there were such rather gradual changes in costs (perhaps fees, commissions, taxes, etc.) that had this influence.[47]

Since this must remain an open question it is necessary to neglect all small variations around the empirical zero or around the different means, when a series is for a longer period above or below the empirical zero. Account may be taken if the mean (which we shall not compute; it may be seen roughly from the charts) changes sign. There are furthermore some over-all tendencies that the charts disclose amply for our purposes. These are the over-all tendencies, visible for all series before 1914, of a contraction of each series and generally smaller oscillations around the properly defined zeros. This is hardly surprising after having seen the smaller dispersion of the second part of the frequencies for the derived rates (Table 47). The early parts of the pre-World-War-I arbitrage series are decidedly more erratic than the last. This is

condition could always be created. We need not elaborate this point and its obvious consequences.

[47] This may have been connected with shifts in the interest rate differentials.

especially true for Paris–New York via London, which for 1878–1888 certainly differs widely from any conception one might form about this type of series.

Whether the prewar or post-World-War-I series are considered, there are no cycles to be found, whatever visual criterion might be applied.[48] Instead there appear the kind of sudden "outbursts" mentioned earlier, which reappear in a totally different field elsewhere.[49] They are of interest for discovering specific dates of trouble in these international contacts. Before determining these dates we will discuss the frequency distributions of the arbitrage series.

Tables 49 and 50 show these distributions. The first two for the pre-World-War-I period are of 439, the last two of 329 and 439 months; all those for the post-World-War-I period are of 79 months. The question of units arises again, aggravated by the choice intervals. The reader will determine for himself whether he considers the distributions as comparable.

Their differences are striking. Taking first the pre-World-War-I statistics they show each one belonging to a separate class of the typical textbook variety. Comparison with Charts 14 and 15, showing the four time series, makes this immediately clear. The expectation for the ideal case would of course be a very narrow and perfectly symmetric distribution. That for Paris–New York via London corresponds best, though its symmetry leaves much to be desired (skewness, $\chi = +0.833$). If the part from 1878 to about 1888 were omitted the results would conform much better to expectation and would have eliminated the hump from +0.025 to +0.029 fc. A somewhat wider class interval would also have made the symmetry greater. Berlin–New York via London also conforms not badly with the expected shape; but this cannot be said of the other two. The question of symmetry can here be raised significantly, while for the direct and derived series, as was pointed out, there is no interseries comparability, since each one can be inverted with no preference for either form possible. In these two cases the

[48] There may be complicated cycles in these series. They could be discovered only by means of Fourier and spectral analysis and the attempt may be made elsewhere.

[49] For example, in the discount rate of the Bank of France (cf. Chapter VIII, section 5). There are other instances. It is not unlikely that this is a type of economic fluctuation deserving further study. We referred to this in section 5 of Chapter I as particularly pertinent for interactions of various countries. These forms have also some bearing on sun spots, which also may not be "cyclical" in a simple sense of continuous phenomena.

TABLE 49

Frequency Distribution, Arbitrage Rates, Prewar, Seasonally Uncorrected Data

BERLIN–PARIS VIA LONDON (JAN. 1878–JULY 1914) (*M per 100 fc*)		BERLIN–PARIS VIA NEW YORK (JAN. 1888–JULY 1914) (*M per 100 fc*)	
Class	*Frequency*	*Class*	*Frequency*
−0.36 to −0.35	1	−0.38 to −0.37	2
−0.16 to −0.15	1	−0.36 to −0.35	
−0.14 to −0.13		−0.34 to −0.33	2
−0.12 to −0.11	2	−0.32 to −0.31	
−0.10 to −0.09	5	−0.30 to −0.29	2
−0.08 to −0.07	13	−0.28 to −0.27	
−0.06 to −0.05	25	−0.26 to −0.25	
−0.04 to −0.03	43	−0.24 to −0.23	3
−0.02 to −0.01	66	−0.22 to −0.21	1
+0 to +0.01	71	−0.20 to −0.19	3
+0.02 to +0.03	78	−0.18 to −0.17	8
+0.04 to +0.05	78	−0.16 to −0.15	9
+0.06 to +0.07	41	−0.14 to −0.13	15
+0.08 to +0.09	7	−0.12 to −0.11	20
+0.10 to +0.11	4	−0.10 to −0.09	21
+0.12 to +0.13	4	−0.08 to −0.07	29
		−0.06 to −0.05	39
		−0.04 to −0.03	45
		−0.02 to −0.01	46
		+0 to +0.01	26
		+0.02 to +0.03	22
		+0.04 to +0.05	9
		+0.06 to +0.07	7
		+0.08 to +0.09	4
		+0.10 to +0.11	3
		+0.12 to +0.13	2
		+0.14 to +0.15	1
Total	439	Total	319
Arithmetic mean	+0.009 M		−0.052 M
Median	+0.013 M		−0.039 M
Mode	+0.021 M		−0.025 M
Standard deviation	0.046 M		0.076 M
Coefficient of variation	0.005		−1.462
Skewness	−0.26		−0.36

TABLE 49, concluded

BERLIN–NEW YORK VIA LONDON (MAR. 1887–JULY 1914) (*M per $100*)		PARIS–NEW YORK VIA LONDON (JAN. 1878–JULY 1914) (*fc per $1*)	
Class	*Frequency*	*Class*	*Frequency*
−2.0 to −1.9	1	−0.025 to −0.021	1
−1.8 to −1.7		−0.020 to −0.016	1
−1.6 to −1.5		−0.015 to −0.011	4
−1.4 to −1.3	1	−0.010 to −0.016	32
−1.2 to −1.1		−0.005 to −0.001	179
−1.0 to −0.9		+0 to +0.004	123
−0.8 to −0.7	4	+0.005 to +0.009	20
−0.6 to −0.5	13	+0.010 to +0.014	15
−0.4 to −0.3	13	+0.015 to +0.019	12
−0.2 to −0.1	26	+0.020 to +0.024	11
+0 to +0.1	55	+0.025 to +0.029	28
+0.2 to +0.3	106	+0.030 to +0.034	6
+0.4 to +0.5	68	+0.035 to +0.039	5
+0.6 to +0.7	26	+0.040 to +0.044	
+0.8 to +0.9	10	+0.045 to +0.049	1
+1.0 to +1.1	1	+0.050 to +0.054	1
+1.2 to +1.3	1		
+1.4 to +1.5	3		
+2.4 to +2.5	1		
Total	329	Total	439
Arithmetic mean	+0.22 M		+0.0031 fc
Median	+0.25 M		+0.0001 fc
Mode	+0.30 M		−0.0059 fc
Standard deviation	0.40 M		0.0108 fc
Coefficient of variation	+1.82		3.484
Skewness	−0.20		+0.83

greatest frequency, occurring very near the empirical zero, may indicate the location of the true zero. Only a very radical enlargement of class intervals would help in that respect in the other two cases. The units there, being fairly large in the first place, make this impossible.

The most perfect frequency distribution in the sense of our expectation is that for Berlin–Paris via New York 1925–1931 (Table 50). There all averages are zero as is the skewness; hence no coefficient of variation exists. The other postwar distributions too show a much more regular behavior than the pre-World-War-I data. These parts of the entire post-World-War-I period make it therefore most plausible that the true and the empirical zeros

TABLE 50

Frequency Distribution, Arbitrage Rates, January 1925–July 1931, Seasonally Uncorrected Data

BERLIN–PARIS VIA NEW YORK (*RM per 100 fc*)		BERLIN–PARIS VIA LONDON (*RM per 100 fc*)	
Class	*Frequency*	*Class*	*Frequency*
−0.06	1	−0.08 to −0.07	1
−0.05	3	−0.06 to −0.05	2
−0.04		−0.04 to −0.03	5
−0.03	1	−0.02 to −0.01	10
−0.02	7	0 to +0.01	57
−0.01	6	+0.02 to +0.03	1
0	44	+0.04 to +0.05	2
+0.01	11	+0.14 to +0.15	1
+0.02	5		
+0.33	1		
Total	79	Total	79
Arithmetic mean	0		−0.001 RM
Median	0		+0.004 RM
Mode	0		+0.008 RM
Standard deviation	0.045 RM		0.020 RM
Coefficient of variation	–		−20.0
Skewness	0		−0.45

coincide for all practical purposes. An extension of this hypothesis for the whole postwar period is admissible, especially since the functioning of arbitrage is independent of the standard.[50]

We *summarize* some of the main points of the arbitrage series: sudden and even large deviations from zero (where the empirical need not coincide with the true zero) are in keeping with any freely operating monetary standard, including all forms of the gold standard, although a monthly unit for the observations is very large. When deviations are extremely large they indicate critical occurrences; when they are only moderately large but last for more than one to two months they betray inefficiency of the operating capital transfer mechanism or institutional changes, e.g., exchange control, open or disguised. The sharpest deviations show clearly such important crises or disturbances as the 1890 Baring crisis, the

[50] This is easily seen from the charts, which frequently fail to show deviations, even though only some or none of the countries were on the gold standard. Furthermore even the 1925–1931 gold standard was more restricted, e.g., hardly any domestic circulation of gold, than that prior to 1914.

TABLE 50, continued

BERLIN–NEW YORK VIA LONDON (*RM per $100*)		BERLIN–NEW YORK VIA PARIS (*RM per $100*)	
Class	*Frequency*	*Class*	*Frequency*
−7.2	1	−8.4 to −8.3	1
−0.5	2	−0.6 to −0.5	5
−0.4		−0.4 to −0.3	6
−0.3	1	−0.2 to −0.1	22
−0.2	10	0 to +0.1	29
−0.1	24	+0.2 to +0.3	5
0	30	+0.4 to +0.5	5
+0.1	11	+0.6 to +0.7	2
+0.2		+0.8 to +0.9	
		+1.0 to +1.1	2
		+1.2 to +1.3	
		+1.4 to +1.5	
		+1.6 to +1.7	1
		+1.8 to +1.9	
		+2.0 to +2.1	1
Total	79	Total	79
Arithmetic mean	−0.15 RM		−0.11 RM
Median	−0.05 RM		+0.02 RM
Mode	+0.15 RM		+0.19 RM
Standard deviation	0.88 RM		1.03 RM
Coefficient of variation	−5.87		9.36
Skewness	−0.34		−0.29

(*table continues on next page*)

1907 strain on international relations, the great turmoil of 1893, and even milder ones, e.g., 1902 (Table 51). In the post-World-War-I period the great upheavals of 1931, 1933, and 1936 are all clearly distinguished and the extent of the disturbance of our series is an indication of their severity. However, besides the confirmation of these crises and disturbances, there are others less easily identified.

Section 8. The Violations of Gold Points by the Exchange Rates

(13) The two Tables 53 and 54 contain for each pair of countries the monthly dates at which the exchanges went beyond the gold points in either direction. The latter are found on top of each column; both the medians and the widest excesses are noted. For each month the actual exchange rate observed is shown from sea-

TABLE 50, concluded

PARIS–NEW YORK VIA LONDON
(*fc per $1*)

Class	*Frequency*
−0.210 to −0.201	1
−0.100 to −0.091	1
−0.090 to −0.081	
−0.080 to −0.071	
−0.070 to −0.061	
−0.060 to −0.051	
−0.050 to −0.041	1
−0.040 to −0.031	
−0.030 to −0.021	8
−0.020 to −0.011	5
−0.010 to −0.001	36
0 to +0.009	19
+0.010 to +0.019	4
+0.020 to +0.029	
+0.030 to +0.039	1
+0.040 to +0.049	2
+0.050 to +0.059	
+0.060 to +0.069	
+0.070 to +0.079	
+0.080 to +0.089	
+0.090 to +0.099	1
Total	79
Arithmetic mean	−0.0059 fc
Median	−0.0033 fc
Mode	−0.0002 fc
Standard deviation	0.0305 fc
Coefficient of variation	−5.177
Skewness	−0.19

sonally uncorrected data (see, however, Table 56, where corrected data are used).[51] Figures in italic with a single dagger show those actual exchange rates that not only went beyond the median gold import and export points, but beyond the maxima recorded. So the tables make two measurements at once by distinguishing between a severe and a less severe criterion of "violation" of the principles of the gold standard. Charts 16 and 17 show these deviations. The

[51] It would have been inadvisable to use corrected data in so delicate a statistic where much weight is placed upon the identification of the actual month and often in several countries simultaneously. The shifting of peaks, mentioned before, often due to seasonal correction, would have blurred the picture beyond hope. Because of averaging this danger is not avoided entirely even when uncorrected data are used.

TABLE 51

Dates When Arbitrage Rate Was Greater than ±0.2% of Parity, January 1888–July 1914

(319 months)

	Berlin–Paris via New York (1)	*Berlin–Paris via London* (2)	*Berlin–New York via London* (3)	*Paris–New York via London* (4)	*Totals* (5)		
					+	—	
June 1889	—				0	1	1
Dec. 1889	—				0	1	1
Feb. 1890			+		1	0	1
Oct. 1890	—				0	1	1
Dec. 1890	—		+		1	1	2
Jan. 1891				—	0	1	1
Nov. 1891	—				0	1	1
Dec. 1891	—		+		1	1	2
June 1893	—			—	0	2	2
July 1893	—		+		1	1	2
Sept. 1893			—		0	1	1
Feb. 1894		—	—		0	2	2
Jan. 1896	—				0	1	1
Aug. 1896	—			—	0	2	2
Sept. 1896	—		+		1	1	2
Dec. 1900	—				0	1	1
May 1901	—				0	1	1
June 1905			+	+	2	0	2
July 1905			+	+	2	0	2
Dec. 1905	—				0	1	1
Jan. 1906	—				0	1	1
Sept. 1906			+		1	0	1
Dec. 1906	—		+	—	1	2	3
Nov. 1907	—			—	0	2	2
Dec. 1907	—			—	0	2	2
Jan. 1908			+		1	0	1
Dec. 1912			+		1	0	1
Apr. 1913	—				0	1	1
Nov. 1913	—				0	1	1
Dec. 1913	—				0	1	1

Totals	No.	Per cent*	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
+	0	—	0	0	11	3.4	2	0.6	13	1.0
—	21	6.6	1	0.3	2	0.6	6	1.9	30	2.4
Total	21	6.6	1	0.3	13	4.1	8	2.5	43	3.4

+ = Differential, excess derived over spot rate was greater than +0.2% of parity.

— = Differential, excess derived over spot rate was greater than —0.2% of parity.

* Percentages for Cols. 1–4 computed on basis of 319 months. Percentages for Col. 5 computed on basis of total observations of all rates, 1,276 months.

TABLE 52

Dates When Arbitrage Rate Was Greater than ±0.2% of Parity, January 1925–July 1939

(175 months)

	Berlin–New York via Paris	*Berlin–New York via London*	*Berlin–Paris via London*	*Berlin–Paris via New York*	*Paris–New York via London*	*Totals*		
						+	−	
Feb. 1925	+		−	−		1	2	3
Mar. 1925			−			0	1	1
May 1925			−			0	1	1
June 1925			−			0	1	1
Oct. 1925	+			−		1	1	2
Dec. 1925	+		−	−		1	2	3
June 1926			+		−	1	1	2
July 1926	+		−	−	+	2	2	4
Mar. 1931			+		−	1	1	2
July 1931	−	−	+	+		2	2	4
Aug. 1931	−		+	+		2	1	3
Sept. 1931	−		+	+		2	1	3
Oct. 1931	−	−	+	+		2	2	4
Nov. 1931			+			1	0	1
Dec. 1931	−		+	+		2	1	3
Jan. 1932	−		+	+		2	1	3
Mar. 1932	+	−		−	−	1	3	4
May 1932	+		−	−		1	2	3
Aug. 1932			−			0	1	1
Sept. 1932	+		−			1	1	2
Dec. 1932	+		−	−		1	2	3
Feb. 1933	+		−	−		1	2	3
Mar. 1933	+	+		−		2	1	3
Apr. 1933	−		+	+		2	1	3
May 1933	−	+	+	+		3	1	4
June 1933	−		+	+		2	1	3
July 1933	+		−	−		1	2	3
Sept. 1933	+		−	−	−	1	3	4
Jan. 1934	−			+	+	2	1	3
Feb. 1934	−		+	+		2	1	3
Mar. 1934	−		+	+		2	1	3
Apr. 1934	−		+	+		2	1	3
May 1934	−		+	+		2	1	3
June 1934	−		+	+		2	1	3
July 1934	−		+	+		2	1	3
Aug. 1934	−		+	+		2	1	3
Sept. 1934			+	+		2	0	2
Mar. 1935			−	−		0	2	2
May 1935		+	+			2	0	2
July 1935		−	−			0	2	2
June 1936			−			0	1	1
July 1936			−			0	1	1
Aug. 1936			−			0	1	1

TABLE 52, concluded

	Berlin–New York via Paris	*Berlin–New York via London*	*Berlin–Paris via London*	*Berlin–Paris via New York*	*Paris–New York via London*	*Totals*		
Sept. 1936	+			−	−	1	2	3
June 1937	+			−	−	1	2	3
Sept. 1937	+			−	−	1	2	3
Jan. 1938	+					1	0	1
Apr. 1938					+	1	0	1
May 1938			+		−	1	1	2

Jan. 1925–July 1931	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
+	4	5.1	0		3	3.8	1	1.3	1	1.3	9	2.3
−	1	1.3	1	1.3	6	7.6	4	5.1	2	2.5	14	3.5
total	5	6.3	1	1.3	9	11.4	5	6.3	3	3.8	23	5.8
Aug. 1931–July 1939												
+	12	12.5	3	3.1	19	19.8	17	17.7	2	2.1	53	11.0
−	16	16.7	3	3.1	12	12.5	11	11.5	6	6.3	48	10.0
total	28	29.2	6	6.2	31	32.3	28	29.2	8	8.3	101	21.0
Jan. 1925–July 1939												
+	16	9.1	3	1.7	22	12.6	18	10.3	3	1.7	62	7.1
−	17	9.7	4	2.3	18	10.3	15	8.6	8	4.6	62	7.1
total	33	18.9	7	4.0	40	22.9	33	18.9	11	6.3	124	14.2

+ = Differential positive, cheaper to buy currency directly.
− = Differential negative, cheaper to buy currency through third country.

heavy center line there represents the *entire interval* between the median gold points so that *all* the intermediate variations of the exchange rates are absorbed and consequently not shown. Violations of these points—now assumed to be constant over time—are indicated by the areas below or above. The maximum gold points of Tables 33 and 34 are indicated by broken lines beyond the center line. It can instantly be seen whether the violations went even beyond these maxima. At the same time a picture is obtained of the extent of the deviation of the maximal gold points from the medians and it is seen that for the same country the deviation is sometimes bigger in one direction than in the other.[52] The deviations have been shown when they actually occurred; when there was an in-

[52] This is here a *purely statistical* consequence and must not be confused with the fact that the upper and lower gold points often are at different distances from the currency par. The actual difference is due, as already mentioned in footnote 20, to differences of costs of shipping gold in different directions between the same countries. This condition is often artificially created by the central banks. There may however be a coincidence of these facts and the above-mentioned statistical result.

TABLE 53

Deviations of Exchange Rates from Gold Points,[a] January 1880–July 1914,[b] Seasonally Uncorrected Data

Med. 4.845–4.890 Max. 4.827–4.900 NEW YORK–LONDON ($ per £)		Med. 515.00–521.83 Max. 514.75–522.402 PARIS–NEW YORK (fc per $100)		Med. 25.125–25.3275 Max. 25.10–25.35 PARIS–LONDON (fc per £)		Med. 416.80–421.85 Max. 416.80–421.875 BERLIN–NEW YORK (M per $100)		Med. 20.34–20.505 Max. 20.31–20.53 BERLIN–LONDON (M per £)		Med. 80.55–81.35 Max. 80.50–81.49 BERLIN–PARIS (M per 100 fc)	
Date	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*
Jan. 1880	4.8370	Sept. 1880	521.9	Aug. 1880	25.3388	Dec. 1888	*416.5*†	Oct. 1885	20.3300	Sept. 1880	*80.45*†
Aug. 1880	4.8394	Oct. 1880	522.2	Sept. 1880	*25.3663*†	Mar. 1891	*416.7*†	Nov. 1885	20.3338	Oct. 1880	*80.47*†
Sept. 1880	4.8275	Nov. 1880	522.7	Oct. 1880	*25.3570*†	Dec. 1892	*416.2*†	Dec. 1890	20.3300	Nov. 1886	*80.48*†
Oct. 1880	4.8300	Dec. 1880	*522.7*†	Feb. 1881	25.3450	Mar. 1898	*422.7*†	Jan. 1891	20.3310	Dec. 1886	*80.35*†
Nov. 1880	*4.8256*†	Jan. 1881	522.1	Mar. 1881	25.3413	Apr. 1898	*423.4*†	Aug. 1891	20.3200	Jan. 1887	*80.44*†
Dec. 1880	*4.8169*†	Mar. 1881	*522.7*†	Apr. 1881	25.3310	May 1906	*422.0*†	Sept. 1891	20.3313	Feb. 1887	*80.35*†
Jan. 1881	4.8375	Apr. 1881	522.1	Oct. 1881	25.3400	Feb. 1907	*422.3*†	Oct. 1891	20.3310	Mar. 1887	*80.35*†
Mar. 1881	4.8306	Feb. 1882	*512.5*†	Feb. 1885	*25.3525*†	Mar. 1907	*422.8*†	Dec. 1891	20.3200	Sept. 1837	*80.48*†
Apr. 1881	4.8390	Mar. 1882	*513.4*†	Mar. 1885	*25.3750*†			Oct. 1893	20.3250	Oct. 1887	*80.38*†
Aug. 1881	4.8394	Apr. 1882	*513.1*†	Apr. 1885	*25.3763*†			Nov. 1893	20.3213	Nov. 1887	*80.41*†
Sept. 1881	4.8375	May 1882	*512.2*†	Nov. 1886	*25.3550*†			Dec. 1893	20.3320	Dec. 1887	*80.31*†
Oct. 1881	4.8385	June 1882	*513.2*†	Dec. 1886	*25.3738*†			Apr. 1898	20.5280	Mar. 1888	*80.48*†
Feb. 1882	4.8981	July 1882	*514.2*†	Jan. 1887	*25.3560*†			Dec. 1899	20.5120	Sept. 1888	80.51
May 1882	4.8988	Aug. 1882	*513.8*†	Feb. 1887	*25.3863*†			Feb. 1900	20.5144	Nov. 1888	80.51
Dec. 1882	4.8395	Mar. 1884	*514.4*†	Mar. 1887	*25.3813*†			Apr. 1900	20.5063	Dec. 1888	*80.48*†
Mar. 1883	4.8310	Apr. 1884	*514.4*†	Sept. 1887	*25.3950*†			May 1900	20.5088	Oct. 1890	*80.45*†
Oct. 1883	4.8381	May 1884	*514.4*†	Oct. 1887	*25.3820*†			Mar. 1903	20.5100	Nov. 1890	*80.46*†
Nov. 1883	4.8400	Nov. 1884	521.9	Dec. 1887	25.3380			Apr. 1903	20.5069	Dec. 1890	80.51
Dec. 1883	4.8400	Dec. 1884	521.9	Aug. 1888	*25.3613*†			May 1906	20.5063	Aug. 1891	*80.40*†
Mar. 1884	4.8965	Feb. 1886	*514.2*†	Sept. 1888	*25.4150*†			Nov. 1906	20.5219	Sept. 1891	*80.30*†
Apr. 1884	*4.8963*†	Mar. 1886	*514.2*†	Oct. 1888	*25.3713*†						
Aug. 1884	4.8405	Apr. 1886	514.8	Dec. 1888	25.3340			Feb. 1907	20.5188	Oct. 1891	*80.45*†
Oct. 1884	4.8369	Sept. 1886	522.0	Jan. 1893	25.1150			Mar. 1907	20.5180	Feb. 1900	81.39
Nov. 1884	4.8360	Oct. 1886	522.4	Aug. 1893	25.3288			Nov. 1907	*20.5570*†	May 1900	81.39
Dec. 1884	4.8375	Nov. 1886	*522.8*†	May 1897	25.1020			Dec. 1907	20.5288	July 1900	81.37
Jan. 1886	4.8933	Dec. 1886	*524.2*†	June 1897	25.1050			Feb. 1909	20.5131	Aug. 1900	81.36
Dec. 1886	4.8394	Aug. 1887	*522.5*†	July 1897	25.1030			Nov. 1912	20.5110	Oct. 1900	81.39
Aug. 1887	4.8413	Sept. 1887	*524.1*†	Nov. 1898	25.3300					Nov. 1900	81.40
Mar. 1889	4.8945	Oct. 1887	*523.1*†	July 1900	25.1225					Dec. 1900	81.35

TABLE 53, concluded

Med. 4.845–4.890 Max. 4.827–4.900 NEW YORK–LONDON ($ per £)		Med. 515.00–521.83 Max. 514.75–522.402 PARIS–NEW YORK (fc per $100)		Med. 25.125–25.3275 Max. 25.10–25.35 PARIS–LONDON (fc per £)		Med. 416.80–421.85 Max. 416.80–421.875 BERLIN–NEW YORK (M per $100)		Med. 20.34–20.505 Max. 20.31–20.53 BERLIN–LONDON (M per £)		Med. 80.55–81.35 Max. 80.50–81.49 BERLIN–PARIS M per 100 fc	
Date	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*
Apr. 1889	4.8944	Nov. 1887	522.0	Oct. 1900	25.1225					Jan. 1901	81.41
May 1889	4.8938	Sept. 1891	*522.8*†	Nov. 1900	25.1088					Jan. 1903	81.39
Oct. 1891	4.8405	Oct. 1891	522.6	Dec. 1900	*25.0930*†					Feb. 1903	81.45
Dec. 1891	4.8413	Apr. 1893	*514.7*†	Jan. 1901	25.1225					Mar. 1903	81.46
May 1893	4.8969	Dec. 1894	514.8	May 1904	25.1125					Apr. 1903	81.44
July 1893	4.8368	Jan. 1895	*514.7*†	Dec. 1905	25.1120					Apr. 1904	81.35
Mar. 1895	4.8955	June 1895	*514.3*†	Jan. 1906	25.1213					Apr. 1905	81.37
Apr. 1895	4.8975	July 1895	*514.3*†	Apr. 1906	25.1238					July 1905	81.35
June 1895	4.8948	Apr. 1896	514.9	June 1908	25.1213					Jan. 1906	81.38
July 1895	*4.9038*†	May 1896	*514.6*†	July 1908	25.1231					Feb. 1906	81.48
Aug. 1895	*4.9060*†	Mar. 1898	*522.6*†	Oct. 1908	25.1090					Mar. 1906	81.44
Sept. 1895	4.8963	Apr. 1898	*523.1*†	Nov. 1908	25.1019					Apr. 1906	*81.50*†
Nov. 1895	4.8945	Oct. 1898	522.1	Dec. 1908	25.1219					May 1906	81.39
Dec. 1895	4.8944	Mar. 1907	*522.5*†							July 1906	81.36
Jan. 1896	4.8969									Aug. 1907	81.38
Sept. 1906	4.8410									Sept. 1907	81.35
										Oct. 1907	*81.50*†
										Nov. 1907	81.46
										Dec. 1907	81.41
										Jan. 1908	81.39
										Nov. 1908	81.46
										Dec. 1908	81.43
										Jan. 1909	81.48
										Oct. 1911	81.45
										May 1914	81.41
										June 1914	81.44
										July 1914	81.41

Dagger signifies deviation from both maximum and median gold points; otherwise the deviation is from median gold points.

[a] Median and maximum gold import and export points used. See Table 33 for exact gold points.

[b] For New York–Berlin the period used was March 1887–July 1914, 329 months (data not available for preceding period).

TABLE 54

Deviations of Exchange Rates from Gold Points,[a] Postwar,[b] Seasonally Uncorrected Data

NEW YORK–LONDON *Jan. 1925–Aug. 1931 (80 mo., $ per £)*		PARIS–LONDON *July 1928–July 1931 (37 mo., fc per £)*		NEW YORK–BERLIN *Jan. 1925–July 1931 (79 mo., $ per 100 RM)*		BERLIN–LONDON *May 1925–July 1931 (75 mo., RM per £)*		BERLIN–PARIS *July 1928–July 1931 (37 mo., RM per 100 fc)*	
Date	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*	*Date*	*Rate*
Sept. 1925	4.8465	July 1930	123.66	Jan. 1927	23.722	Sept. 1925	20.36	July 1931	*16.52*†
Oct. 1925	4.8428	Sept. 1930	123.77	Feb. 1927	23.670	Oct. 1925	20.34		
Nov. 1925	4.8459	Nov. 1930	123.65	Mar. 1927	23.714	Nov. 1925	20.35		
Dec. 1925	4.8498	Dec. 1930	123.60	Apr. 1927	23.701	Dec. 1925	20.36		
Nov. 1926	4.8488	Mar. 1931	*123.13*†	May 1927	23.692	Aug. 1928	20.36		
Oct. 1928	4.8495			June 1927	23.692	Sept. 1928	20.36		
Nov. 1928	4.8492			Mar. 1929	23.722	Oct. 1928	20.36		
Jan. 1929	4.8499			Apr. 1929	23.704	Nov. 1928	20.35		
June 1929	4.8482			July 1931	23.278	Dec. 1928	20.36		
Aug. 1929	4.8485					June 1929	20.34		
Sept. 1929	4.8482					July 1929	20.36		
						Aug. 1929	20.36		
						Sept. 1929	20.36		
						May 1930	20.36		
						July 1931	20.51		

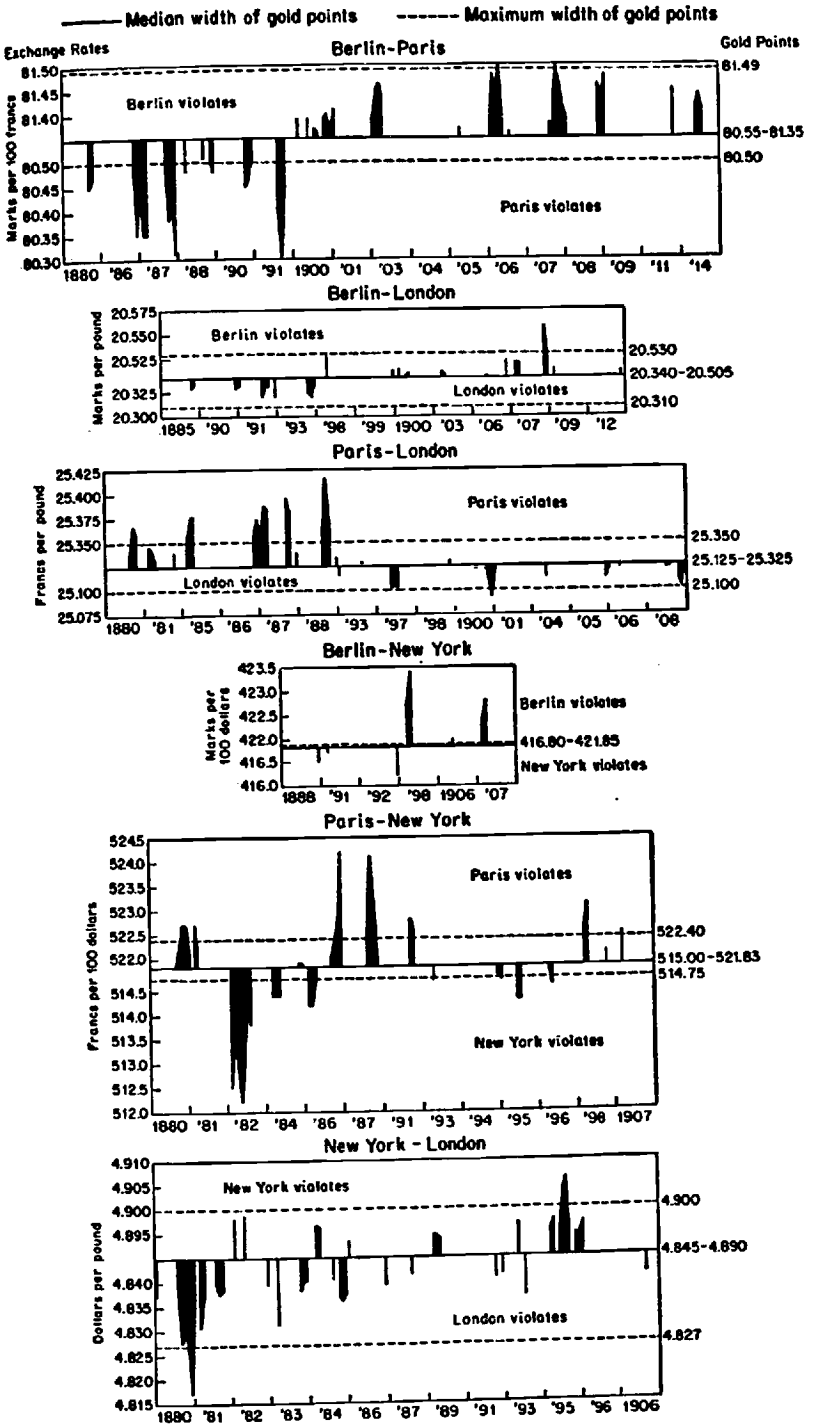
Dagger signifies deviation from both maximum and median gold points; otherwise the deviation is from median gold points.

[a] Median and maximum gold import and gold export points used. See Table 34 for exact gold point. New York–Paris had no violations of either set of gold points for the period covered, July 1928–December 1931.

[b] See individual pairs for time covered.

CHART 16

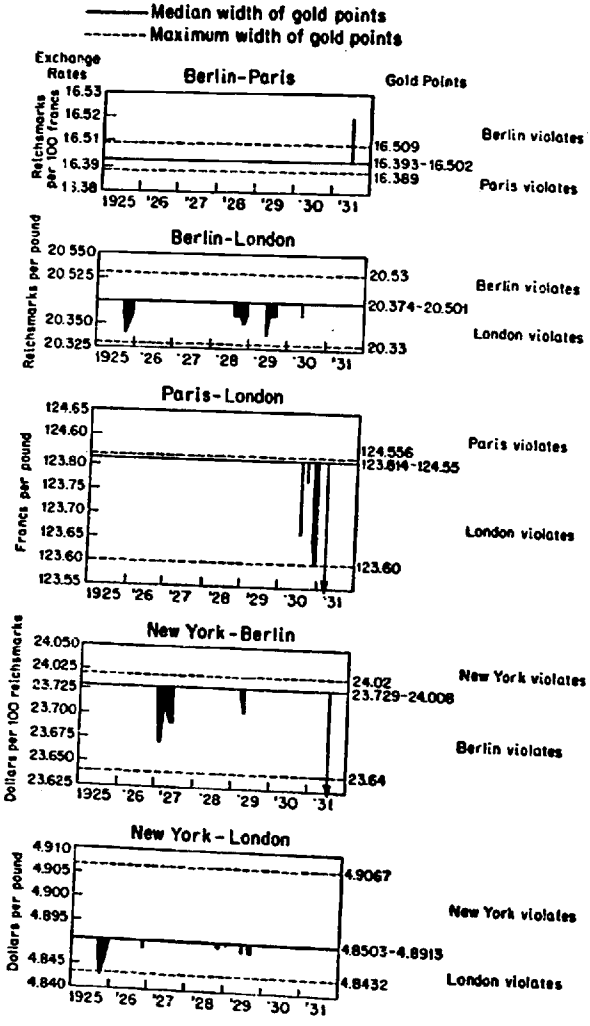
Deviations of Exchange Rates from the Gold Points, Prewar, 1880–1914



For description of the chart see the accompanying text.

CHART 17

Deviation of Exchange Rates from the Gold Points, Postwar, 1925–1934



For description of the chart see the accompanying text.

terval of at least one month between two (or more) occurrences, a uniform spatium has been left; when they lasted for more than one month they are shown as continuous.[53] Years in which there were no violations are omitted. Thus the graphs give as complete a picture of violations of the gold standard principles as can be obtained. The charts and graphs are so arranged that the deviations directed upward are "violations" of the first named money market always, since the graph shows that—and to what extent—the price of the other currency went beyond one or the other kind of gold export point. The deviations directed downward then show by necessity "violations" of the currency of the second named money market.

(14) Table 55 is a more easily read summary of some aspects of the data presented in Tables 53 and 54. In the prewar period Paris–Berlin was the most frequent violator of the median gold points, while Berlin–New York, closely followed by Berlin–London, violated them least often. When the maximum gold points are used the picture changes somewhat, Paris–New York becoming the worst violator and Berlin–London the best behaved. The unequal increase in the width of the gold points from the medians to the maxima accounts for this slight shift in relative position of the rates. It has already been pointed out that the medians are really a "lenient" set of data, if the entire variation of the data on gold points is considered.[54] Therefore this difference should not cause too much concern.

In the postwar period London and Berlin are the only violators of the gold points, the former being the greater offender, especially when paired with Berlin.

When the same computations are made for seasonally corrected exchange rate data it is shown that such violations were not just seasonal events.

(15) Charts 16 and 17 show the deviations from the two categories of gold points on a directly comparable basis so that deviations of the same size (plus or minus) represent the same amounts of money on the basis of currency par. This representation has to be supplemented by showing the percentages of the deviations from the basis of the two gold point variants (Tables 56 and 57). The

[53] Consult Tables 53 and 54.

[54] As far as the exchange rate deviations beyond the gold points are concerned, the medians are the more severe standard and the maximum gold points are a lenient measure (cf. pp. 191 ff.).

TABLE 55

Frequency of Deviations of the Exchange Rates from Median and Maximum of Gold Export and Import Points,[a] January 1880–July 1914[b] and 1925–1931[c]

New York–London

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	0		6	2	6	2
1881	0		6		6	
1882	2		1		3	
1883	0		4		4	
1884	2		4		6	
1885	0		0		0	
1886	1		1		2	
1887	0		1		1	
1888	0		0		0	
1889	3		0		3	
1890	0		0		0	
1891	0		2		2	
1892	0		0		0	
1893	1		1		2	
1894	0		0		0	
1895	8	2	0		8	2
1896	1		0		1	
1897	0		0		0	
1898	0		0		0	
1899	0		0		0	
1900	0		0		0	
1901	0		0		0	
1902	0		0		0	
1903	0		0		0	
1904	0		0		0	
1905	0		0		0	
1906	0		1		1	
1907	0		0		0	
1908	0		0		0	
1909	0		0		0	
1910	0		0		0	
1911	0		0		0	
1912	0		0		0	
1913	0		0		0	
1914	0		0		0	
1925	0		4		4	
1926	0		1		1	
1927	0		0		0	
1928	0		2		2	
1929	0		4		4	
1930	0		0		0	
1931	0		0		0	

TABLE 55, continued

New York–London

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	18	2	27	2	45	4
As per cent of total observations[a]	4.3	0.5	6.5	0.5	10.8	1.0
Seasonally adjusted	20	3	19	3	39	6
As per cent of total observations[a]	4.8	0.7	4.6	0.7	9.4	1.4
1925–1931						
Unadjusted for seasonal	0	0	11	0	11	0
As per cent of total observations[a]	0	0	13.8	0	13.8	0

(*continues on next pages; notes on page 263*)

TABLE 55, continued

Paris–New York

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	4	1	0		4	1
1881	3	1	0		3	1
1882	0		7	7	7	7
1883	0		0		0	
1884	2		3	3	5	3
1885	0		0		0	
1886	4	2	3	2	7	4
1887	4	3	0		4	3
1888	0		0		0	
1889	0		0		0	
1890	0		0		0	
1891	2	2	0		2	2
1892	0		0		0	
1893	0		1	1	1	1
1894	0		1		1	
1895	0		3	3	3	3
1896	0		2	1	2	1
1897	0		0		0	
1898	3	2	0		3	2
1899	0		0		0	
1900	0		0		0	
1901	0		0		0	
1902	0		0		0	
1903	0		0		0	
1904	0		0		0	
1905	0		0		0	
1906	0		0		0	
1907	1	1	0		1	1
1908	0		0		0	
1909	0		0		0	
1910	0		0		0	
1911	0		0		0	
1912	0		0		0	
1913	0		0		0	
1914	0		0		0	
1925						
1926						
1927						
1928	0		0		0	
1929	0		0		0	
1930	0		0		0	
1931	0		0		0	

TABLE 55, continued

Paris–New York

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	23	12	20	17	43	29
As per cent of total observations[a]	5.5	2.9	4.8	4.1	10.4	7.0
Seasonally adjusted	12	1	16	0	28	1
As per cent of total observations[a]	2.9	0.2	3.8	0	6.7	0.2
1925–1931						
Unadjusted for seasonal	0	0	0	0	0	0
As per cent of total observations[a]	0	0	0	0	0	0

(*continues on next pages; notes on page 263*)

TABLE 55, continued

Paris–London

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	3	2	0		3	2
1881	4		0		4	
1882	0		0		0	
1883	0		0		0	
1884	0		0		0	
1885	3	3	0		3	3
1886	2	2	0		2	2
1887	6	5	0		6	5
1888	4	3	0		4	3
1889	0		0		0	
1890	0		0		0	
1891	0		0		0	
1892	0		0		0	
1893	1		1		2	
1894	0		0		0	
1895	0		0		0	
1896	0		0		0	
1897	0		3		3	
1898	1		0		1	
1899	0		0		0	
1900	0		4	1	4	1
1901	0		1		1	
1902	0		0		0	
1903	0		0		0	
1904	0		1		1	
1905	0		1		1	
1906	0		2		2	
1907	0		0		0	
1908	0		5		5	
1909	0		0		0	
1910	0		0		0	
1911	0		0		0	
1912	0		0		0	
1913	0		0		0	
1914	0		0		0	
1925						
1926						
1927						
1928	0		0		0	
1929	0		0		0	
1930	0		4		4	
1931	0		1	1	1	1

TABLE 55, continued

Paris–London

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	24	15	18	1	42	16
As per cent of total observations[d]	5.8	3.6	4.3	0.2	10.1	3.9
Seasonally adjusted	23	3	16	9	39	12
As per cent of total observations[d]	5.5	0.7	3.9	2.2	9.4	2.9
1925–1931						
Unadjusted for seasonal	0	0	5	1	5	1
As per cent of total observations[e]	0	0	13.5	2.7	13.5	2.7

(*continues on next pages; notes on page 263*)

TABLE 55, continued

Berlin–New York

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	0		0		0	
1881	0		0		0	
1882	0		0		0	
1883	0		0		0	
1884	0		0		0	
1885	0		0		0	
1886	0		0		0	
1887	0		0		0	
1888	0		1	1	1	1
1889	0		0		0	
1890	0		0		0	
1891	0		1	1	1	1
1892	0		1	1	1	1
1893	0		0		0	
1894	0		0		0	
1895	0		0		0	
1896	0		0		0	
1897	0		0		0	
1898	2	2	0		2	2
1899	0		0		0	
1900	0		0		0	
1901	0		0		0	
1902	0		0		0	
1903	0		0		0	
1904	0		0		0	
1905	0		0		0	
1906	1	1	0		1	1
1907	2	2	0		2	2
1908	0		0		0	
1909	0		0		0	
1910	0		0		0	
1911	0		0		0	
1912	0		0		0	
1913	0		0		0	
1914	0		0		0	
1925	0		0		0	
1926	0		0		0	
1927	6		0		6	
1928	0		0		0	
1929	2		0		2	
1930	0		0		0	
1931	1		0		1	

TABLE 55, continued

Berlin–New York

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	5	5	3	3	8	8
As per cent of total observations[d]	1.5	1.5	0.9	0.9	2.4	2.4
Seasonally adjusted	8	5	5	5	13	10
As per cent of total observations[d]	2.4	1.5	1.5	1.5	4.0	3.0
1925–1931						
Unadjusted for seasonal	9	0	0	0	9	0
As per cent of total observations[e]	11.4	0	0	0	11.4	0

(*continues on next pages; notes on page 263*)

TABLE 55, continued

Berlin–London

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	0		0		0	
1881	0		0		0	
1882	0		0		0	
1883	0		0		0	
1884	0		0		0	
1885	0		2		2	
1886	0		0		0	
1887	0		0		0	
1888	0		0		0	
1889	0		0		0	
1890	0		1		1	
1891	0		5		5	
1892	0		0		0	
1893	0		3		3	
1894	0		0		0	
1895	0		0		0	
1896	0		0		0	
1897	0		0		0	
1898	1		0		1	
1899	1		0		1	
1900	3		0		3	
1901	0		0		0	
1902	0		0		0	
1903	2		0		2	
1904	0		0		0	
1905	0		0		0	
1906	2		0		2	
1907	4	1	0		4	1
1908	0		0		0	
1909	1		0		1	
1910	0		0		0	
1911	0		0		0	
1912	1		0		1	
1913	0		0		0	
1914	0		0		0	
1925	0		4		4	
1926	0		0		0	
1927	0		0		0	
1928	0		5		5	
1929	0		4		4	
1930	0		1		1	
1931	1		0		1	

TABLE 55, continued

Berlin–London

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	15	1	11	0	26	1
As per cent of total observations[d]	3.6	0.2	2.7	0	6.3	0.2
Seasonally adjusted	10	1	8	1	18	2
As per cent of total observations[d]	2.4	0.2	1.9	0.2	4.3	0.5
1925–1931						
Unadjusted for seasonal	1	0	14	0	15	0
As per cent of total observations[e]	1.3	0	18.7	0	20.0	0

(*continues on next pages; notes on page 263*)

TABLE 55, continued

Berlin–Paris

	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880	0		2	2	2	2
1881	0		0		0	
1882	0		0		0	
1883	0		0		0	
1884	0		0		0	
1885	0		0		0	
1886	0		2	2	2	2
1887	0		7	7	7	7
1888	0		4	2	4	2
1889	0		0		0	
1890	0		3	2	3	2
1891	0		3	3	3	3
1892	0		0		0	
1893	0		0		0	
1894	0		0		0	
1895	0		0		0	
1896	0		0		0	
1897	0		0		0	
1898	0		0		0	
1899	0		0		0	
1900	6		0		6	
1901	1		0		1	
1902	0		0		0	
1903	4		0		4	
1904	0		0		0	
1905	1		0		1	
1906	6	1	0		6	1
1907	4	1	0		4	1
1908	3		0		3	
1909	1		0		1	
1910	0		0		0	
1911	1		0		1	
1912	0		0		0	
1913	0		0		0	
1914	3		0		3	
1925						
1926						
1927						
1928	0		0		0	
1929	0		0		0	
1930	0		0		0	
1931	1	1	0	0	1	1

TABLE 55, concluded

Berlin–Paris

TOTALS:	VIOLATIONS OF IMPORT POINTS		VIOLATIONS OF EXPORT POINTS		TOTAL VIOLATIONS	
	Median gold points	*Maximum gold points*	*Median gold points*	*Maximum gold points*	*Median gold points*	*Maximum gold points*
1880–1914						
Unadjusted for seasonal	30	2	21	18	51	20
As per cent of total observations[d]	7.2	0.5	5.1	4.3	12.3	4.8
Seasonally adjusted	28	2	19	9	47	11
As per cent of total observations[d]	6.7	0.5	4.6	2.2	11.3	2.7
1925–1931						
Unadjusted for seasonal	1	1	0	0	1	1
As per cent of total observations[e]	2.7	2.7	0	0	2.7	2.7

[a] Exchange rate data are unadjusted for seasonal variation except for the second summary of 1888–1914. Gold points are those of the second named place for each pair.

[b] For New York–Berlin period covered is March 1887–July 1914, 329 months.

[c] Period covered for six pairs of countries observed.
New York–London, January 1925–August 1931 (80 mo.)
Paris–New York, July 1928–December 1931 (42 mo.)
Paris–London, July 1928–July 1931 (37 mo.)
Berlin–New York, January 1925–July 1931 (79 mo.)
Berlin–London, May 1925–July 1931 (75 mo.)
Berlin–Paris, July 1928–July 1931 (37 mo.)

[d] 415 months except for New York–Berlin.

[e] See note c for number of months.

TABLE 56

Percentage Width of Exchange Rate Deviations from Gold Points, Prewar Period

NEW YORK–LONDON			PARIS–NEW YORK			PARIS–LONDON		
	PER CENT DEVIATION FROM:			PER CENT DEVIATION FROM:			PER CENT DEVIATION FROM:	
DATE	*Median gold points*[a]	*Maximum gold points*[b]	DATE	*Median gold points*	*Maximum gold points*	DATE	*Median gold points*	*Maximum gold points*
Jan. 1880	0.17		Sept. 1880	*0.01*		Aug. 1880	*0.04*	
Aug. 1880	0.12		Oct. 1880	*0.07*		Sept. 1880	*0.15*	*0.06*
Sept. 1880	0.36		Nov. 1880	*0.09*		Oct. 1880	*0.08*	*0.03*
Oct. 1880	0.31		Dec. 1880	*0.17*	0.06	Feb. 1881	*0.07*	
Nov. 1880	0.40	0.03	Jan. 1881	*0.05*		Mar. 1881	*0.05*	
Dec. 1880	0.58	0.21	Mar. 1881	*0.17*	0.06	Apr. 1881	*0.01*	
Jan. 1881	0.15		Apr. 1881	*0.05*		Oct. 1881	*0.05*	
Mar. 1881	0.29		Feb. 1882	0.49	0.44	Feb. 1885	*0.10*	*0.01*
Apr. 1881	0.12		Mar. 1882	0.31	0.26	Mar. 1885	*0.19*	*0.10*
Aug. 1881	0.12		Apr. 1882	0.37	0.32	Apr. 1885	*0.19*	*0.10*
Sept. 1881	0.15		May 1882	0.55	0.50	Nov. 1886	*0.11*	*0.02*
Oct. 1881	0.13		June 1882	0.33	0.28	Dec. 1886	*0.18*	*0.09*
Feb. 1882	*0.17*[c]		July 1882	0.16	0.11	Jan. 1887	*0.11*	*0.02*
May 1882	*0.18*		Aug. 1882	0.23	0.18	Feb. 1887	*0.23*	*0.14*
Dec. 1882	0.11		Mar. 1884	0.12	0.07	Mar. 1887	*0.21*	*0.12*
Mar. 1883	0.29		Apr. 1884	0.12	0.07	Sept. 1887	*0.27*	*0.18*
Oct. 1883	0.14		May 1884	0.12	0.07	Oct. 1887	*0.22*	*0.13*
Nov. 1883	0.10		Nov. 1884	*0.01*	0.07	Dec. 1887	*0.04*	
Dec. 1883	0.10		Dec. 1884	*0.01*		Aug. 1888	*0.13*	*0.04*
Mar. 1884	*0.13*		Feb. 1886	0.16	0.11	Sept. 1888	*0.35*	*0.26*
Apr. 1884	*0.13*		Mar. 1886	0.16	0.11	Oct. 1888	*0.17*	*0.08*
Aug. 1884	0.09		Apr. 1886	0.04		Dec. 1888	*0.26*	
Oct. 1884	0.17		Sept. 1886	*0.03*		Jan. 1893	0.04	
Nov. 1884	0.19		Oct. 1886	*0.11*		Aug. 1893	0.01	
Dec. 1884	0.15		Nov. 1886	*0.19*	*0.08*	May 1897	0.09	
Jan. 1886	*0.07*		Dec. 1886	*0.45*	*0.38*	June 1897	0.08	
Dec. 1886	0.13		Aug. 1887	*0.13*	*0.02*	July 1897	0.09	
Aug. 1887	0.08		Sept. 1887	*0.43*	*0.32*	Nov. 1898	0.01	
Mar. 1889	*0.09*		Oct. 1887	*0.24*	*0.13*	July 1900	0.01	
Apr. 1889	*0.09*		Nov. 1887	*0.03*		Oct. 1900	0.01	
May 1889	*0.08*		Sept. 1891	*0.19*	*0.08*	Nov. 1900	0.06	
Oct. 1891	0.09		Oct. 1891	*0.15*	*0.04*	Dec. 1900	0.13	0.03
Dec. 1891	0.08		Apr. 1893	0.06	0.01	Jan. 1901	0.01	
May 1893	*0.14*		Dec. 1894	0.04		May 1904	0.05	
July 1893	0.17		Jan. 1895	0.06	0.01	Dec. 1905	0.05	
Mar. 1895	*0.11*		June 1895	0.14	0.09	Jan. 1906	0.01	
Apr. 1895	*0.15*		July 1895	0.14	0.09	Apr. 1906	[d]	
June 1895	*0.10*		Apr. 1896	0.02		June 1908	0.01	
July 1895	*0.26*	*0.08*	May 1896	0.08	0.03	July 1908	0.01	
Aug. 1895	*0.33*	*0.12*	Mar. 1898	*0.15*	*0.04*	Oct. 1908	0.06	
Sept. 1895	*0.13*		Apr. 1898	*0.24*	*0.13*	Nov. 1908	0.09	
Nov. 1895	*0.09*		Oct. 1898	*0.05*		Dec. 1908	0.01	
Dec. 1895	*0.09*		Mar. 1907	*0.13*	*0.02*			
Jan. 1896	*0.14*							
Sept. 1906	0.08							
Average per cent deviation	0.16	0.11		0.16	0.14		0.09	0.09
Average deviation of exchange rate from export points, second-named country	0.18	0.12		0.18	0.16		0.04	0.03
Average deviation of exchange rates from export points, first-named country	0.14	0.10		0.14	0.11		0.14	0.09
Range	0.07–0.58	0.03–0.21		0.01–0.55	0.01–0.50		0.01–0.35	0.03–0.26

See Table 139 for exact periods covered. Seasonally corrected data.

[a] Median gold points basis.

[b] Maximum gold points basis.

[c] Figures in italic indicate that the first-named country, of each pair, violated the gold export points, otherwise the figures refer to the gold export point of the second-named country.

[d] Less than 0.01 per cent.

TABLE 56, concluded

BERLIN–NEW YORK			BERLIN–LONDON			BERLIN–PARIS		
	PER CENT DEVIATION FROM:			PER CENT DEVIATION FROM:			PER CENT DEVIATION FROM:	
DATE	*Median gold points*	*Maximum gold points*	DATE	*Median gold points*	*Maximum gold points*	DATE	*Median gold points*	*Maximum gold points*
Dec. 1888	0.07	0.07	Oct. 1885	0.05		Sept. 1880	0.12	0.06
Mar. 1891	0.02	0.02	Nov. 1885	0.03		Oct. 1880	0.10	0.04
Dec. 1892	0.02	0.02	Dec. 1890	0.05		Nov. 1886	0.09	0.02
Mar. 1898	*0.20*	*0.20*	Jan. 1891	0.04		Dec. 1886	0.25	0.18
Apr. 1898	*0.37*	*0.36*	Aug. 1891	0.10		Jan. 1887	0.14	0.07
May 1906	*0.04*	*0.03*	Sept. 1891	0.04		Feb. 1887	0.25	0.18
Feb. 1907	*0.11*	*0.10*	Oct. 1891	0.04		Mar. 1887	0.25	0.18
Mar. 1907	*0.23*	*0.22*	Dec. 1891	0.10		Sept. 1887	0.09	0.02
			Oct. 1893	0.07		Oct. 1887	0.21	0.15
			Nov. 1893	0.09		Nov. 1887	0.17	0.11
			Dec. 1893	0.04		Dec. 1887	0.30	0.24
			Apr. 1898	*0.11*		Mar. 1888	0.09	0.02
			Dec. 1899	*0.03*		Sept. 1888	0.05	
			Feb. 1900	*0.05*		Nov. 1888	0.05	
			Apr. 1900	*0.01*		Dec. 1888	0.09	0.02
			May 1900	0.02		Oct. 1890	0.12	0.06
			Mar. 1903	*0.02*		Nov. 1890	0.12	0.05
			Apr. 1903	*0.01*		Dec. 1890	0.05	
			May 1906	*0.01*		Aug. 1891	0.19	0.12
			Nov. 1906	*0.08*		Sept. 1891	0.31	0.25
			Feb. 1907	*0.07*		Oct. 1891	0.12	0.06
			Mar. 1907	*0.06*		Feb. 1900	*0.05*	
			Nov. 1907	*0.25*	*0.13*	May 1900	*0.05*	
			Dec. 1907	*0.12*		July 1900	*0.02*	
			Feb. 1909	*0.04*		Aug. 1900	*0.01*	
			Nov. 1912	*0.03*		Oct. 1900	*0.05*	
						Nov. 1900	*0.06*	
						Jan. 1901	*0.07*	
						Jan. 1903	*0.05*	
						Feb. 1903	*0.12*	
						Mar. 1903	*0.14*	
						Apr. 1903	*0.11*	
						Apr. 1905	*0.02*	
						Jan. 1906	*0.04*	
						Feb. 1906	*0.16*	
						Mar. 1906	*0.11*	
						Apr. 1906	*0.20*	*0.01*
						May 1906	*0.05*	
						July 1906	*0.01*	
						Aug. 1907	*0.04*	
						Oct. 1907	*0.18*	0.01
						Nov. 1907	*0.14*	
						Dec. 1907	*0.07*	
						Jan. 1908	*0.05*	
						Nov. 1908	*0.14*	
						Dec. 1908	*0.10*	
						Jan. 1909	*0.16*	
						Oct. 1911	*0.12*	
						May 1914	*0.07*	
						June 1914	*0.11*	
						July 1914	*0.07*	
	0.15	0.15		0.06	0.13		0.11	0.09
	0.08	0.08		0.06	0		0.16	0.10
	0.19	0.19		0.06	0.13		0.09	0.01
	0.02–0.37	0.02–0.37		0.01–0.25	0.13		0.01–0.31	0.01–0.25

TABLE 57

Percentage Width of Exchange Rate Deviations from Gold Points, Postwar Period[a]

NEW YORK–LONDON		PARIS–LONDON		NEW YORK–BERLIN		BERLIN–LONDON		BERLIN–PARIS	
Date	*Per cent deviation*[b]	*Date*	*Per cent deviation*	*Date*	*Per cent deviation*	*Date*	*Per cent deviation*	*Date*	*Per cent deviation*
Sept. 1925	0.08	July 1930	0.12	Jan. 1927	0.03	Sept. 1925	0.07	July 1931	0.11 *0.07*[c]
Oct. 1925	0.15	Sept. 1930	0.04	Feb. 1927	0.25	Oct. 1925	0.17		
Nov. 1925	0.09	Nov. 1930	0.13	Mar. 1927	0.06	Nov. 1925	0.12		
Dec. 1925	0.01	Dec. 1930	0.17	Apr. 1927	0.12	Dec. 1925	0.07		
Nov. 1926	0.03	Mar. 1931	0.56 0.38[c]	May 1927	0.16	Aug. 1928	0.07		
Oct. 1928	0.02			June 1927	0.16	Sept. 1928	0.07		
Nov. 1928	0.02			Mar. 1929	0.03	Oct. 1928	0.07		
Jan. 1929	0.01			Apr. 1929	0.11	Nov. 1928	0.12		
June 1929	0.04			July 1931	1.94	Dec. 1928	0.07		
Aug. 1929	0.04					June 1929	0.17		
Sept. 1929	0.04					July 1929	0.07		
						Aug. 1929	0.07		
						Sept. 1929	0.07		
						May 1930	0.07		
						July 1931	*0.06*[d]		
Average per cent deviation	0.05		0.20		0.12[e]		0.09		
Average deviation of exchange rates from export points, second-named country	0.05		0.20		0.11		0.09		
Average deviation of exchange rates from export points, first-named country							0.06		
Range	0.01–0.15		0.04–0.56		0.03–0.25		0.06–0.17		

[a] See Table 54 for exact periods covered.
[b] Using median gold points as basis.
[c] Using maximum gold points as basis.
[d] See footnote c, Table 56.
[e] See footnote b, Table 56.

arrangement is the same as for Tables 53 and 54. The percentages are of course directly comparable with each other. At the bottom of each table the average differences are given, and the range of the percentages in each column.

The postwar situation is much simpler. There are only four pairs for which averages were computed. The maximum average for the medians, 0.20 per cent, is higher than any prewar average. It is furthermore the value for London, which occurs in three of the four series, in two of them as the sole violator. The only other money market is Berlin, with 0.66 per cent, against London. The maximum deviation, 0.56 per cent, is for London against Paris in March 1931 (0.38 per cent for the maximum gold points); it is one point higher than the prewar maximum deviation.

Therefore, when deviations occurred they were of not inconsiderable magnitude, and the fact that London appears so persistently is probably as good an indication of that market's difficulties as can be had. These difficulties, attributed to the "overvaluation" of sterling, have previously not been shown conclusively by other means, as e.g., by loss of gold, or deterioration in other items in the British balance of payments. Our statistics are a possible way of expressing them on the basis of a procedure that was not made up *ad hoc* but applied to a great variety of cases. The identification of the several hundred instances in Tables 53 and 54 or, respectively, in Tables 56 and 57 is important; the variations of the exchange rates can be brought into proper connection with other relevant data and the dates when these show at least as well-defined critical points.

(16) A further important fact, difficult to reconcile with the current views, is the *continuity of deviations* beyond the gold points. Frequently the rate of one currency would be beyond the gold export points for more than one month in succession. The deviation of a monthly average need not have been a deviation every day or week of that month. Likewise the same can be said if for several successive months a deviation of the average occurs. But the chances are that it represents a continuous condition and deeper lying disturbances. Table 58 shows these successive periods from two to seven months. There were, before 1914, not less than two six-month periods during which sterling and marks were each beyond gold export points. That is clearly so long, that friction and other minor circumstances cannot be applied to explain it. There even was one seven-month period with New York as the

TABLE 58

Number of Times Exchange Rates Deviated from Gold Points Continuously for Periods of Two to Seven Months, Prewar Period[a]

	MEDIAN GOLD POINTS AS BASIS			MAXIMUM GOLD POINTS AS BASIS		
	No.	*Months*	*Violators*[b]	*No.*	*Months*	*Violators*
7 months	1	7	New York	1	7	New York
6 months	1	6	London	0	0	
5 months	4	20	Paris (3)	2	10	Paris (2)
4 months	7	28	Berlin	1	4	Paris
3 months	19	57	Berlin (2)	5	15	Paris (4)
2 months	25	50	London (1)			New York
			Paris (3)	12	24	Berlin (2)
			New York (1)			Paris (6)
			Berlin (2)			New York (3)
			Paris (6)			London (1)
			New York (4)			
			London (7)			
			Berlin (8)			
			Paris (7)			
			New York (5)			
			London (5)			
Total	57	168		21	60	
Average	2.9 months			2.9 months		
Median	3 months			3 months		
Per cent of months that were continuous deviations of total deviations observed[c]	76.9					
			Postwar[d]			
7 months	0	0				
6 months	1	6	Berlin			
5 months	1	5	London			
4 months	3	12	London (3)			
3 months	0	0				
2 months	4	8	London (3)			
Total	9	31	Berlin (1)			
Average	3.4 months					
Median	4 months					
Per cent of months that were continuous deviations of total deviations observed[e]	75.6					

[a] See Tables 53 and 54 for periods covered.

[b] Number in parentheses indicates the number of times the place named violated the gold points.

[c] Number of deviations from median gold points, 215. Number of deviations from maximum gold points, 78.

[d] Only median gold points used. There were no continuous deviations from the maximum gold points.

[e] Postwar period: number of observed deviations, 41.

violator, February–August 1882. The total number of months is distributed over the four money markets (for prewar and postwar) in Table 59. (There were no continuous violations of maximum gold points after World War I.) It is again Paris scoring worst, with London a close follow-up.

TABLE 59

Number of Months that Comprised the Continuous Violations of the Gold Points, Prewar and Postwar

	NEW YORK		LONDON		BERLIN		PARIS		TOTAL	
	Pre-war	*Post-war*	*Pre-war*	*Post-war*	*Pre-war*	*Post-war*	*Pre-war*	*Post-war*	*Pre-war*	*Post-war*
Median	33		41	22	35	8	59		168	30
Maximum	14		2		4		39		59	

Section 9. A Special Case

(17) Carl Heiligenstadt's investigation into the German-British balance of payments and the theory of foreign exchange[55] had the immediate purpose of determining to what extent the assertion by Viscount Goschen and others was correct that the Reichsbank would not always part with gold while the Bank of England always would when circumstances demanded.

Tables 60 and 61 give two time series, one each for the gold import point for London, and for the gold import point for Berlin for the year 1890, which is incidentally the year of the Baring crisis, for many reasons one of the most interesting and important economic disturbances of the late nineteenth century.[56] The most strik-

[55] Carl Heiligenstadt, "Beiträge zur Lehre von den auswärtigen Wechselkursen," 3 parts, *Jahrbücher für Nationalökonomie und Statistik*, 3rd Series, Vols. IV–VI, 1892–1893.

[56] This interest is partly due not only to the cooperation of the Bank of England with the domestic banks, but to the support it found in the Banque de France and the Russian Treasury, both of which pledged gold. A detailed account is given in Sir J. Clapham, *The Bank of England*, Cambridge, 1944, Vol. II, Chapter VII.

These series were transcribed from a graph, since the author does not publish the figures from which it was constructed; nor was it possible to reconstruct the figures from their component parts, which is hardly surprising when one recalls the many small items that enter into a gold point. Nor can the transcription be entirely accurate. Nevertheless the tables prove of great interest because of the apparent absence of similar undertakings. The variations of the gold points within such very small time intervals as two or three days are

ing feature brought out by Heiligenstadt is unquestionably the fact that the two separate notations of each of the two gold points give significantly different results (Tables 62 to 64). Table 63 shows the gold point for London reached only twice and passed thirteen times, 0.22 and 1.40 per cent respectively out of 929 observations. Practically the same percentages should have been recorded in London for the London import point; but instead the percentages were 2.79 and 6.72 respectively. In the preceding table the contrast is not quite so great but still significant.

As to be expected, the import point of gold was reached and passed in twice as many per cent in Berlin as the equivalent export point in London. The percentages are very much larger in each case on Table 62 than on Table 63. Although this is in itself not a guarantee of larger gold flows toward Berlin than toward London, that is indeed what happened, as the last columns in both tables show.

It is interesting to note that, as Table 62 shows, gold moved to Germany in great quantities even when the exchange rate in London did not nearly as often reach or pass the gold export point as sterling fell in Berlin to the gold import point there. So it could be argued that the London mark rate was not as characteristic and sensitive as the sterling rate in Berlin. This is Heiligenstadt's thought. But it could equally be argued that generally the export points are not so favorable to gold movements as are the corresponding country's import points—with which they should be identical for all practical purposes. The same is to be observed, *mutatis mutandis*, on Table 63. Such could easily be the consequence of central bank intervention, gold premium, etc., that are not considered in establishing the other country's gold import point. This serves again to illustrate the great complexity of the situation, shows with what care statements in this field must be qualified, and how difficult it is to establish what the facts actually were.

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chiefly due to the changes in the interest rate which Heiligenstadt considered. It was the rate charged in London for "floating money," in other terms the call money rate. Another variable item was the London price of gold bullion; for Germany a gold price 1/2 d. higher was taken than the London quotation (*op. cit.*, Vol. IV, 1892, pp. 838–839). So there are two variable factors and it is noteworthy that we nevertheless find periods of over two months *in succession* in which the almost daily quotations remain unchanged. Costs of transportation and insurance were kept constant, as is probable for as short a period as one year. We know that these items remained the same even over years.

TABLE 60

Germany–England, Gold Import Point for London, 1890

(*marks per £*)

Parity = 20.4294 M

Date	Gold import point	Date	Gold import point	Date	Gold import point	Date	Gold import point	Date	Gold import point	Date	Gold import point
Jan.		Feb.		Mar.		Apr.		May		June	
2	20.505	1	20.515	1	20.504	1	20.495	1	20.490	1	20.475
4	20.505	4	20.515	4	20.504	3	20.495	3	20.490	3	20.475
7	20.505	6	20.515	6	20.504	5	20.495	6	20.490	5	20.475
9	20.505	8	20.515	8	20.504	8	20.495	8	20.475	7	20.475
10	20.505	11	20.515	11	20.504	10	20.495	10	20.475	10	20.475
14	20.505	13	20.515	13	20.504	12	20.495	13	20.475	12	20.480
16	20.515	15	20.515	15	20.504	15	20.495	14	20.475	14	20.480
18	20.515	18	20.515	18	20.504	17	20.490	17	20.495	17	20.480
21	20.515	20	20.515	22	20.504	19	20.490	20	20.495	19	20.470
23	20.515	22	20.515	25	20.504	22	20.490	22	20.485	21	20.470
25	20.515	25	20.515	27	20.504	24	20.485	24	20.485	24	20.470
28	20.515	27	20.515	29	20.504	26	20.485	27	20.485	26	20.480
30	20.515					29	20.485	29	20.480	28	20.480
								31	20.480		
Monthly average	20.510		20.515		20.504		20.492		20.484		20.476
July		Aug.		Sept.		Oct.		Nov.		Dec.	
1	20.486	2	20.510	1	20.505	2	20.510	1	20.485	2	20.490
3	20.486	5	20.510	4	20.505	4	20.510	4	20.485	4	20.490
5	20.486	7	20.510	6	20.505	7	20.510	6	20.500	6	20.490
8	20.486	9	20.510	9	20.505	9	20.510	8	20.500	9	20.490
10	20.486	12	20.510	11	20.505	11	20.510	11	20.500	11	20.455
12	20.486	14	20.510	13	20.505	14	20.510	13	20.500	13	20.455
15	20.486	16	20.510	16	20.505	16	20.500	15	20.500	16	20.455
17	20.486	19	20.510	18	20.505	18	20.500	18	20.500	18	20.480
19	20.486	21	20.510	20	20.505	21	20.500	20	20.490	20	20.480
22	20.486	23	20.510	23	20.505	23	20.500	22	20.490	23	20.445
24	20.505	26	20.510	25	20.505	25	20.500	25	20.490	27	20.445
26	20.505	28	20.510	27	20.505	28	20.500	27	20.510	30	20.445
29	20.505	30	20.510	30	20.505	30	20.485	29	20.510		
31	20.505										
Monthly average	20.491		20.510		20.505		20.503		20.497		20.468

Yearly average	20.496	Standard deviation	0.084
Median	20.505	Maximum gold point base	0.585%
Range	20.445–20.515		

Source: *Jahrbücher für Nationalökonomie und Statistik*, 3rd series, vol. 4, 1892, pp. 817 ff. Translated from graph. The figures themselves are not given, but our averages, median, and range. No further source indicated, but cf. comment in the text.

TABLE 61

Germany–England, Gold Import Point for Berlin, 1

(*marks per £*)

Date	Gold import point	Date	Gold import point	Date	Gold import point	Date	Gold import point	Date	Gol imp poi
Jan.		Feb.		Mar.		Apr.		May	
2	20.375	1	20.385	1	20.385	1	20.385	1	20.3
4	20.375	4	20.385	4	20.385	3	20.385	3	20.3
7	20.375	6	20.385	6	20.385	5	20.385	6	20.3
9	20.375	8	20.385	8	20.385	8	20.385	8	20.3
10	20.375	11	20.385	11	20.385	10	20.385	10	20.3
14	20.375	13	20.385	13	20.385	12	20.385	13	20.3
16	20.385	15	20.385	15	20.385	15	20.385	14	20.3
18	20.385	18	20.385	18	20.385	17	20.379	15	20.3
21	20.385	20	20.385	20	20.385	19	20.379	16	20.3
23	20.385	22	20.385	22	20.385	22	20.379	17	20.3
25	20.385	25	20.385	25	20.385	24	20.375	20	20.3
28	20.385	27	20.385	27	20.385	26	20.375	22	20.3
30	20.385			29	20.385	29	20.375	24	20.3
								27	20.3
								29	20.3
								31	20.3
Monthly average	20.380		20.385		20.385		20.381		20.3
July		Aug.		Sept.		Oct.		Nov.	
1	20.365	2	20.385	1	20.385	2	20.385	1	20.3
3	20.365	5	20.385	4	20.385	4	20.385	4	20.3
5	20.365	7	20.385	6	20.385	7	20.385	6	20.3
8	20.365	9	20.385	9	20.385	9	20.385	8	20.3
10	20.365	12	20.385	11	20.385	11	20.385	11	20.3
12	20.365	14	20.385	13	20.385	14	20.385	13	20.3
15	20.365	16	20.385	16	20.385	16	20.375	15	20.3
17	20.365	19	20.385	18	20.385	18	20.375	18	20.3
19	20.365	21	20.385	20	20.385	21	20.375	20	20.3
22	20.365	23	20.385	23	20.385	23	20.375	22	20.3
24	20.385	26	20.385	25	20.385	25	20.375	25	20.3
26	20.385	28	20.385	27	20.385	28	20.375	27	20.3
29	20.385	30	20.385	30	20.385	30	20.365	29	20.3
31	20.385								
Monthly average	20.371		20.385		20.385		20.379		20.3

Yearly average	20.376	Minimum gold point base	
Median	20.385	Standard deviation	
Range	20.320–20.385	Per cent width of yearly avera	

Source: Carl Heiligenstadt, *Jahrbücher für Nationalökonomie und Statistik*, 3r 1892, p. 843.

TABLE 62

Gold Points for Berlin and Movement of Exchange Rates in Berlin and London, 1886–1891

YEAR	IN BERLIN					IN LONDON					IN BERLIN AND LONDON TOGETHER						Gold movement to Germany from England £
	No. times exchange rate observed	GOLD POINT FOR BERLIN: Reached No.	Reached %	Passed No.	Passed %	No. times exchange rate observed	GOLD POINT FOR BERLIN: Reached No.	Reached %	Passed No.	Passed %	No. times exchange rate observed	GOLD POINT FOR BERLIN: Reached No.	Reached %	Passed No.	Passed %	Gold point reached and passed No.	Gold point reached and passed %	
1886	155	5	3.23	27	17.42	103	—	—	22	21.36	258	5	1.94	49	18.99	54	20.93	634,108
1887	156	12	7.69	70	44.87	102	2	1.96	24	23.53	258	14	5.43	94	36.43	108	41.86	2,627,619
1888	154	13	8.44	40	25.97	102	—	—	29	28.43	256	13	5.08	69	26.95	82	32.03	1,182,882
1889	154	3	1.95	17	11.04	100	—	—	7	7.00	254	3	1.18	24	9.45	27	10.63	334,476
1890	155	17	10.97	52	33.55	101	2	1.98	4	3.96	256	19	7.42	56	21.88	75	29.30	1,634,020
1891	155	13	8.39	81	52.26	102	1	0.98	9	8.82	257	14	5.45	90	35.02	104	40.47	6,375,271
Total	929	63	6.78	287	30.89	610	5	0.82	95	15.57	1,539	68	4.42	382	24.82	450	29.24	

Source: Carl Heiligenstadt, *Jahrbücher für Nationalökonomie und Statistik*, 3rd series, vol. 4, 1892, p. 843.

TABLE 63

Gold Points for London and Movement of Exchange Rates in Berlin and London, 1886–1891

	IN BERLIN					IN LONDON					IN BERLIN AND LONDON TOGETHER							
		GOLD POINT FOR LONDON:					GOLD POINT FOR LONDON:					GOLD POINT FOR LONDON:						
	No. times exchange rate	*Reached*		*Passed*		*No. times exchange rate*	*Reached*		*Passed*		*No. times exchange rate*	*Reached*		*Passed*		*Gold point reached and passed*		*Gold movement to England from Germany*
YEAR	*observed*	*No.*	*%*	*No.*	*%*	*observed*	*No.*	*%*	*No.*	*%*	*observed*	*No.*	*%*	*No.*	*%*	*No.*	*%*	£
1886	155	—	—	—	—	103	—	—	—	—	258	—	—	—	—	—	—	39,375
1887	156	—	—	—	—	102	4	3.92	4	3.92	258	4	1.55	4	1.55	8	3.10	28,357
1888	154	—	—	9	5.84	102	5	4.90	11	10.78	256	5	1.95	20	7.81	25	9.77	216,272
1889	154	2	1.30	3	1.95	100	7	7.00	8	8.00	254	9	3.54	11	4.33	20	7.87	186,443
1890	155	—	—	—	—	101	1	0.99	9	8.91	256	1	0.39	9	3.52	10	3.91	204,040
1891	155	—	—	1	0.65	102	—	—	9	8.82	257	—	—	10	3.89	10	3.89	458,241
Total	929	2	0.22	13	1.40	610	17	2.79	41	6.72	1,539	19	1.23	54	3.51	73	4.74	

Source: Carl Heiligenstadt, *Jahrbücher für Nationalökonomie und Statistik*, 3rd series, vol. 4, 1892, p. 844.

TABLE 64

Times When German Exchange Rate Reached and Exceeded Gold Import or Export Points, 1896–1910

YEAR	LONDON (8 days, from 1909 sight)			PARIS (8 days, from 1909 sight)			NEW YORK (sight)		
	Number of quotations	*On or below theoretical gold import point of 20.34*	*On or above theoretical gold export point of 20.50*	*Number of quotations*	*On or below theoretical gold import point of 80.60*	*On or above theoretical gold export point of 81.40*	*Number of quotations*	*On or below theoretical gold import point of 416.80*	*On or above theoretical gold export point of 421.875*
1896	156	—	—	156	2	—	149	11	—
1897	157	—	—	157	—	—	138	—	—
1898	156	—	22	156	—	—	145	—	30
1899	156	—	19	156	—	—	143	—	—
1900	157	—	48	157	—	94	142	—	8
1901	155	—	—	155	—	18	143	—	—
1902	157	—	—	157	—	40	149	—	—
1903	157	—	21	157	—	50	154	—	9
1904	157	2	6	157	—	21	155	—	—
1905	156	—	—	156	—	50	156	—	—
1906	157	—	42	157	—	87	157	—	15
1907	156	—	77	156	—	74	156	—	32
1908	157	—	5	157	—	57	157	—	—
1909	305	—	40	305	—	33	157	—	—
1910	304	—	27	304	—	—	156	—	—
	2,643	2	307	2,643	2	524	2,257	11	94

Source, *Die Reichsbank 1912*, Table 82, p. 212. The gold points are those of the Reichsbank.

Section 10. Summary

(18) In this chapter we have dealt with the concept of the international solidarity of money markets. This has necessitated exploring the foreign exchange rates (including the gold points) as the main expression of such contact.

In the course of this study, we have also been able to observe certain characteristics of the rates. The seasonal pattern was determined, as well as other, more durable factors. Our study verified the weakness of the dollar in the pre-World-War-I years, and the sterling difficulties of the interwar period. These rates were further studied by examining the crossrates used for arbitrage purposes, where "violations" were noted, particularly in the Berlin–Paris rate via New York (in the pre-World-War-I years).

A further study of violations, including the incredible phenomenon of exchange rates often and persistently beyond the gold points, enabled us to isolate periods of international financial tension. In general Paris and Berlin were the violators before World War I, and London and Berlin in the interwar period. Thus it was possible to verify observations from other sources that the authorities in these centers had intervened, or that these were periods of stress.

In the next two chapters we shall pursue this objective further, bringing in the influence of the interest rate. The measurement of international stress combines these strands—exchange rates, gold points, and interest rates—giving a statistical test of this elusive concept.

Appendix. Description of the Data

Here are the descriptions, as needed, of the six foreign exchange series which have been chosen. The choice was simple, since there is essentially only one exchange rate between two countries, that is, one only for "spot" quotations. Sometimes there is a futures market besides. Our monthly data are, practically, spot prices of currencies.

Great care was taken in each case to assure, as far as technically possible, that the rates were actual market rates, i.e., that they arose from genuine large scale business transactions. To be distinguished from these are the "posted" rates, which are usually slightly higher. These are maximal rates announced in the respective money

markets by leading international banks; they were used only occasionally and for smaller individual transactions.[1]

These are the six series:[2]

(a) *Paris on London:* units are French francs. The data represent the French "cheque" exchange, which up to November 1887 was called "French short exchange." The sources were: for 1877–1898 and 1909–1914, the *Economist;* for 1899–1908, the *National Monetary Commission's* "Statistics for Great Britain, Germany and France, 1867–1909" (Washington, 1910), pp. 70–74. The data are monthly averages and, when taken from the *Economist,* are computed on the basis of Saturday quotations; the number of Saturdays in the month were used in determining the average. The post-World-War-I rates are taken from the *London and Cambridge Economic Service,* which calculates the monthly averages from official daily average quotations, which come from Reuters. Up to June 24, 1928, parity was 25.221 fc, thereafter 124.21 fc for the pound sterling.

(b) *Berlin on London:* units are marks, after 1925 Reichsmarks. The data represent German short exchange. The sources were as above under (a) and the computation of the monthly average was the same also. The post-World-War-I data are from the *London and Cambridge Economic Service;* they are calculated as above under (a). There was no change in the parity: 20.430 RM (after the war the German mark was called Reichsmark).

(c) *New York on London:* units are dollars. The data prior to August 7, 1886 represent New York short exchange calculated from the sixty-day rate at the current rate of discount, as stated by the *National Monetary Commission, loc. cit.;* after that date they are the New York Exchange "cable transfers." The monthly averages were computed from rates quoted weekly. The sources are as under (a). The post-World-War-I data are from the *Federal Reserve Bulletin.* They are based on noon buying rates for cable transfers

[1] Cf. A. H. Cole, "Seasonal Variation in Sterling Exchange," *Journal of Economic and Business History,* Vol. 2, 1929, pp. 203–218. This paper refers to the New York on London rate; the data used there go back to 1825. Cole states, pages 214–215, that "we are justified in viewing the whole series of sight rate data from 1865 onward as substantially homogeneous." The remark above in the text refers not only to the New York–London exchange. We have carried the principle of using actual rates to all exchange rates and, as a matter of fact, to all our data wherever a similar situation might arise.

[2] The first three series could be inverted in name; but this is immaterial, since wherever London is involved there is only one single way of stating the exchange rate. It is never stated in terms of pounds sterling.

in New York as determined by the New York Federal Reserve Bank. There was no change in parity after the reintroduction of the gold standard in England (1925).

(d) *Berlin on New York:* units are marks (or Reichsmarks) per $100 for sight draft. Quotations begin at the Berlin Stock Exchange, March 1887. The original source is the *Deutscher Reichsanzeiger*, which publishes daily official quotations, from which the monthly averages were computed as published up to 1894 in *Vierteljahrshefte für Statistik des Deutchen Reiches*, and from 1895–1914 in *Statistisches Jahrbuch für das Deutsche Reich*. As an alternative source for 1888–1907, Volume 21 of the publications of the *National Monetary Commission* may be consulted.

For the post-World-War-I period the inverted series of New York rates on Berlin was used. The data are monthly averages of daily rates for cable transfers in cents per Reichsmark. They are taken from the *Federal Reserve Bulletin*, which obtains them from the New York Federal Reserve Bank. Parity is 23.82 cents per Reichsmark or 419.81 RM per $100.

(e) *Berlin on Paris:* units are marks (or Reichsmarks) per 100 francs for eight-day drafts. Original and secondary sources are the same as in (d), with the same alternative source for 1888–1907. Beginning March 1909 official quotations for sight draft on Paris became available for every business day. This new series was used to check the other for the last five years before 1914 since the eight-day draft declined in importance, but both series moved closely together. The monthly averages for 1876–1884 and 1910–July 1914 were computed by the National Bureau of Economic Research on the same basis as the data for the intervening years, as compiled by the *Statistisches Reichsamt*. The post-World-War-I series are for sight drafts. These data are taken from the *Konjunkturstatistisches Handbuch* (Berlin, 1936) for 1925–1935; thereafter from the *Vierteljahrshefte zur Konjunkturforschung*. They are monthly averages of official daily quotations. The reader is reminded of the value, or rather lack of it, of German official quotations of foreign currencies due to the regime of exchange control. These data are essentially duplicated in the *Federal Reserve Bulletin* for the inverse relationship. The parity was 81.00 RM before June 1928, thereafter 16.447 RM per 100 fc.

(f) *Paris on New York:* units are francs, paid up to January 1877 for three-day drafts, thereafter for the demand (or sight, or short) draft. These different names covered however the same draft, as

can be concluded from the *Commercial and Financial Chronicle*, which was the source of this series. The monthly averages were computed by the National Bureau for the major part from rates for all Fridays, but prior to 1890 from all rates available, when rates could not be obtained for all Fridays. Beginning with November 14, 1902 all rates are definitely actual market rates, while before that date only posted rates are available.[3] When upper and lower limits of posted or actual rates are given, as is the case from the third Friday in August 1885 on, then our rates are based on the arithmetic average of these two quotations. The margin between the highest and the lowest quotations is at the beginning usually $\frac{5}{8}$ centime (slightly over 0.1 per cent of the average rate) and drops to as little as $\frac{1}{32}$ centime 0.007 per cent of the average rate) at the end of the prewar series. Incidentally this serves to show the smallness of variations involved, and it can only be repeated that, though they are of concern for operators in the arbitrage business, these differences become quite unimportant for most statistical purposes.

For the period after World War I it was found best to take the inverted series. Thus we have American cents per franc for cable transfers, the check transfers having declined in importance to such an extent that publication of check rates was stopped by the *Commercial and Financial Chronicle* in May 1934. The monthly averages, taken from the *Federal Reserve Bulletin*, are based on noon buying rates, as determined by the New York Federal Reserve Bank. Parity was established at 3.92 cents in June 1928, and at 6.623 cents in February 1934; the first equalled to 25.51 francs per dollar, the second to 15.1 francs. The prewar parity had been 5.183 francs per dollar. The monthly averages used are computed by the Federal Reserve Bank of New York.

[3] About the difference between actual and posted rates, cf. above, page 277 and footnote 1.