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Flexible Exchange Rates in
Historical Perspective

Peter Bernholz

INTERNATIONAL FINANCE SECTION
DEPARTMENT OF ECONOMICS
PRINCETON UNIVERSITY

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There were no marks to be had in Strasbourg . . . so we changed some French money in the railway station at Kehl. For 10 francs I received 670 marks. Ten francs amounted to about 90 cents in Canadian money. That 90 cents lasted Mrs. Hemingway and me for a day of heavy spending and at the end of the day we had 120 marks left!

*Ernest Hemingway*¹

. . . and thus hordes [of Bavarians] went over [to Salzburg] with wives and children to indulge in the luxury of guzzling as much beer as their bellies could hold. . . . But the happy Bavarians did not know that a terrible revenge was approaching. For when the [Austrian] crown stabilized and the mark plummeted downward in astronomical proportions, the Austrians went over [to Bavaria] from the same railway station in their turn. The same performance began a second time, but in the opposite direction.

*Stefan Zweig*²

1 INTRODUCTION

After many industrialized countries moved to flexible exchange rates in 1973, nearly all economists were caught by surprise when exchange rates were not only very volatile but for months and years were out of line with purchasing-power parities. Around 1976, for example, large undervaluations developed for the British pound and the Italian lira, while the Swiss franc and the German mark became overvalued (see Table 8 in Chap. 9). (Whenever I speak of under- or overvaluation, I mean the following: Let e be the spot exchange rate in domestic currency units per unit of foreign currency, p the domestic price level, p^* the foreign price level, and a a constant resulting from transport costs, import duties, higher prices of services because of higher per capita incomes, etc. Then absolute purchasing-power parity holds if $p = ep^* + a$. Using hats to indicate rates of change, relative purchasing-power parity is defined as $\hat{p} = \hat{e} + \hat{p}^*$. The first equation implies the second if $a = 0$ but not vice versa. Relative under- or overvaluation of the domestic currency as compared with some basic period is present if $\hat{e} \cong \hat{p} - \hat{p}^*$. Under- or overvaluation develops if the exchange rate moves upward or downward from the base period faster than the difference between the changes in the domestic and foreign price levels. This phenomenon has been referred to as "overshooting" in the theoretical literature on foreign exchange rates.)

I am grateful to Ronald McKinnon, Charles Kindleberger, and John Bilson for their comments.

¹ *Toronto Daily Star*, 1921. Quoted by Fergusson (1975, p. 92).

² Zweig (1944, pp. 336-337), my translation. I owe the reference to Zweig to R. Gann, The Hoover Institution, Stanford University.

The unexpected exchange-rate fluctuations and trends posed a problem for economists, and, not surprisingly, several dynamic models were developed to explain this overshooting compared with purchasing-power parities (see, e.g., Dornbusch, 1976; Calvo and Rodriguez, 1977; Niehans, 1977).

It is not my purpose to discuss these models or the econometric models that were estimated following them (see, among others, Artus, 1976; Driskill, 1981; and Bernholz and Kugler, 1980). The empirical base for econometric work is still somewhat narrow, since flexible exchange rates were not introduced in most industrialized countries until 1973. It should therefore be helpful to look instead at experiences with flexible exchange rates in earlier periods and for different countries and at the analyses by contemporaneous Continental European economists who studied the relationships of flexible exchange rates (often aptly described at that time as inconvertible paper currencies) to gold and silver currencies. The results are remarkable:

1. The phenomenon of overshooting was common to all the periods and currencies considered, from the mid-eighteenth century up to the twentieth century.

2. Purchasing-power parity more or less reasserted itself in the long run, but the long run sometimes meant ten to twenty years.

3. In all the cases considered, a higher inflation rate in one country relative to its trading partners led to an undervaluation of its currency. The exchange rate depreciated faster than the difference between the changes in domestic and foreign price levels. The degree of undervaluation was usually roughly correlated to the size of the difference between the inflation rates.

4. Undervaluation vanished either when the country with the undervalued currency ended its faster monetary expansion or when it inflated its currency beyond hope (which usually led to hyperinflation).

5. In most cases, exchange rates and relative price levels (domestic divided by foreign) rose more slowly than relative money supplies. Only in the last phases of very large growth in the domestic money supply (especially during hyperinflations) did relative prices and, to a lesser degree, exchange rates increase more rapidly.

6. Nearly all these results were well known to several economists who studied these phenomena at the time and showed remarkable insight into their nature.

In what follows, historical events and contemporary economists' interpretations of them are presented chronologically, in order to make clear the perspectives available to those economists. The discussion neglects the works of English economists, especially at the time of the Napoleonic Wars when the British pound became inconvertible. Not only have the contributions of Thornton, Ricardo, Tooke, and others been widely discussed and appre-

ciated, but these economists did not analyze the phenomenon of overshooting or the events related to it.

The measurement of overshooting presents two inherent difficulties—the selection of a price index and the selection of a base period. The choice of the index could affect the findings. For example, overshooting might appear when measured by a cost-of-living index but be absent when measured by a wholesale-price index. In the earlier historical cases, there was no choice: only one index was available and sometimes only one important price (such as rye flour in the case of Russia). When different indices were available, however, overshooting was found to be present whichever index was used. It was most pronounced when wage and salary indices were used; it was smaller with wholesale-price indices than with cost-of-living or consumer-price indices. The selection of an adequate base period proved to be easier than expected. An exceptionally rapid increase in the money supply—often at the start of a war or a revolution—always marked a clear historical break that could be used to choose a base year.

2 THE SCHOOL OF SALAMANCA IN THE SIXTEENTH CENTURY

Strong movements in exchange rates are usually thought of only in connection with the use of paper currency or demand deposits. But exchange-rate movements have occurred in other situations. First, there have been fluctuations in exchange rates between coins minted from different metals, like gold, silver, and copper, when the relative prices of these metals changed. For example, from the evidence presented by Cipolla (1952, esp. pp. 13-26), it appears that phases of under- and overvaluation occurred in the state of Milan between 1580 and 1700, when token money minted from different metals for different denominations was the most important medium of exchange for daily domestic transactions, while gold and silver moneys were used for all international transactions. The parities between token money and gold and silver moneys were neither legally fixed nor kept fixed in fact by the monetary authorities. Exchange rates between them were therefore flexible, with consequences similar to those described below for paper money. Second, exchange rates between coins of the same nominal value and the same metal have changed when the metal content was changed. Finally, and most important for monetary and exchange-rate theory, coins minted from the same metal with the same metal content have traded at fluctuating rates when they were in different locations, as happened in the sixteenth century.

At the end of the fifteenth century, gold and silver began to flow from Spanish America to Seville and from there flowed slowly to Santiago de Compostela, to France, and to Flanders. As Grice-Hutchinson (1952, pp. 52-58) has pointed out, this development led to the first formulation of the purchasing-power-parity theorem by theologians at the School of Salamanca in Spain. In 1556 one of these theologians, Martin de Azpilcueta Navarro, described the process as follows:

Still later, when the money of a particular country came to be worth less there than abroad (as today nearly all the gold and silver of Spain is worth less in Spain than in Flanders and France), there came into being the art of exchange, which is the art of giving and taking one kind of money in exchange for another. In this way money began to pass from places where it was worth less to those where it was worth more. Thus, in our own day many people have greatly increased their fortunes by carrying to Flanders and France ducates of two, four, and ten, some in kegs as though they were olives, others in barrels hidden in the wine, on each of which they make a big profit; and they bring merchandise from abroad which

is worth little there and here much . . . (translated by Grice-Hutchinson, 1952, p. 90).

So much for the facts. Here is Navarro's explanation:

Now, we maintain that the value of the two monies may diverge for one of eight reasons: . . . Seventh, because of scarcity and need. . . . As to the seventh respect which causes money to rise or fall in value (namely, whether it is scarce and greatly needed, or abundant), money is worth more when and where it is scarce than where it is abundant.

Second, and of great importance, that all merchandise becomes dearer when it is in great demand and short supply, and that money insofar as it may be sold, bartered, or exchanged by some other form of contract, is merchandise and therefore also becomes dearer when it is in great demand and short supply.

Third, that (other things being equal) in countries where there is a great scarcity of money all other saleable goods, and even the hands and labor of men, are given for less money than where it is abundant. Thus we see by experience that in France, where money is scarcer than in Spain, bread, wine, cloth, and labor are worth much less. And even in Spain, in times when money was scarcer, saleable goods and labor were given for very much less than after the discovery of the Indies, which flooded the country with gold and silver (translated by Grice-Hutchinson, 1952, pp. 91-95).

There is no need to add much to these quotations, since they clearly amount to a formulation of the purchasing-power-parity theorem in its absolute version. Navarro states that the price level p in Spain is higher than the level p^* in France, and this causes the values of the two moneys to diverge. In this context, divergence refers to the rate of exchange between coins of the same gold or silver content. If no divergence were present, the exchange rate between two gold or two silver coins would be 1. Now, setting $a = 0$ in the formula $p = ep^* + a$, so that $e = p/p^*$, a divergence of e from 1 will occur if $p \neq p^*$. This is exactly what Navarro asserts.

Navarro's formulation is correct but raises one problem. We know from the theory of the pure gold standard that when there is sufficient competition exchange rates should not move beyond the limits given by the gold-export and gold-import points. We must therefore conclude from the quotations above that one or both of two phenomena were responsible for the high discounts on gold and silver in Seville as compared with France and Flanders: (1) Transportation costs and risk were substantial and competition was not too pronounced in the sixteenth century; (2) gold arbitrage from Spain to France and Flanders took a long time, so that the constant inflow of gold and silver from America kept them plentiful in Spain. In the former case, there would be a big spread between the gold-export and gold-import

points. In the latter case, a disequilibrium exchange rate might persist for a long time, with the rate in Flanders or France remaining above the gold-export point for Seville. Both explanations seem reasonable at first glance. If the latter explanation is valid, however, we would expect to find discrepancies from purchasing-power parity. We will see that such discrepancies can be identified in later episodes.

3 EXCHANGE-RATE THEORY IN EIGHTEENTH-CENTURY SWEDEN

During the eighteenth century, the Swedish Riksbank began to issue daler bank notes. The quantity in circulation was kept within certain limits from 1745 to 1755, but began to increase rapidly when Sweden entered the Seven Years' War in 1756. It grew from 6.9 million dalers in 1745 to 13.7 million in 1755, then surged to 20.9 million in 1756 and to 44.6 million in 1762. With the end of the war in 1763 and a change in government in 1765 from the inflationary Hat Party to the deflationary Cap Party, the amount decreased rapidly to 32.2 million in 1768. In 1777, bank notes, which had been inconvertible since 1745, became convertible into specie again, and the era of the Swedish paper daler came to an end. (For a full account, see Eagley, 1971, on which my summary relies.)

As we would expect, prices increased and the daler depreciated strongly during the first half of the period. The movements were reversed during the second half (see Figure 1). Three conclusions are immediately obvious. First, the money supply rose faster than the exchange rate, and the exchange rate rose faster than the price level. As I have used the exchange rate on Hamburg to measure the depreciation of the daler, and Hamburg was on a pure silver standard, it is safe to take p^* as constant. Purchasing-power parity would then require \hat{e} to equal \hat{p} , but \hat{e} is larger than \hat{p} . Thus our second conclusion is that the Swedish inflation produced an undervaluation of the daler. Finally, when the money supply decreased, the exchange rate on Hamburg fell more rapidly than the general price level, eliminating the undervaluation of the daler and restoring relative purchasing-power parity after thirteen years. We will find these same patterns in all similar cases that we look at later.

The hero of this story from the point of view of economic theory was the contemporary Swedish economist, P. N. Christiernin. Let us see what he had to say about the phenomena emphasized in my introduction. Writing in 1761, Christiernin saw quite clearly that the depreciation of the paper daler was caused by the growth of the money supply:

The current trend of the price of foreign exchange in Sweden must originate in factors unique to the domestic scene since we find examples of such a rapid and uninterrupted rise neither in earlier times nor in other lands. In other countries, the exchange rate cannot rise higher than the cost of exporting specie. . . . But here in Sweden the price of foreign exchange rises uninterruptedly. We cannot set a boundary above which it may not rise. . . . In terms of silver and gold, the exchange rate is about the same (translated by Eagley, 1971, p. 62).

The proposal has been made to lower the price of foreign exchange and the price of specie in terms of bank notes by increasing the bank-loan rate of interest, thereby reducing the amount of bank notes in circulation. This measure would doubtless appreciate the value content of the monetary unit . . . (p. 92).

Christiernin was well aware of the dynamic adjustment process initiated by a change in the money supply:

If money which had once been in circulation is drained abroad or hoarded in a chest, it is clear that that portion of goods and services that loses its market must also disappear from the market because of permanently reduced demand. . . . The population and its industriousness must then subsequently diminish until the scarcity of commodities sets them into equilibrium with the money supply circulating in the economy. Because of this, the community suffers more when a portion of the money supply is withdrawn from circulation than if the money had never come into circulation in the first place. In view of the fact that bank notes are the main component in our money supply, they could not be reduced without causing the same changes and dislocations . . . (pp. 86-87).

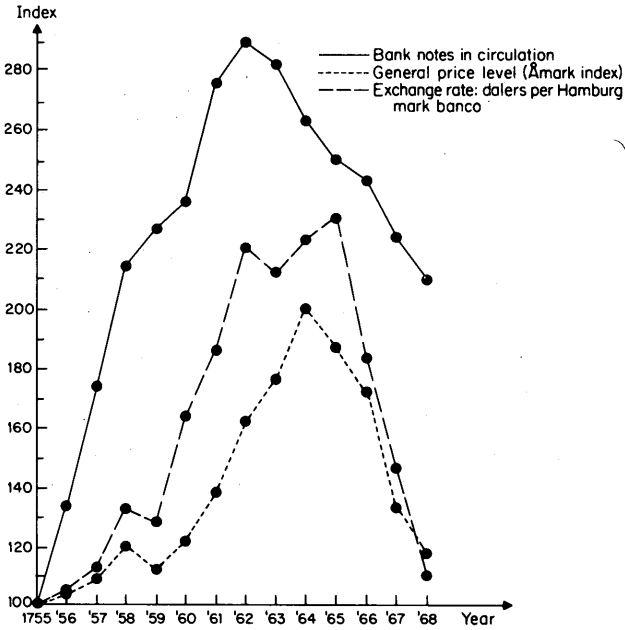
Christiernin does not seem to have known or reinvented the purchasing-power-parity theorem, but he came rather close in this formulation: "Goods are bought and sold between nations as if the exchange rate did not exist. Pig iron in Stockholm is sold for just as many daler at home as abroad—regardless whether the exchange rate is high or low" (p. 82). Unfortunately, we cannot decide from Christiernin's writings whether he had in mind the law of one price or the more general purchasing-power-parity theorem. To complicate matters, Christiernin makes this statement:

The high price of foreign exchange occasions high prices of foreign exchange for only imports and exports. Accordingly, those who have exportable commodities benefit, while those who consume imported goods suffer. . . . From all this it is clear that the increase in the exchange rate tends to increase exports and decrease imports and in the process automatically turns the balance of trade from deficit to equilibrium. When the high exchange rate makes foreign finished or unfinished goods . . . more expensive in Sweden, domestic producers begin to supply the market. Because a high exchange rate raises the price of all imported goods, it must increase the export of all types of goods and work. On the other hand, the high exchange rate cannot help but reduce the import of foreign goods (pp. 84-85).

Here we seem to have a contradiction. If the purchasing-power-parity theorem were true, the domestic price level should have risen by the same percentage as the exchange rate, affording no stimulus to exports and no discouragement of imports. Or was Christiernin trying to say that purchasing-power parity holds in a kind of long-run equilibrium while dealing, in the quotation above, with a dynamic short-term or medium-term equilib-

FIGURE 1

INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN SWEDEN, 1755-68



SOURCE: Eagley (1971, Appendices A-C, pp. 115-117).

rium? As the context does not seem to support this interpretation, it would be best to conclude that Christiernin did not spot the contradiction or did not see clearly the way to resolve it.

If we impose a dynamic interpretation on the last quotation, we would expect to find an undervaluation of the Swedish currency, stimulating exports and discouraging imports. If Sweden was close to purchasing-power parity in 1755, the data in Figure 1 conform to expectation; the daler appears to have been undervalued from 1755 through 1765. It is obvious in any case that the daler was undervalued for some significant part of the period, because the exchange rate rose so much faster than the price level, while foreign prices were stable. Note that the exchange rate rose in almost every year of this period, and that the difference between the rise in the exchange rate and the rise in the price level became greater and greater until 1762. The difference decreased only after the exchange rate fell, and it increased once more after the exchange rate rose again. These regularities can hardly be due to pure chance.

The years 1765 to 1768 show a similar pattern. The exchange rate fell

more than the price level, and the difference between them increased in every year except 1767. The undervaluation of the Swedish currency vanished, and there was even a small overvaluation (which may have been eroded in the following year). In the long run, after thirteen years, purchasing-power parity had been restored.

Christiernin can be said to have predicted the developments of the latter phase from 1765 to 1768 or, if you prefer, from 1762 to 1768:

. . . however damaging a further increase in the exchange rate would be, a reduction in the price of foreign exchange would not only be without actual benefit but, more important, would have the worst possible consequences for commerce and industry throughout our nation. . . . When the currency is appreciated in terms of specie, not all prices fall immediately. People continue for a long time to demand the old price for their products, despite the change in the metallic content of our monetary unit. There are instances of this in other countries and in Sweden in 1633 and in 1719. . . .

It is easy for prices to adjust upward when the money supply increases, but to get prices to fall has always been more difficult. No one reduces the price of his commodities or his labor until the lack of sales necessitates him to do so. Because of this workers must suffer want and the industriousness of wage earners must stop before the established market price can be reduced. . . .

The price impact of a reduction in the money supply is not uniform: Not all prices fall; not all prices fall at the same time; and after the reduction, relative prices are not the same (pp. 90-91).

Again, we find a very clear understanding of exchange-rate and price dynamics. Christiernin saw that prices are stickier than exchange rates, and that some prices are stickier than others. He realized that this is especially true for a downward price movement, which must thus be preceded by a depression. Elsewhere he argued that a revival of economic activity would be the first consequence of an increase in the money supply, and that prices would not rise until later. He saw, too, the asymmetry between the consequences of an expansion and a contraction of the money supply. But there is no formulation of the purchasing-power-parity theorem as being valid in the long run and no prediction of increasing undervaluation during a monetary expansion and of its disappearance during the subsequent monetary contraction.

4 THE FRENCH ASSIGNAT DURING THE REVOLUTION

During the French Revolution, paper money was introduced in France. Like the daler, this ill-fated currency apparently experienced an undervaluation soon after its introduction. Let me quote the French historian, M. A. Thiers:

The fall of the assignat began at the exchange, against the numeraire [gold coins] and all nonfixed assets. Then it spread to goods, which became dearer in the shops and the markets. But the prices of goods did not rise as rapidly as the numeraire, because the markets are far from the exchange, because they are not as sensitive, and also because merchants cannot pass information around as rapidly as brokers who are together in one hall. Therefore, the difference that has developed at the exchange develops elsewhere only after a more or less extended period; the 5-franc assignat that has a value of only 2 francs at the exchange is still worth 3 in the market, and the arbitrageurs thus have the difference necessary for speculation (Thiers, 1825, Vol. 5, pp. 172-173, my translation).

The assignat,¹ of course, never recovered, and Thiers does not tell us whether the prices of goods ever caught up with those of coins. Nor does he refer to exchange rates in the quotation above. But we can safely assume that exchange rates moved in unison with the value of gold coins (see the Russian example of Chap. 5) because most foreign countries were on a pure gold or silver standard.

The case of the French assignat differs from that of the Swedish daler in that the quantity of assignats was never stabilized. Instead, a runaway inflation developed, which led to the abolition of the assignat and of its successor, the mandat. The French experience with paper money during the Revolution was much more like the hyperinflations of the 1920s in several European countries. It is therefore worth looking into it more closely.

The figures in the middle section of Table 1 show that from October to December 1795 the indices of the prices of the gold coin and the Dutch currency rose from 100 to 262 and 375, respectively, much more rapidly than the index of the price of wheat, which rose only to 190. This widened a gap that had opened earlier. According to Falkner (1924, p. 54), from 1790 to September 1795 the general price index for twenty-four goods had already risen from 100 to 3,400 but the index for gold coins had risen faster, from 100 to 4,483. From December 1795 to March 1796, however, the index of the wheat price rose more rapidly, from 100 to 410, while the

¹ "Assignat" was used as a general expression for paper money. Its name stems from the fact that the French assignat originally assigned to its holder the right to buy confiscated church property. The French assignat was denominated in francs (1 franc = 1 livre).

TABLE 1
MONEY SUPPLY, PRICES, PRICE OF GOLD, AND EXCHANGE RATE IN FRANCE, 1789-96

Date	Assignats in Circulation		Price of Quintal of Wheat		Price of Gold Livre		Exchange Rate	
	Billions of Paper Livres	Index	Paper Livres	Index	Paper Livres per Gold Livre	Index	Paper Livres per Dutch Currency Unit	Index
(Index: 1790 = 100)								
1789	0.1	30	—	—	1.03	96	—	—
1790	0.4	100	—	—	1.07	100	196	100
1791	1.2	295	—	—	1.17	109	220	112
1792	1.7	436	—	—	1.53	143	301	154
1793	3.2	808	—	—	2.58	240	349	178
1794	6.4	1,598	—	—	3.14	293	—	—
1795	12.9	3,235	—	—	15.11	1,409	9,259	4,728
1796	34.2	8,550	—	—	256.41	23,910	37,500	18,150
1795—Aug.	14.5	3,635	—	—	36.76	3,428	7,143	3,648
Sept.	16.1	4,019	—	—	48.08	4,483	7,143	3,648
Oct.	17.9	4,470	—	—	73.53	6,857	6,667	3,404
(Index: Oct. 1795 = 100)								
1795—Oct.	17.9	100	122	100	73.53	100	6,667	100
Nov.	20.5	114	155	127	129.87	177	14,286	214
Dec.	23.3	130	232	190	192.31	262	25,000	375
(Index: Dec. 1795 = 100)								
1795—Dec.	23.3	100	232	100	192.31	100	25,000	100
1796—Jan.	27.6	118	600	259	217.39	113	33,333	113
Feb.	33.9	145	738	318	285.71	149	33,333	113
Mar.	36.0	154	950	410	277.78	144	50,000	200

SOURCE: Falkner (1924, Tables 3-5, 9, 10, 12, pp. 36-49, 57).

index for gold coins rose only from 100 to 144 and that for the Dutch currency from 100 to 200 (bottom section, Table 1). Thus, as in Sweden, a deep undervaluation developed quickly, lasted several years (from 1790 to December 1795), and then disappeared rapidly during a short second phase (from December 1795 to March 1796). But the Swedish undervaluation lasted longer and was ended by a stabilization of the money supply. The first phase of the French experience corresponded more closely to developments in the early phase of the German hyperinflation of the 1920s (see Chap. 8). As in the German case, moreover, prices and the exchange rate rose faster than the money supply during the second short phase of the runaway inflation (beginning about August 1795). I will return to these points later when I draw conclusions from all the cases considered.

In his study of the assignat, Harris (1930) comes to the same conclusions concerning the undervaluation:

A perusal of the preceding charts will make it evident that until May, 1793, the exchanges depreciated more rapidly than in proportion to the increase in metallic prices. Moreover, before any increase in the prices of commodities occurred, the exchanges had depreciated appreciably. . . .

The relatively high values of the local tables are explained by the failure of commodity prices to rise as rapidly as the prices of gold and silver . . . (pp. 257-258).

In 1795, for the first time, the premium on the exchanges was less than the premium on gold and silver. (I doubt, however, whether the premium on the exchanges was less than the increase in internal prices for any extended period.) . . . The decline in the internal value of the Assignat was not as great as its decline abroad; but the difference was reduced. The reduction in the difference may be attributed to the speculative reactions from the maximum [for prices that had been abolished] and the general scarcity of supplies (pp. 260-261).

It is surprising that Harris apparently never considered the possibility that he had found a general pattern that might apply to all other inflations. As we can see from the last sentence, he was looking only for explanations of the specific French case.

5 THE RUSSIAN CURRENCY EXPERIENCE AROUND 1800

It is well known that the English classical economist David Ricardo re-discovered the purchasing-power-parity theorem (Ricardo, 1811). Some authors, however, like Thornton (1803) and Tooke (1838), expressed skepticism concerning the validity of the quantity theory of money and the purchasing-power-parity theorem and stressed the dynamic aspects of the British economy during the Napoleonic Wars. The British classical economists have been so extensively discussed that I do not want to dwell on them here except to stress that they either did not observe or did not recognize the phenomena of under- and overvaluation. This may be attributable to the fact that the fluctuations of the British pound were not as pronounced as those of the Swedish and French currencies during the episodes just considered or of the Russian currency to be studied in this chapter. Moreover, one can infer from the evidence that the discount on the pound (e.g. against the Hamburg mark) may not have been a consequence of an excessive increase in the volume of bank notes, as Ricardo asserted, resulting in a higher domestic price level. It seems more probable that the subsidies sent abroad to allied countries and payments made to British armed forces outside the country were mainly responsible for the discount on the pound (i.e. the fluctuations in its exchange rate), as was asserted by Tooke (1838, Vol. I, pp. 375-376).

Quite different conditions surrounded the Russian currency at about the same time. Catherine II had introduced paper money as early as 1768. But until 1786 circulation was held constant at 40 million paper rubles, so that the annual average value of the silver ruble never showed a premium of more than 4 per cent over the paper ruble. This situation changed rapidly when an additional 60 million paper rubles were issued in 1787 and when further issues followed in each year from 1790 to 1810, oscillating between 2.7 and 95 million paper rubles per year (Storch, 1823, Vol. 4, Table V, pp. 303-304). As a consequence, the price of the silver ruble and of rye flour shot up in terms of paper rubles, while the foreign-exchange value of the paper ruble fell substantially (see Table 2).

Heinrich Friedrich Freiherr v. Storch, a political economist of the period, was able to offer an impressive theoretical explanation of these developments. Born in 1766 in Riga, Latvia, Storch was the son of a Baltic German nobleman. He studied in Germany, at Heidelberg and Jena, and became a professor at the Imperial Cadet Corps Academy in St. Petersburg. He won the favor of the Czarist court and taught political economy to the future Czar Nicholas I and his brother. When Storch died in 1835, he was Vice

TABLE 2

MONEY SUPPLY, PRICES, PRICE OF SILVER, AND EXCHANGE RATE IN RUSSIA, 1786-1814

Date	Assignats in Circulation		Price of 1 lb. Rye Flour in St. Petersburg		Price of Silver Ruble		Exchange Rate ^a	
	Million Rubles	Index	Paper Kopecks	Index	Paper Kopecks	Index	Paper Rubles per Dutch Florin	Index
(Index: 1786 = 100)								
1786	40	100	—	—	102	100	0.51	100
1787	100	250	—	—	103	101	0.51	100
1788	100	250	—	—	108	106	0.59	115
1789	100	250	—	—	109	107	0.67	130
1790	111	278	—	—	115	113	0.67	130
1791	117	293	—	—	123	120	0.71	139
1792	120	300	—	—	126	124	0.74	145
1793	124	310	—	—	135	132	0.83	163
1794	146	365	—	—	141	138	0.74	145
1795	150	375	—	—	146	143	0.71	139
1796	158	395	—	—	142	139	0.69	135
1797	164	410	—	—	126	124	0.67	130
1798	195	488	—	—	137	134	0.74	145
1799	210	525	—	—	148	145	0.80	156
(Index: 1800 = 100)								
1800	213	100	70	100	153	100	0.83	100
1801	222	104	75	107	151	99	0.80	97
1802	230	108	100	143	140	92	0.71	87
1803	248	116	100	143	125	82	0.63	78
(Index: 1803 = 100)								
1803	248	100	100	100	125	100	0.62	100
1804	261	105	100	100	126	101	0.65	102
1805	292	118	—	—	130	104	0.67	107
1806	319	129	100	100	137	110	0.74	118
1807	382	154	—	—	148	118	0.87	139
1808	477	192	—	—	186	149	1.18	188
1809	533	215	162	162	224	179	1.25	198
1810	577	233	172	172	300	240	1.82	286
1811	577	233	180	180	394	315	2.00	307
1812	577	233	200	200	379	303	1.67	267
1813	577	233	215	215	397	318	1.82	277
1814	577	233	220	220	397	318	2.00	304

^a Computed from Storch (1823, Table VII).

EQUIVALENTS: 100 paper kopecks = 1 paper ruble.

SOURCE: Storch (1823, Vol. 4, Tables V, pp. 303-304, VII, pp. 315-316, and IX, pp. 321-322). Storch does not give rye-flour prices for some years.

President of the Russian Academy of Sciences. His work was published mainly in German and French, under the names Heinrich or Henri Storch.

Storch put forward his theoretical propositions in four volumes published in Paris under the title *Cours d'Economie Politique* (1823). We are interested here in the relationship he traces between domestic prices and the foreign-exchange rate. (As Storch refers to the paper ruble as an assignat, I do so here. This assignat should not be confused with the French assignat discussed in the previous chapter.) Unfortunately, we have only the price of rye flour to represent domestic prices, but rye flour was an important component of the consumption basket of ordinary people. Moreover, Storch prefers to compare fluctuations in the price of rye flour with fluctuations in the price of the silver ruble in terms of paper kopecks (100 kopecks = 1 paper ruble) rather than with fluctuations in the exchange rate. But once we have considered his theoretical arguments, we will take the exchange rate into consideration.

Storch not only states that purchasing-power parity holds in the long run but plainly hypothesizes that an ongoing inflationary process results initially in an undervaluation of the paper currency compared with its value in silver rubles. He points out, moreover, that the undervaluation tends to disappear when inflation is eliminated by stabilizing policies. These are exactly the results we have already observed in the Swedish episode, the only difference being that Storch substitutes the price of silver rubles for the exchange rate:

It has been proved that the assignat has fallen; but in what proportion? This question seems to have been solved for you, Gentlemen, since you have in front of your eyes Table V [see Table 2], which shows in terms of silver money all the variations undergone by the assignat since its creation. But I have to remind you that this table only indicates the *numerical value* of the assignat, or its purchasing power in terms of silver money; this value, however, is often substantially different from its *real value*, or the purchasing power it has in buying labor or Russian goods. . . .

In a country in which the paper money dominates, the prices of labor and goods are rarely evaluated in terms of silver money. . . . It therefore happens that the people, who have been accustomed to paper money in their exchanges, have accustomed themselves easily to regard it as the real numeraire and to attribute to it the same immutability of value which long experience has taught them with respect to silver money. The consequence of this popular opinion is that when the numerical value of the paper varies, the real value cannot immediately follow these variations and that it always remains behind the former. Thus, when the numerical value of the paper *falls*, when its power to buy silver money decreases, the prices of the country's labor and goods do not rise in the same proportion, and it follows that the paper buys, compared with silver money, *more* labor and goods than it could buy before its fall. . . . On the other hand, when

the numerical value of paper *rises again*, when its power to buy silver increases again, then the nominal prices of the country's labor and goods do not fall in the same proportions, with the result that paper buys *less* labor and goods compared with silver than it could buy before its rise. In spite of this and though this observation is well-founded, it has been shown by experience that these two values always tend to converge again or to regain their level; but, for them actually to reach it, it is absolutely necessary that the numerical value of paper either cease to vary or reverse its previous direction . . . (Storch, 1823, Vol. 4, pp. 212-214, my translation of Storch throughout).

This remarkable statement shows deep insight into the dynamic process leading to the undervaluation of paper as compared with silver money and into the long-term tendency for purchasing-power parity to be reestablished. Taking the foreign price level as constant, because there were pure gold or silver standards abroad, and assuming with Storch (see quotation below) that exchange-rate movements correspond to fluctuations of the silver ruble, one gets $\hat{e} > \hat{p}$ when the value of the paper assignat falls faster in terms of silver than its real value because of an expansion of the money supply. If these two values converge again because the money supply was stabilized, then $\hat{e} = \hat{p}$ is finally reached and purchasing-power parity restored. Storch does not mention, however, that the money supply rose faster than the price of silver money and faster than the price of rye flour from 1803 until 1810, when the money supply was stabilized (see Table 2). This fact, too, corresponds to the Swedish experience.

Storch goes on to show that the record of Russian experience with paper money corresponds to his hypothesis. He turns his attention to two periods, from 1800 to 1803, when the value of the assignat rose constantly in terms of silver, and from 1803 to 1814, when its value fell in almost every year (see Table 2):

During the first period . . . the numerical value of the assignat constantly *rose*; so we see that its real value [in terms of flour] was less than its numerical value, compared with the year 1800,

in 1801, by 8%,
in 1802, by 51%,
in 1803, by 61%.

The [price of the] silver ruble in assignats fell successively from 153 kopecks to 125, or in the proportion of 100 to 82, the prices of the country's food did not fall in the same proportion; on the contrary they increased from 100 to 143; so that within one year the ruble assignat bought more and more of silver and foreign goods and less and less of the country's labor and food.

During the second period beginning in the year 1803 the numerical value of the assignat constantly fell; thus we find that the real value of the assignat was higher than its numerical value compared with the year 1803,

in 1804, by 1%,
in 1806, by 10%,
in 1809, by 17%,
in 1810, by 68%,
in 1811, by 135%,
in 1812, by 103%,
in 1813, by 103%,
in 1814, by 98%.

Though the price of the silver ruble in assignats rose successively from 125 kopecks to 397 . . . the prices of the country's food did not rise in the same proportion, but only from 100 to 220 . . . [Table 2]. If [the assignat] continues to keep its value [in silver] for some years, there is no doubt that its real value will reach the level of the numerical value. Then the prices in assignats of all things will appear to be exorbitant; but the prices in silver money will be the same as they were in 1803 and the equilibrium between the two values of the assignat will be reestablished (Storch, 1823, Vol. 4, pp. 216-218).

Storch says clearly that his hypotheses are not confined to the Russia of his time: "These observations have been verified in all countries where a devalued paper money dominates in circulation, as in Russia, Austria, Denmark, etc. All travelers find that one lives nowhere cheaper than in these countries; and in the business world, they are renowned for their low prices of food, of labor, and of all domestic goods" (Storch, 1823, Vol. 4, p. 223).

Finally, let us look at the exchange-rate index. Storch states that the exchange rate moves broadly in line with the price of silver rubles. He writes in a footnote (Vol. 4, p. 215): "The real value of paper money in terms of *foreign goods* is always the same as its *numerical value*; for since in foreign trade the goods are always evaluated in silver money and have to be finally paid with silver money if they are not paid with goods, there can be no difference between these two kinds of values." Looking at Table 2, this seems to have been true, at least with respect to direction and magnitude. Furthermore, the relation stated earlier by Storch between the price of silver and the price of domestic goods has also held between the exchange rate and the price of domestic goods, because the exchange rate and the price of silver tended to move together.

Storch attributes the slower upward and downward movements of general prices, compared with the silver price and the exchange rate, to the different amounts of information available to participants in the different markets. In the second paragraph of the first quotation, Storch referred to the fact that people had become accustomed to the long-run stability of silver money and expected the same for paper money in the future. This expectation changes only slowly:

It takes the people a long time . . . before they comprehend that it is the

assignat which falls; they believe in good faith that it is the price of silver which rises. Victims of this illusion, they go on to deliver the products of their labor at the same price at which they have sold them before the fall of the assignat; and it is the consequence of this that the numerical value of all goods falls (Storch, 1823, Vol. 4, p. 223).

Storch points out that not all prices fall in terms of silver money, because some domestic products require foreign materials for their production. Moreover:

The ignorance of the people concerning values is not general; merchants, especially those trading in foreign goods, very rapidly observe the difference existing between the prices of goods in assignats and in silver, and they try to keep to this latter level [of the prices in silver] as much as possible (p. 225).

He goes on to argue that the real prices of domestic products must go up eventually because of the excess demand created by the increase in the amount of paper money:

Thus, whatever may be the ignorance of the people as to the value of the assignat compared to that of silver money, the prices of all domestic goods soon show a tendency to regain the old level prevailing before the fall of the assignat. Nevertheless, they cannot regain it without again disturbing all relations between the different values; for the goods reach this level only one after the other, and one more slowly than the other. If the depreciation of the assignat continues to increase, most of the goods will never regain it in spite of their tendency to move back to their old silver prices; for them to arrive at that level, it is necessary that the fall of the paper money stop for several years (pp. 225-226).

Here Storch again stresses his hypothesis that an undervaluation will disappear only if monetary stability is restored. But we saw in the case of the French assignat, and will see again in the German hyperinflation of the 1920s, that prices rise more rapidly than the exchange rate in the final months of a runaway inflation. This tends to restore purchasing-power parity even when the money supply is not stabilized and the exchange rate is rising rapidly. Thus Storch is wrong in this particular respect, although the error is understandable, since it corresponds to the facts in all cases where there is no runaway inflation and the money supply is stabilized eventually. I return to this problem in the concluding section.

English classical economists neither discovered nor discussed the phenomenon of overshooting analyzed by Storch. But was Storch familiar with the purchasing-power-parity theorem as put forward by David Ricardo in 1811? Storch does not quote any of the classical economists except Adam Smith and Henry Thornton (1803) when he discusses the development of

paper money. Furthermore, his text gives the impression that he completed it in 1814 or 1815. It would not be too surprising, then, if the Napoleonic Wars cut him off from the relevant books and papers. On the other hand, Storch's work is mentioned by Tooke and Newmarch (1862, p. 654), but surprisingly they do not discuss his hypothesis.

6 THE AUSTRO-HUNGARIAN AND RUSSIAN PAPER MONEYS IN THE NINETEENTH CENTURY

Austria-Hungary introduced paper money in 1761, seven years earlier than Russia. As in Russia, issues of paper money were at first restricted (in this case, until 1796), and paper money was easily convertible into silver money. The expansion of the paper money in circulation began slowly in the 1780s and reached dramatic proportions in the 1790s. Convertibility into silver became increasingly difficult to maintain and was finally ended in 1797. Austria-Hungary and Russia both stayed with inconvertible paper moneys until the 1890s, when they adopted the gold standard and introduced gold convertibility. In some periods, new issues of paper money were limited and price levels and exchange rates were relatively stable (see Yeager, 1969, for the period from 1879 to 1891). In other periods—during the French Revolution and the Napoleonic Wars, the Crimean War, and the war between Austria-Hungary and France and Savoy in the 1850s, as well as in the years right after them—there were big increases in the quantity of paper money, price inflations, and wide exchange-rate fluctuations.

Adolph Wagner, the German scholar, is well known to economists working in the field of public finance, particularly for "Wagner's law" on the increasing level of state activity. But his extensive work in the fields of money and banking as a young professor in Vienna and Dorpat¹ in the 1860s has been virtually forgotten. Wagner looked most closely at the developments in Austria-Hungary at the time of the French Revolution (Wagner, 1861, 1863a) and in the 1850s and 1860s (Wagner, 1862). He also studied Russian paper money during the latter period (Wagner, 1868). He developed the same hypotheses as Storch, without making them as specific and without corroborating them in the same way with figures relating to goods prices. He tried, however, to give a somewhat more explicit explanation of the reasons for undervaluations. Wagner never mentions Storch but refers to the English classical writers. He explains that the purchasing-power-parity theorem and the quantity theory of money are only roughly true. Large and lasting divergencies can occur, mainly because of information gaps, long distances, and differences in the degree of development of markets and transportation systems. It is perhaps not surprising that Wagner is on the whole rather critical of the currency school but refers approvingly to Tooke's work.

In his article concerning Austro-Hungarian paper money during the Napoleonic period, Wagner says:

¹ Dorpat is now Tartu, Estonia. At that time, Dorpat had a German university, and a majority of its inhabitants were German-speaking.

The decrease in the value of the paper money first appears in relation only to [silver] coin and precious metals. . . . The real loss to [the individual] is in fact much smaller if the money, and this is the rule, is only considered as representing a certain amount of purchasing power. The 100 fl. [Austrian guilder] paper money, which have a value of only about 70 fl. in silver coins, still presumably give him command over an amount of goods and services that would earlier have cost him, *ceteris paribus*, let us say 98 or at least 95 fl. So he loses, too, in relation to all goods that can be purchased, but he loses much less than one would expect from the premium for silver. . . .

The reasons for these phenomena, . . . the occurrence of which can be proved from the history of paper money, have to be seen in the fact that the changes in the exchange value of paper money in terms of goods happen later, more slowly, and in different magnitude than that in the exchange rate between paper money and metal money. Or, expressed in other words, that the prices of goods expressed in terms of paper money do not increase at once and not exactly in the same relation as the premium on silver. The validity of this hypothesis is with certain conditions probably generally accepted. Opinions differ only as to the rapidity, generality and magnitude of the influence of the premium on silver on the prices of goods. . . . We believe that the aforementioned hypothesis is true to a higher degree than commonly expressed (Wagner, 1861, pp. 610-611, my translation of Wagner throughout).

Wagner restates these ideas when he discusses later developments with Russian and Austro-Hungarian paper moneys in the 1850s and 1860s (Wagner, 1862; 1863b, p. 184; 1868, pp. 7-8 and 169-170). In one passage relating to this later period and to the Austro-Hungarian paper money, Wagner refers also to the elimination of the undervaluation and to its consequences for exports:

The prices of the different kinds of goods do not increase or decrease with the premium [on silver coins] at once or in the same proportion. It is exactly because of this that the advantages which industry enjoys for some time from the premium can be explained: the competition of foreign countries is eliminated or diminished, since the foreign manufacturer has to raise his prices in correspondence to the devaluation of the paper money . . . but the domestic producer is able to extend his sales abroad, since he is paid there in silver, which gains domestically in terms of paper money, and since wages, costs of raw materials and other costs increase only slowly, sometimes very slowly, as a consequence of the premium. . . . He suffers, however, because of the same law as soon as the process turns around and the premium diminishes substantially. Foreign competition is again felt more strongly, sales abroad stagnate more and more, the prices of products decrease whereas those of many of the articles used in production as well as wages diminish only slowly and reluctantly. It is for these reasons that industry must of necessity suffer from a return to par value (Wagner, 1862, pp. 92-93).

Here, too, we find the idea that undervaluation vanishes later on, presumably because of an end to the excessive increase in the supply of paper

money, and that a return to purchasing-power parity takes place. But Wagner does not formulate these ideas as clearly as Storch, and it may therefore be helpful to give some additional explanation. A return to "par value" meant at that time a return to the gold or silver parity that had been in effect before paper money became inconvertible. This implies restoration of the old parities for the exchange rates, since most other countries were on gold or silver standards. Now, taking the foreign price level and the exchange rate to be constant, since the present exchange rate is equal to the original rate after the return to par value, one gets from the equation for absolute purchasing-power parity, $p = ep^* + a$, that p is determined by e and p^* . Thus, when Wagner speaks of a return to par value, he is predicting that p will fall to the point where the equation becomes valid again. Relative undervaluation of the currency will be eliminated, too, because the equation implies that $\hat{p} = \hat{e} + \hat{p}^* = 0$, and the final values of e and p^* are those that obtained before inflation started. This kind of reasoning probably forms the basis for the second part of the last quotation. Wagner expects the undervaluation to disappear and purchasing-power parity to return in the long run if the money supply is stabilized and the old gold or silver parity restored.

But what reasons does Wagner give for the slower rises and falls in general prices than in the premium on silver coins, and therefore in the exchange rate? How does he account for the long-term tendency for price-level and exchange-rate changes to converge? Like Storch, Wagner seems to attribute great importance to the lower levels of information in ordinary goods markets than in foreign-exchange markets. He also mentions higher transportation costs and the blocking of international trade as possible reasons for the Austrian currency experience during the Napoleonic Wars:

There are special reasons to think that a rapid and equal increase of prices was even less probable at that time than at present. The condition of the means of communication and of the information system, the much less advanced development of domestic trade, and the nearly complete standstill of international trade meant necessarily that a cause for rising prices like the increase in the premium would be felt much less generally than today (Wagner, 1863a, p. 426).

Thus Wagner refers to high transaction costs in addition to communication and information costs as a decisive cause of the slower and unequal changes in goods prices. He argues further that goods prices will tend to catch up eventually with the exchange rate because of higher import prices, which are a consequence of the premium on silver, and because of the excess demand (or supply) created by the additional paper money:

There follows, however, in accordance with the ordinary laws of prices, a gradual equalization; the faster and larger increase in the premium on silver little by little causes a rise in prices (Wagner, 1863a, pp. 476-477).

The money [spent by the state] now flows to banks, to the stock exchanges, the discount is lowered, government bonds rise because of the artificial demand for them caused by the idle paper-money capital. The end of the war removes the fetters with which the dominating fear had shackled initiative until then. Trade revitalizes. Regular sales are partly restored. Low interest rates encourage great undertakings, joint stock companies are formed, railroads and mines are begun, banks and financial institutions of all kinds are founded. . . . It is only now that the new paper money spreads into all lines of business, brings about manifold price increases, and creates a favorable environment for prosperity and spirited activity (Wagner, 1868, p. 7).

Returning to undervaluation, we find that Wagner also observes that foreigners live more cheaply in inflationary countries:

It may be recalled that the foreigner lives more cheaply in Austria, even today [1861], and that the well-known and quite accurate assertion that exports flourish with the premium [on silver], as well as with export subsidies, demonstrates clearly that one knows in practical life that prices advance more slowly than the premium. These are well-known facts the consequences of which, however, are forgotten by theory and practice again and again (Wagner, 1861, p. 614, fn. 1).

Wagner goes somewhat farther than Storch in emphasizing the wide fluctuations of exchange rates and their dependence on expectations and on the amount of the country's foreign indebtedness. He states that the London exchange rate for the ruble became more and more influenced by political events:

From these [figures] one observes an average effect taken as the average of the decrease and the increase [in the exchange rate during and after the political crisis in question],

- during the Crimean War, 1854-56, 11%,
- during the Italian War, 1859, 14.5%,
- during the German War, 1866, 19.4%,
- during the Luxemburg crisis, 1867, 7.9%.

If one calculates the highest premium according to the . . . London exchange rates that was reached at some time in each of these four political crises, and . . . puts the par value at 38.25, one gets the sequence 15.9%, 22.4%, 48.6%, 27.5%—an increase that provides food for thought. In the next great catastrophe in Europe, even if Russia does not participate in a new European war and there is no new issue of paper money, an even lower exchange rate than in 1866 must be expected for a short time, judging from previous experiences. On the other hand, one can expect . . . with certainty a substantial increase in the exchange rate after the disturbing cause has been removed. . . . Probably the fact that Russia is at present much more in debt abroad and, as a consequence, the changing trust and mistrust of foreign holders of Russian securities have an important influence on the stronger effects on exchange during crises (Wagner, 1868, pp. 142-143).

Wagner's thinking was influential in Central European universities, where economists such as Foeldes (Weisz) (1882), Lexis (1893), and Schmidl (1892) took up his ideas and tried more or less successfully to develop the theory further. Lexis even mentioned Storch among his references but did not explicitly discuss his contributions. Space does not permit a discussion of the writings of these and other scholars working on currency and exchange-rate problems during this period. In any case, there were no important developments and even some deterioration in the quality of the discussion. This would perhaps explain the oblivion into which knowledge of the relationships discussed above had apparently fallen when the First World War forced most belligerent countries to go off the gold standard and when major currency unrest followed in the post-war period. Cassel (1916, 1921), the Swedish economist who was one of the most influential writers on the subject at that time, revived the purchasing-power-parity theorem and drew attention to the big exchange-rate fluctuations around 1920. He knew Ricardo's work but never mentioned Wagner or Storch and their ideas, although they were just as relevant for the 1920s.

The level of knowledge about paper money, inflation, and exchange-rate movements had apparently deteriorated even more in Germany than in other countries, as can be seen from a statement by Helfferich (1923) about the reasons for the great German inflation of the early 1920s:

The depreciation of the German mark in terms of foreign currencies was caused by the excessive burdens thrust onto Germany and by the policy of violence adopted by France; the increase of the prices of all imported goods was caused by the depreciation of the exchanges; then followed the general increase of internal prices and of wages, the increased need for means of circulation on the part of the public and the State, greater demands on the Reichsbank by private business and the State and the increase of the paper mark issues. Contrary to the widely held conception, *not inflation but depreciation of the mark was the beginning of this chain of cause and effect*; inflation is not the cause of the increase of prices and of the depreciation of the mark; but the depreciation of the mark is the cause of the increase of prices and of the paper mark issues. The decomposition of the German monetary system has been the primary and decisive cause of the financial collapse (quoted from Bresciani-Turroni, 1937, p. 45).

From this passage one must infer that Helfferich was unaware that the kind of currency undervaluation implied by his statement had happened during earlier inflations and had been discussed by Storch and Wagner. Otherwise, he might not have mistaken the secondary, or reinforcing, effect of undervaluation on prices, via more expensive imports, for the primary cause of inflation.

7 INFLATION DURING THE AMERICAN CIVIL WAR

Let us briefly examine the inflation brought about by the American Civil War (1861-65), when the United States was off the gold standard. Did the pattern of relationships conform to the hypotheses used to explain the Swedish, Russian, and Austro-Hungarian inflations? Looking at Figure 2, we observe that they did, although the difference between the rise in the price of gold and the cost-of-living index were not quite as pronounced in the first phase as, for example, in Sweden.

It is interesting that a contemporary observer, the Austrian economist and statesman Carl Freiherr von Hock, was quite aware of the typical pattern:

For the products of Northern and Western states it can clearly be observed that the value of the valuta [foreign currency] is only one of the elements determining the price, and that the changes in the price of a good follow that of the valuta more slowly, the more distant the places of production from the great centers of political and trade transactions.

Only with the advent of 1864, i. e. long after the consequences of the devalued valuta were felt for import goods, was there a large general increase in prices of domestic products that undoubtedly corresponds to the devaluation of the valuta (Hock, 1867, pp. 592-593, my translation).

Hock's statement that there was a general price increase in 1864 is not borne out by Figure 2. The discrepancy probably stems from the fact that his sources for prices were less reliable and no index was available. It is also possible that prices rose during the first months of 1864 but fell farther during the rest of the year.

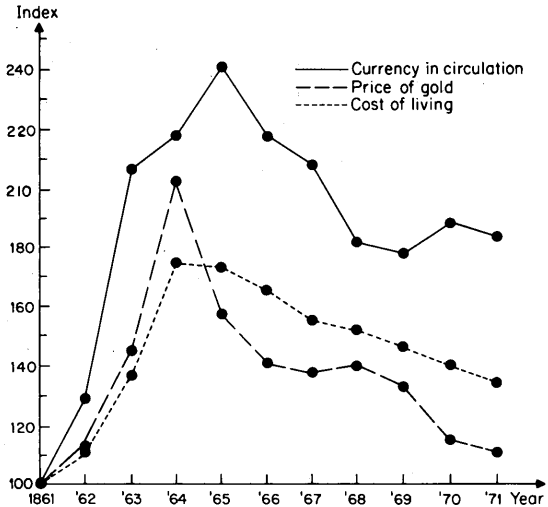
Hock does not indicate whether he believes that the phenomena observed are valid only for the United States in this period or are just an example of a general pattern, true for different countries and different times. The same applies to Wesley C. Mitchell, the well-known American economist, who, writing forty years after the events took place, came to similar conclusions:

During the war gold moved up or down in price more quickly than the mass of commodities—probably because the market for gold was more highly organized and more sensitive than the markets for other goods to the many influences touching the credit of the government-notes which formed the money in which all prices were quoted. When gold was rising in price the majority of commodities followed, but more slowly, and its price therefore advanced above the median. . . . When gold was falling in price the majority of commodities stood still or followed more slowly, and the gold quotation then dropped below the median. . . .

This more sluggish movement of commodity prices appears still more clearly after the war. Rapid as was the fall of prices in the spring of 1865, it was not so rapid as the fall in gold. A more curious fact is that the price-level for commodities continued for ten years to be rather higher than the price level for gold (1908, p. 40).

Neither Hock nor Mitchell mentions the fact that, again as in Sweden and Russia, the amount of currency in circulation rose more rapidly than the cost-of-living index and the price of gold (and therefore the exchange rate).

FIGURE 2
INDICES OF MONEY SUPPLY, PRICES, AND PRICE OF GOLD
IN THE UNITED STATES, 1861-71



SOURCE: For money-supply and cost-of-living indices, Bureau of the Census (1975, Series X, Part 2, p. 993, and Series E, Part 1, p. 212). For gold-price index, Mitchell (1908, Table I, p. 4).

8 FLOATING EXCHANGE RATES IN THE 1920S

Developments after the First World War seem again to have followed the patterns described by Storch and Wagner. In a theoretical explanation of the reasons for the fluctuations of the German mark, Ludwig Hahn (who does not refer to Wagner or Storch) mentions that the dollar rose to 104.75 against the mark in February 1920, went down to 36.58 in June 1920, went up again to 310 in November 1921, and finally went down to 163 in December 1921 (Hahn, 1924, p. 39).

As Storch and Wagner would have expected, a large undervaluation of the mark resulted from the high and accelerating German inflation rate. It was only during the last phase of the inflation that participants in domestic goods markets became sufficiently well informed and institutional rigidities were sufficiently reduced for domestic prices to increase more rapidly than exchange rates and for purchasing-power parity to be approached in spite of the ongoing hyperinflation. This obviously conflicts with Storch's thinking that for the numerical and real values to reach the purchasing-power-parity level "it is absolutely necessary that the numerical value of paper either cease to vary or reverse its previous direction" (1823, p. 214). But it does not conflict with Wagner's hypotheses, which are somewhat less precise.

To give an impression of trends during the German hyperinflation, I have put together in Table 3 figures calculated from tables in a study of the inflation by the Italian economist, Costantino Bresciani-Turroni. It is immediately clear from the upper part of Table 3 that the exchange rate rose much higher and more rapidly than the domestic price level. Furthermore, with the exception of the period from February 1920 to May 1921, the difference between the figures became bigger and bigger. Even this exceptional period corresponds to Storch's theory. While the volume of bank notes in circulation grew by more than 100 per cent from October 1918 to February 1920, a period of seventeen months, it increased by "only" a little over 50 per cent from the latter date to May 1921, a period of fifteen months, which corresponds to not quite 58 per cent in seventeen months. There was, therefore, a relative stabilization of the growth of the money supply. Thus it is perhaps not surprising that the exchange rate against the dollar fell from February until October 1920, while the price level actually increased before it fell somewhat from October 1920 to May 1921. From May to October 1921, the money supply grew more rapidly again, by almost 22 per cent, corresponding to almost 75 per cent in seventeen months. So the earlier pattern resumed of increasing differences between the indices of the exchange rate and the domestic price level.

TABLE 3

INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN GERMANY, 1918-23

<i>Date</i>	<i>Paper Marks in Circulation</i>	<i>Goods Prices</i>	<i>Exchange Rate: Marks per U.S. Dollar</i>
(Index: Oct. 1918 = 100)			
1918—Oct.	100	100	100
1919—Oct.	163	211	407
1920—Feb.	204	506	1,503
Oct.	290	541	1,034
1921—May	306	527	944
Oct.	373	930	2,276
1922—July	761	3,870	7,478
Oct.	1,811	20,627	48,236
1923—June	65,112	704,090	1,667,758
(Index: July 1923 = 100)			
1923—July 31	100	100	100
Aug. 15	267	391 ^a	245
Sept. 15	7,302	20,683 ^b	8,206
Oct. 23	1,202,593	8,447,205	5,076,300
Oct. 31	5,733,945	10,993,789 ^c	6,603,053
Nov. 30	13,177,838	853,664,596 ^d	381,679,389 ^d

^a Aug. 14.^b Sept. 18.^c Oct. 30.^d Nov. 20.

SOURCE: Bresciani-Turroni (1937, Tables III-VII, pp. 30-36).

The lower part of Table 3 demonstrates that from July 1923 to the end of the hyperinflation, the domestic price level rose much more rapidly than the exchange rate against the dollar, in such a way that the undervaluation of the mark was gradually eliminated.

These relationships were clearly recognized by Bresciani-Turroni, who made these observations:

After the Armistice a new phase in the evolution of the mark was begun. The external value of the German currency fell well below its internal value and remained lower until September 1923 (1937, p. 131).

Every depreciation of the exchange tended to lessen the external value and to increase the divergence between this and the internal value . . . [and] every time the increase in the disparity between the two values provoked a reaction. The reaction consisted, not in an improvement of the exchange, . . . but, because of the continual note issues, in a rise in the internal price-level . . . (p. 132).

. . . in the last phase of the depreciation of the mark, the adaptation of home prices to exchange rates tended to become continually more rapid. . . .

But though the equalization of the internal and external values of the mark was not reached before the summer of 1923, the tendency to adaptation was always present, and was a force which for four years kept in a continual state of agitation prices of goods, security prices, wages, salaries, railway rates, and the rates of taxes . . . (p. 136).

Bresciani-Turroni was well aware of the work done by Wagner. He quotes from Wagner's book on the Russian paper currency, referring to his statement that increases in domestic prices lag behind the rise in the premium on gold. (It should read "silver.") Hence domestic prices tend to remain lower than world prices, bringing about a kind of export premium. Bresciani-Turroni also quotes Thiers concerning developments during the French Revolution. And he points out (1937, pp. 120-123) that in 1750 Ferdinando Galiani had observed that the value of debased money declined more slowly in the country of issue than abroad. Galiani, an Italian Catholic priest and well-known writer and economist, had written:

. . . and if this change [the debasement of a currency] occurred in an island separated from any trade with foreigners, the old ideas [concerning the price level] would change very slowly. The existence of trade, however, means that the first to change is the exchange rate, the thermometer of countries; if it did not change one country would absorb the other country's money (Galiani, 1804, Vol. 11, p. 85; quoted and translated by Tullio, 1981, p. 15).

Bresciani-Turroni does not mention Storch, however.

The figures in Table 3 reveal that from October 1918 to October 1923 the amount of bank notes in circulation in Germany rose much more slowly than domestic prices or the exchange rate. The apparent divergence from our earlier observations can be explained by the fact that the German monetary expansion had actually started as early as 1914. Between 1914 and 1918, prices and the exchange rate increased much less than the money supply, quite in accordance with the earlier French experience with the assignat. Indeed, this first period lasted until July 1919, a fact hidden by the annual figures in Table 3. The index of domestic prices rose from 100 in October 1918 to 143 in July 1919, but the money supply rose from 100 to 157. And the increase in bank-note circulation kept ahead of the increase in the exchange rate until January 1919 (see Bresciani-Turroni, 1937, Table II, p. 28).

Similar observations can be made for the Austrian, Hungarian, Polish, and French currencies in the 1920s.

Table 4 shows that in Austria, from January 1920 to December 1921, the exchange-rate index rose more rapidly than the index of goods prices. The trends were reversed during the second phase from December 1921 to August 1922. Then, when the Federal Acts of July 24 and November 14,

1922, stabilized the currency, the exchange rate fell at first and then stabilized, while the price index kept on rising at first (see also De Bordes, 1924). Moreover, the continued growth in the money supply was accompanied by a decrease in the velocity of money toward its normal level.

TABLE 4
INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN AUSTRIA, 1920-23

Date	Paper Crowns in Circulation	Goods Prices	Exchange Rate: Crowns per U.S. Dollar
(Index: Jan. 1920 = 100)			
1920—Jan.	100	100	100
Dec.	231	126	243
1921—June	375	173	260
Dec.	1,313	914	2,031
(Index: Dec. 1921 = 100)			
1921—Dec.	100	100	100
1922—June	319	398	344
Aug.	778	1,649	1,402
Dec.	2,345	2,596	1,272
1923—June	3,122	2,754	1,284
Dec.	4,095	3,022	1,282

SOURCE: Bresciani-Turroni (1937, Table XVIII, p. 161).

In Hungary, also, the exchange rate rose much faster than the retail-price level during the first inflationary phase from 1914 until November 1921 (see Table 5). There followed a short stabilization period from November 1921 to January 1922 during which the exchange rate fell much more than the price level. The stabilization was obviously the consequence of a sharp drop in the rate of increase in the money supply. Whereas the money supply had risen by almost 37 per cent from August to October 1921, it rose slightly less than 9 per cent from October 1921 to January 1922. With bank-note circulation increasing again, by almost 50 per cent from January to July 1922 and even faster thereafter, a third phase began in which prices rose much faster than the exchange rate. As can be seen from the 1925 price and exchange-rate indices, a somewhat puzzling overvaluation remained even after monetary reforms were introduced in March 1924. The exchange rate fell after July 1924, but the price index continued to rise for some time. This time, the money supply kept on increasing rapidly for a few months. But, as in Germany, Austria, and Poland, the stabilization occurred because people *believed* that the monetary reforms introduced in March 1924 would lead to a *future* stabilization of the growth in the money supply. This actually happened beginning in November 1924. Here, again,

the continued growth in the money supply in the first months after March 1924 was accompanied by a decrease in the velocity of money toward its normal level.

TABLE 5
INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN HUNGARY, 1914-25

Date	Paper Crowns in Circulation	Retail Prices ^a	Exchange Rate: Crowns per U.S. Dollar
(Index: 1914 = 100)			
1914	—	100	100 ^b
1920 ^c	100 ^d	4,696	—
1921 ^e	149	6,225	11,741
1922	314	18,788	29,069
1923	2,534	308,900	37,267
1924	21,043	2,105,600	1,410,648
1925 ^f	30,188	2,214,667	1,445,931
1921—Jan.	106	—	—
July	110	4,200	6,093
Aug.	121	5,400	7,692
Sept.	146	6,250	10,405
Oct.	165	6,750	14,130
Nov.	173	8,300	18,785
(Index: Nov. 1921 = 100)			
1921—Nov.	100	100	100
Dec.	102	99	71
1922—Jan.	104	98	71
July	155	210	142
1923—Jan.	298	464	275
July	915	3,446	1,111
1924—Jan.	4,384	12,361	2,763
Feb.	5,167	22,158	3,265
Mar.	6,495	25,020	7,184
July	13,248	27,645	8,980
1925—Jan.	17,984	27,801	7,697
Mar.	17,258	25,516	7,697

^a Retail-price index to Dec. 1923, wholesale-price index thereafter.

^b Dollar parity of the crown, 1914 = 4.97.

^c Calculated from *Statistisches Jahrbücher für das Deutsche Reich*, Berlin, 1922, p. 63*, and 1928, p. 158*.

^d Dec. 1920.

^e Average July-Dec. 1921.

^f Average Jan.-Mar. 1925.

SOURCE: Young (1925, pp. 321-322).

As Table 6 shows, in Poland the exchange-rate index rose much more rapidly than the wholesale-price index up to December 1922. The trends were reversed during the second phase from December 1922 to January 1924. Starting with measures introduced in December 1923 and January 1924 and taking final shape on February 1, 1924, the Polish mark was sta-

bilized at the rate of 1.8 million marks = 1 zloty, the new currency unit. Thus, after February 1924 the exchange rate fell faster than the price level. The comments relating to the continued growth of the money supply in Austria and Hungary apply to Poland as well.

TABLE 6
INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN POLAND, 1919-25

<i>Date</i>	<i>Bank Notes in Circulation</i>	<i>Wholesale Prices^a</i>	<i>Exchange Rate: Polish Marks per U.S. Dollar</i>
(Index: Jan. 1921 = 100)			
1919	4	—	4
1920	52	—	29
1921	227	177	183
1922	725	547	770
1923	35,823	8,612	10,523
1924 ^b	912,089	972,788	1,283,185
1921—Jan.	100	100	100
July	209	182	281
1922—Jan.	435	236	443
July	609	404	784
Dec.	1,342	1,378	2,544
(Index: Dec. 1922 = 100)			
1922—Dec.	100	100	100
1923—Jan.	115	157	133
Feb.	148	248	228
July	564	886	814
Dec.	15,801	41,085	24,359
1924—Jan.	39,532	69,919	49,138
(Index: Jan. 1924 = 100)			
1924—Jan.	100	100	100
Feb.	169	103	106
March	190	101	103
April	182	100	102

^a Retail prices of food from Jan. through Aug. 1921.

^b Average Jan.-April 1924.

SOURCE: Young (1925, pp. 347-350).

In France, the increase in the circulation of bank notes began in 1922 (see Table 7). Once again, the exchange rate against the dollar rose much more rapidly in the first phase than the cost-of-living index. With the return of money stability after July 1926, the exchange-rate index dropped rapidly. The cost-of-living index continued to rise, but at a declining rate. In 1927, it, too, finally dropped somewhat (see also Graham, 1930, Table XIII, pp. 118-120).

TABLE 7

INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATE IN FRANCE, 1920-27

<i>Date</i>	<i>Bank Notes in Circulation</i>	<i>Cost of Living</i>	<i>Exchange Rate: Francs per U.S. Dollar</i>
(Index: 1922 = 100)			
1920	105	116	117
1921	104	104	109
1922	100	100	100
1923	103	113	135
1924	111	125	157
1925	123	135	172
1926	147	171	255
1926—July	155	164 ^a	334
(Index: July 1926 = 100)			
1926—July	100	100 ^b	100
Aug.	98	—	86
Sept.	98	111	85
Oct.	97	—	83
Nov.	95	—	71
Dec.	95	112	62
1927—Dec.	96	102	63

^a June 1926.^b June 1926 = 100.SOURCE: *Statistisches Jahrbuch für das Deutsche Reich*, Berlin, 1927; *Internationale Wirtschaftszahlen*, France, p. 15.

9 THE BEHAVIOR OF EXCHANGE RATES IN THE 1970S

When most industrialized countries returned to floating exchange rates in 1973 after twenty-five years of fixed rates within the Bretton Woods system, nearly all knowledge of earlier experiences with flexible rates had been forgotten. Few people thought that the experiences of the 1920s and 1930s and the observations of economists like Bresciani-Turroni or even of Graham or Nurkse (1944) had anything to tell them about the future. It is doubtful whether economists were familiar with the experiences with paper currencies and their exchange rates in the eighteenth and nineteenth centuries or knew of the hypotheses of Storch and the others. Most modern monographs and articles (see, e.g., Sohmen, 1961) did not even mention the dynamic problems that could arise from wide exchange-rate fluctuations and from over- or undervaluations of currencies. Thus we have found another sad example of the inadequate transfer of relevant human knowledge from one generation to the next. The problem probably stems from the fact that a given body of theory has not been applicable for several decades, and in the meantime the structure and institutions of the social environment have changed.

Now let us see whether recent experiences with floating exchange rates correspond to earlier ones and to Storch's hypotheses. We must keep three points in mind:

First, in recent years several paper currencies have been floating against each other. Thus it is not enough, as it was in the earlier cases, just to look at one paper currency and its exchange rate against some stable currency on a pure gold or silver standard. In those cases, it was fairly safe to take as given the relevant prices or price indices and the money supply of the country with the stable currency. But when we consider several paper moneys, we must look at *relative* price levels and *relative* money supplies if we want to compare the exchange rates across these countries.

Second, the processes that may lead back to purchasing-power parity after some years have presumably not been completed. This may be either because the more inflationary country has not yet sufficiently decreased the growth rate of its money supply or because its inflation rate has not yet increased enough to bring about a more rapid increase in the relative price index than in the exchange rate. As a consequence, we are able to observe only the first of Storch's hypotheses, namely the undervaluation of the currency with the higher rate of inflation and the overvaluation of the other currency. The disappearance of under- or overvaluation may either not have begun or not yet have been completed.

Finally, because of exchange-rate fluctuations among foreign trading partners, the domestic price level of a country should be compared not just with the price level of one foreign country but with a weighted average of the price levels of all its trading partners. Only such a procedure will allow accurate comparisons of the changes in relative prices and exchange rates. But here a problem arises about which weights to use. I therefore prefer to compare the cost-of-living indices of several countries with that of Germany, because Germany and its partners in the European Monetary System, with fixed exchange rates among them, were by far the most important trading partners of the other European countries to be considered.

The relevant figures have been calculated in Table 8 for France, Great Britain, Italy, Switzerland, and the United States, all in relation to the corresponding German indices. We observe again that the exchange rates for France, Great Britain, Italy, and the United States rose more than the relative cost-of-living indices, thus leading to an undervaluation of their currencies compared with the Deutsche mark and to a corresponding overvaluation of the Deutsche mark. On the other hand, the value of the Deutsche mark in terms of the Swiss franc fell farther than the relative cost-of-living index, which even increased at first.

Both trends correspond nicely to Storch's hypotheses, that of the countries other than Switzerland to the more inflationary phase, since the relative money supplies increased, and that of Switzerland to the deflationary or less inflationary phase, since Switzerland's relative money supply decreased. While this decrease is very weak for M_2/M_2^* , note that M_1/M_1^* decreased dramatically and seems to be much more in correspondence with the fall in the exchange rate. One reason may be that the Swiss National Bank fixed and announced its monetary growth targets in terms of M_1 until 1978 and thus probably strongly influenced the formation of expectations in the exchange markets.

Let us note two more facts. First, only in Great Britain in 1975-79 and the United States in 1978-79 did the relative cost-of-living index increase more rapidly than M_2/M_2^* . This phenomenon implies that the public's mounting awareness of accelerating inflation caused an increasing velocity of money. The same phenomenon occurred, of course, in the case of the German hyperinflation (see Table 3). But note that no such development had occurred by 1979 in Italy, with its high rate of inflation. One reason may be a somewhat less developed economy, for we observed the same relationship for Sweden in 1755-65 (see Fig. 1) and for Russia in 1800-11 (see Table 2).

Second, Great Britain and the United States may now have entered periods of stabilization. The election victories of the Conservative Party in Great Britain and of Ronald Reagan in the United States and the appoint-

TABLE 8
 INDICES OF MONEY SUPPLY, PRICES, AND EXCHANGE RATES IN FIVE
 COUNTRIES RELATIVE TO GERMANY, 1972-79
 (1972 = 100)

Year	France			Great Britain			Italy		
	M_2/M_2^*	CPI/CPI*	FF/DM	M_2/M_2^*	CPI/CPI*	£/DM	M_2/M_2^*	CPI/CPI*	Lit/DM
1972	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1973	100.63	100.43	108.05	112.17	101.41	119.80	108.76	103.37	122.79
1974	113.38	106.71	115.26	121.19	109.76	134.49	118.76	115.36	148.20
1975	131.33	112.56	106.95	130.70	128.71	142.34	146.72	127.51	143.40
1976	139.15	118.04	130.88	136.08	142.62	189.39	168.71	142.15	202.75
1977	142.56	124.49	140.70	134.47	159.46	185.62	182.60	163.51	229.41
1978	141.46	132.27	145.07	136.85	169.29	203.26	198.43	179.07	253.45
1979	148.71 ^a	140.62	146.44	146.46 ^a	184.23	193.54	215.55 ^a	199.03	257.74

Year	Switzerland				United States		
	M_2/M_2^*	CPI/CPI*	SwF/DM	M_1/M_1^*	M_2/M_2^*	CPI/CPI*	\$/DM
1972	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1973	94.25	101.76	101.19	99.61	97.48	99.44	117.63
1974	95.16	104.32	89.49	90.75	100.68	103.03	132.93
1975	102.71	105.10	84.48	83.98	110.50	106.18	122.19
1976	103.74	102.27	87.42	87.53	116.24	107.49	134.97
1977	100.92	99.86	80.31	81.77	117.51	110.30	153.26
1978	98.36	98.30	74.35	87.91	115.36	115.62	177.87
1979	98.92	97.84	76.71	77.42	117.18	123.77	186.74

^a End-of-third-quarter figures used.

NOTE:

M_1 domestic, M_1^* German bank notes in circulation and checking accounts.

$M_2 = M_1$ plus domestic quasi-money; $M_2^* = M_1^*$ plus German quasi-money.

CPI domestic, CPI* German consumer-price index.

End-of-year or end-of-fourth-quarter figures used for money supplies and exchange rates.

SOURCE: Calculated from the figures given in OECD, *Main Economic Indicators: Historical Statistics, 1960-1979*.

ment of Paul Volcker as Chairman of the U.S. Federal Reserve Board aroused expectations that efforts would be made to slow the increase in the money supply in both countries. The pound and the dollar have already risen sharply against the Deutsche mark and inflation has fallen somewhat. These trends are not reflected in Table 8, except perhaps for the fall in the exchange rate of the pound against the Deutsche mark in 1979. If these stabilization policies are continued, one would expect a return to purchasing-power parities, as already seems to have happened in Britain.

10 SUMMARY AND CONCLUSIONS

The social environment is man-made. Man can therefore change it and thus change the object studied by social scientists. This fact greatly increases the difficulty of transmitting knowledge from one generation to another. If the social environment changes, say from a system of flexible exchange rates to a system of fixed rates, experiences and theories tend to be forgotten or not transmitted because they are no longer applicable. But this man-made environment may change again and revert to the earlier system or one similar to it. In the meantime, knowledge has been lost, and the same serious mistakes that were made before may be repeated again and again.

Recent work by economists has produced hypotheses to explain unexpected exchange-rate movements in relation to price movements under flexible exchange rates. My historical research, which began in the early 1970s, led to the finding that modern economists have only rediscovered some of the hypotheses concerning flexible exchange rates that had been stated by earlier economists and forgotten once or several times. In this study, several hypotheses have been shown to be true of all periods and all countries considered:

- The purchasing-power-parity theorem is valid in the long run but not the short run.
- Systematic undervaluation of a country's currency will develop if the country follows more expansionary monetary policies than its trading partners in the first phase.
- This undervaluation will disappear during the second phase either when inflation is stabilized or when it has accelerated over a long period.
- The degree of undervaluation tends to depend on the difference in the relative rates of inflation during the first phase.

Finally, we have seen that in a first period the money supply rises faster than domestic prices or even the exchange rate, but that in a second period the exchange rate and the price level rise more rapidly than the money supply. The second period may not occur at all, however, if the money supply is stabilized in time, if the inflation rate is not too high, and if there has been no earlier experience with inflation. This last hypothesis holds for the Swedish, Russian, and American Civil War experiences with flexible exchange rates. Developments in France from 1922 to 1926, however, do not fit the hypothesis. Here, the first period is missing: the exchange rate and the cost-of-living index rose faster than the money supply from the

beginning in 1922 until stabilization occurred in July 1926. What explanation can be offered for this exception?

I have already mentioned that the velocity of money or demand for real money balances depends on earlier experience with inflation. In 1922, many foreigners and Frenchmen alike had already witnessed several European hyperinflations. Thus, given the bad political and economic situation in France, many people probably feared that the franc would experience the same fate as the German mark or the Austrian or Hungarian crown. They began to buy foreign currencies, and the exchange rate rose. The rise in the exchange rate increased import prices and influenced inflationary expectations. The movement spread to domestic markets, and the demand for money expanded. At the time, France had a very substantial public debt of a short-term nature stemming from the First World War. When these claims were presented at maturity, the government had to pay them with newly issued money because it could not increase taxes rapidly enough to cover the additional expenditures. The money supply increased, inflation was financed, and inflationary expectations became self-fulfilling. In this case, the chain of cause and effect began with the influence of expectations on the exchange rate and then led to higher prices and a higher money supply. It is interesting that this series of events corresponds to parts of Helfferich's (1923) explanation of the German inflation (quoted at the end of Chap. 6), although it was wrong as an explanation of the German inflation.

The sequence of two periods during high and long-lasting inflations, exhibiting first an abnormally high and then an abnormally low demand for real money balances, implies that many people take a long time to understand the meaning of inflation. But can lack of information be the entire explanation of the fact that domestic prices usually lag behind the exchange rate until rather late in the inflationary process, even in the case of hyperinflations? People are likely to learn their lessons about inflation some time before prices begin to catch up. It follows that the costs of raising prices rapidly must be high, along with the information costs of judging the required price changes. People will incur these costs only if the costs of not changing prices often enough are substantial because of the high inflation rate.

Turning to economic policy, it makes a great difference whether a country is in the period with an abnormally high or an abnormally low real money supply. (For a discussion of the German cases of 1923 and 1948 and a comparison of those two situations, see Pfleiderer, 1976.) If the real money supply is above normal, as was the case for Sweden, Russia, and Civil War United States, inflation can be ended only by decreasing the real money supply. This can be accomplished either by stabilizing the nominal money

supply and tolerating a further increase in the price level or by lowering the nominal money supply.

The situation is quite different if the real money supply is below normal, as happened during the second periods of all the European hyperinflations of the 1920s. In these cases, confidence must be restored by a credible currency reform, by restricting the power of the government to borrow from the central bank, and by increasing tax revenues or lowering government expenditures. If confidence is actually restored, as happened at the end of all the European hyperinflations, the real money supply increases to its normal level and can often be used to finance the needs of the government until sufficient revenue can be secured from regular taxes.

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