

OFFICIAL INTERVENTION IN THE  
FOREIGN EXCHANGE MARKET OR,  
BET AGAINST THE CENTRAL BANK

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"...it would do little harm for a government agency to speculate in the exchange market provided it held to the objective of smoothing out temporary fluctuations and not interfering with fundamental adjustments. And there should be a simple criterion of success-- whether the agency makes or loses money."

--Milton Friedman, "The Case for Flexible Exchange Rates," 1953

Since the floating of exchange rates in the early 1970's, major central banks have failed dismally when judged by Friedman's profit-loss criterion. The combined losses of the central banks of Canada, France, Germany, Italy, Japan, Spain, Switzerland, the United Kingdom, and the United States have been approximately 12 billion dollars, making foreign exchange intervention a costly nationalized industry. To the extent that the speculators offset the central banks' intervention, the central banks' losses are a subsidy to these foreign exchange traders. Without this counter-speculation, the actions of the central banks would have a greater destabilizing effect on the exchange rate and produce a larger misallocation of resources.

This paper examines official foreign exchange intervention since the floating of exchange rates in the early 1970's. None of the central banks in this study have succeeded in their objective of stabilizing exchange markets. Some have incurred substantial losses, adversely affecting exchange rate movements. Generally the authorities have resisted exchange rate changes. When exchange rates have appreciated

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countries have accumulated dollars in an effort to retard appreciation, and when their currencies have depreciated countries have sold dollars to prop up their home currency. Some central banks have tried to maintain an existing exchange rate when there is a change in its fundamental equilibrium level. They are able to hold out for a limited period of time, but are eventually forced to allow the adjustment to take place, and lose substantial sums in the process.

#### I. Central Bank Disclosure

Central banks attempt to conceal their intervention<sup>1</sup> and later release only vague descriptions of their activities. Without concealment, a country's intervention is reflected in its international reserves. To support the price of its currency, the central bank buys its currency with reserves; and to prevent the appreciation of its currency, it buys reserves with its own currency. In practice, however, intervention is frequently hidden so that it does not show up in the official international reserve figures. In France, Italy, Spain, and the United Kingdom, nationalized industries effectively intervene by borrowing foreign currency which is then used to buy their own currency on the foreign exchange market. In Italy and the United Kingdom, the treasury insures the nationalized industries against any foreign exchange loss, but in France, and apparently in Spain, the industry must assume the exchange risk. Japan, and to some extent France, intervene with "hidden reserves," which are dollar deposits held at commercial banks. These are not reported as part of the official reserves. In Switzerland and more recently in Germany, the central banks swap foreign exchange with the commercial banks. Since the official reserves include these swaps, they do not accurately reflect intervention. Italian and French commercial banks effectively intervene, since the government "manages" their foreign exchange position. Also many central banks borrow foreign currency but report only their gross reserves rather than their net reserves.

In addition, the profits and losses from trading foreign exchange are generally

buried in the interest earnings on assets. Canada and the United States are the only countries where profits and losses from foreign exchange trading have been reported. However, it is done on a selective basis. After reporting losses from foreign exchange transactions of C\$22.7 million in 1976, Canada adopted new procedures for reporting which do not segregate the profits or losses on intervention, supposedly to recognize the impact of floating exchange rates.<sup>2</sup>

In 1978 congressional testimony, Federal Reserve Board Governor Henry Wallich cited a \$25 million profit on "current" operations in order to suggest that "intervention has tended to smooth exchange-rate fluctuations."<sup>3</sup> He excluded transactions involved in "the unwinding of pre-August 1971 support operations under fixed exchange rates." These excluded transactions were unsuccessful attempts to manage exchange markets from 1973 to 1978 and resulted in the loss of \$1.8 billion. The Federal Reserve began reporting profit and loss figures for U.S. foreign exchange operations in the June 1978 Bulletin. The profit on "current" operations soon disappeared and by January 1980, the loss on this account was \$562 million.

This paper uses a variety of data sources to uncover the various methods of intervention in order to determine whether the authorities' transactions resulted in stabilizing the exchange rate. Since the monetary authorities direct the other institutions such as the treasury, an exchange stabilization fund, nationalized industries, or commercial banks in their intervention; this paper uses the term central bank synonymously with all institutions the government uses to buy and sell foreign currency in order to influence the exchange rate.

## II. Friedman's Profit Criterion

Friedman argues that the objective of the central banks when trying to stabilize foreign exchange markets should be the same as that of the private speculator -- buy low, sell high. Buying when the price is low drives the price up, and selling when the price is high drives the price down. Therefore, if the central banks are

successful in stabilizing the foreign exchange market, they make a profit. If they are unsuccessful, they suffer a loss.

Most central banks follow a policy of "leaning against the wind" and try to moderate the speed of exchange rate movements. However, when there is a change in the fundamental equilibrium, slowing the adjustment prevents the exchange rate from performing its proper function. The exchange rate, like any other price, transmits information and provides an incentive to act on that information. Distorting this important price leads to a misallocation of resources.

Instead of slowing exchange movements, the objective of intervention should be to promote economic efficiency by reducing deviations from the equilibrium exchange rate. Using this criterion, successful intervention will produce profits but may not reduce variability as measured by the variance of exchange rate movements. When an economic shock causes a shift in the equilibrium exchange rate and the central bank resists the adjustment, the variance of the exchange rate movements will be small but the deviations from the equilibrium rate will be large and the central bank will lose money. If instead, the central bank allows the exchange rate adjustment to take place immediately the variance will be larger (since it depends on squared deviations) but the central bank will not lose money. There will also be greater stability in the sense that the exchange rate will reflect the new equilibrium value. There is even greater economic efficiency if the central bank anticipates the drop in the fundamental equilibrium exchange rate and sells its currency depressing the price before the drop occurs. The central bank will make a profit and the lower price will signal the new equilibrium to the market.<sup>4</sup>

Central banks rationalize purchasing currency at high but falling prices or selling at a low but rising price as enabling changes to take place at an "orderly pace." Sometimes, however, the central banks both increase variability and lose money. Some central banks have resisted a gradual movement in their exchange rate

until they lose too much in reserves. They then drop their support which results in a large sudden movement in the exchange rate.

### III. Central Bank Performance in the 1970's

The gains and losses from intervention for the nine countries in this study, from the time they floated their exchange rate in the early 1970's to the end of the decade, are shown in Table I. Only the gains or losses from transactions in the foreign exchange market are included in these figures. The valuation changes in the assets initially held are excluded.<sup>5</sup> Losses incurred due to the inflow or outflow of reserves just prior to the unpegging of the exchange rate are also excluded.

The first column gives the profit and loss without accounting for interest differentials. Dollars are assumed to be purchased or sold at a constant rate during a month. If, during month  $i$ ,  $n_i$  dollars are purchased and  $e_i$  is the average price of the dollar, then  $n_i e_i$  is the amount of domestic currency sold. The profit is equal to the sum of dollars purchased less the sum of the dollar value of domestic currency sold; or:

$$\text{Profit} = \sum_i (n_i - n_i \frac{e_i}{e_f}) = \sum_i [n_i (1 - \frac{e_i}{e_f})]$$

where  $e_f$  is the price of the dollar at the end of the period. Losses are substantial for Germany, Italy, Spain, Switzerland, the United Kingdom and the United States.

The second column of Table I shows the losses and profits when the difference in interest rates on different assets is taken into account.<sup>6</sup> Intervention is assumed not to effect the money supply. Therefore buying and holding dollars, usually U.S. Treasury bills, will mean holding less in domestic assets. Without any borrowing, the difference in interest earned in a month is the rate on U.S. Treasury bills times the cumulative dollars purchased (and then converted to the domestic

Table I

Gains and Losses from Official Intervention in the  
Foreign Exchange Market

Country	Period	Gain or Loss(-) without interest in millions of \$	Gain or Loss(-) with interest in millions of \$
Canada	First of June 1970 - December 1979	-82	-69
France <sup>1</sup>	End of March 1973 - December 1979	1200 (-1950)	1657
Germany	End of March 1973 - December 1979	-3423	-3394
Italy	End of February 1973 - December 1979	-3724	-2510
Japan	End of February 1973 - December 1979	-331	375
Spain	End of January 1974 - December 1979	-1367	-1537
Switzer- land	End of January 1973 - December 1979	-1209	-788
United Kingdom	End of January 1972 - December 1979	-2147	-3418
United States	End of March 1973 - January 1980	-2351	-2351

<sup>1</sup>For France, the loss is calculated assuming intervention is done in dollars and in marks. A profit is shown for the dollar figure and a dollar equivalent loss, in the parenthesis, for the mark figure.

<sup>2</sup>The United States issued dollar bonds with a Swiss franc exchange rate guarantee. This was equivalent to issuing Swiss franc bonds at U.S. interest rates. Consequently, there is no difference in the calculated loss.

currency) less the domestic interest rate times the total amount of domestic currency sold. The sum of the difference for each month, compounded by the domestic interest rate to the end of period (and then converted to dollars), gives the total additional interest earned on the accumulated dollar balance less the interest lost on domestic assets. Canada, France, Italy, Spain, and the United Kingdom, have, however, borrowed substantial amounts on the international capital market to finance their intervention. With borrowing, the difference in interest earned is the cumulative dollars borrowed less the cumulative dollars sold times the U.S. Treasury Bill rate, less the interest paid on the cumulative dollars borrowed, plus the interest earned on the domestic assets acquired. The combined loss for the nine countries is \$12.0 billion. These results are somewhat tentative since information on interest rates is incomplete;<sup>7</sup> however, even with interest rate data more favorable to the central banks the loss would exceed \$10 billion.

Figures Ia and Ib show the dollar price of each country's currency and the cumulative amount of dollars purchased on the foreign exchange market by the central bank. Since most of the countries resist exchange rate changes there is a similar pattern between the exchange rate and cumulative intervention. In other words, when the price of the currency tends to decline the central bank buys the domestic currency with dollars and when the price tends to rise they sell their own currency and accumulate dollars.

Countries such as Italy, Spain, and the United Kingdom sold substantial amounts of dollars in an attempt to maintain an existing rate but eventually had to give up the support operations producing an abrupt adjustment in the exchange rate. From the time Italy floated the lira in February 1973 until January 1976 the authorities spend \$13 billion in reserves buying lira to support its price. When support of the lira was suspended in January 1976 the exchange rate dropped by about 20 percent. In the next four years the Italian authorities increased reserves by \$25 billion



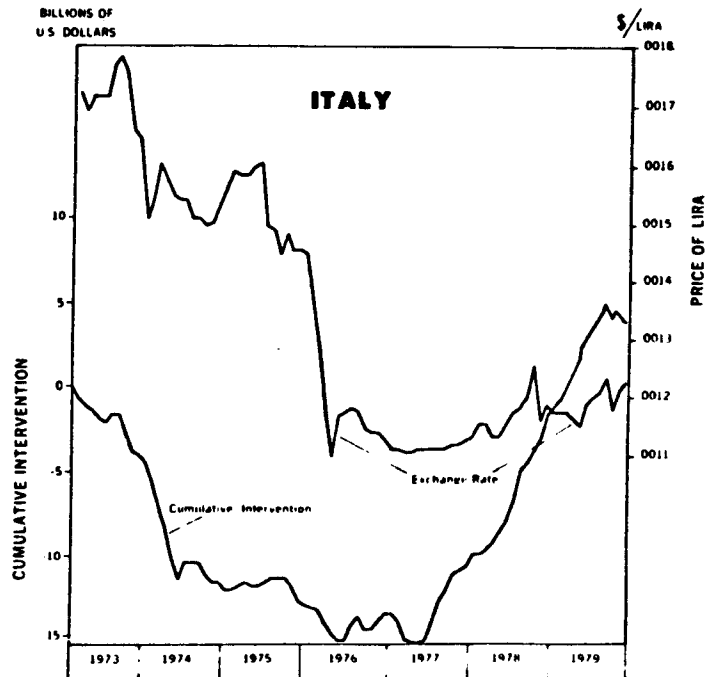
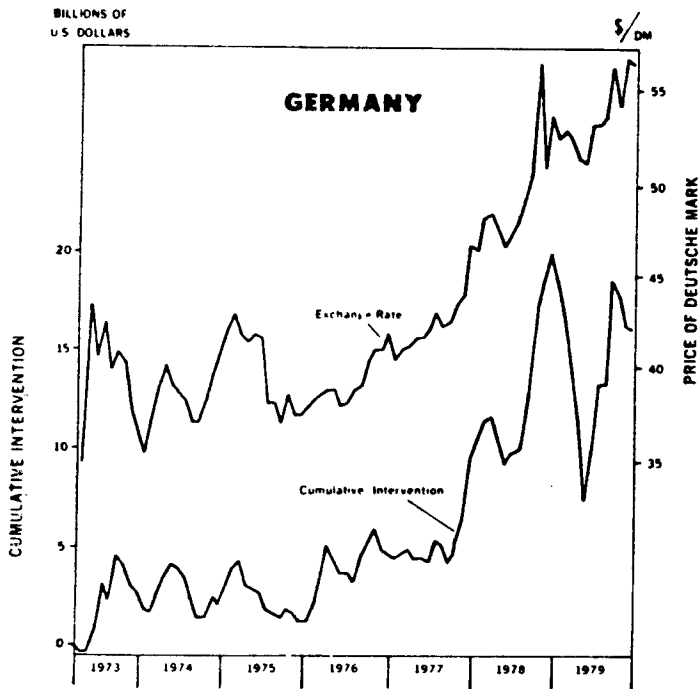
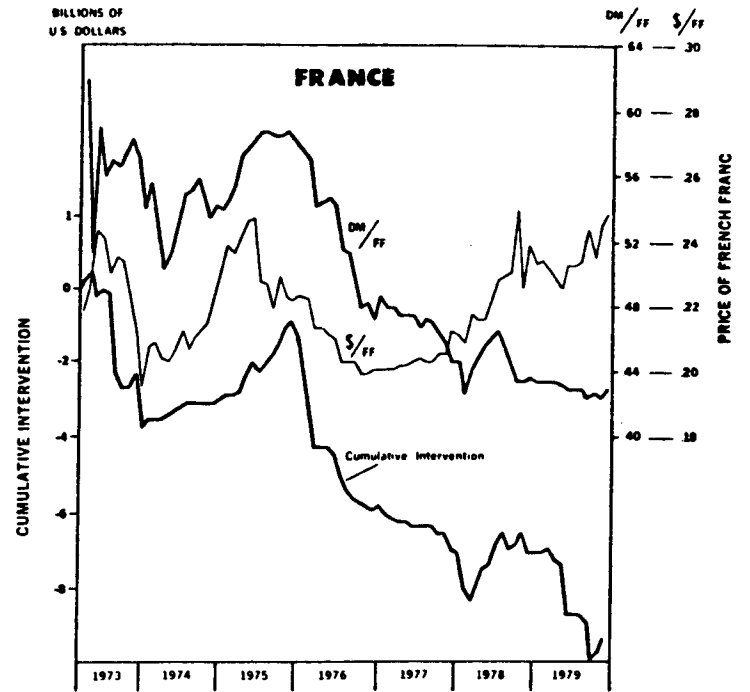
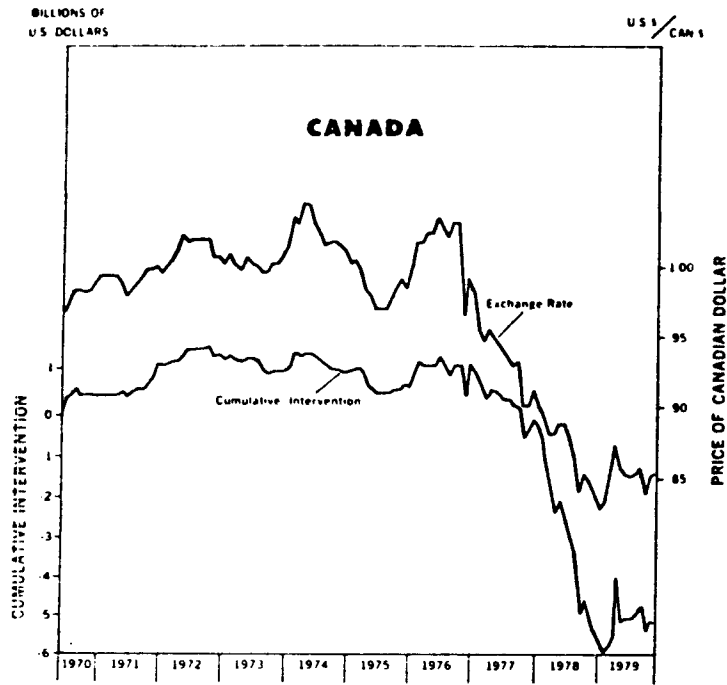
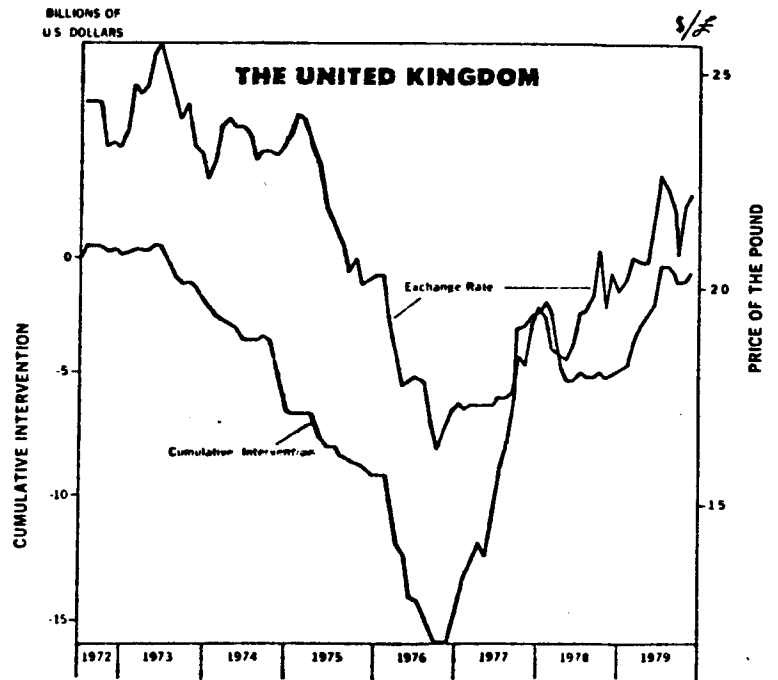
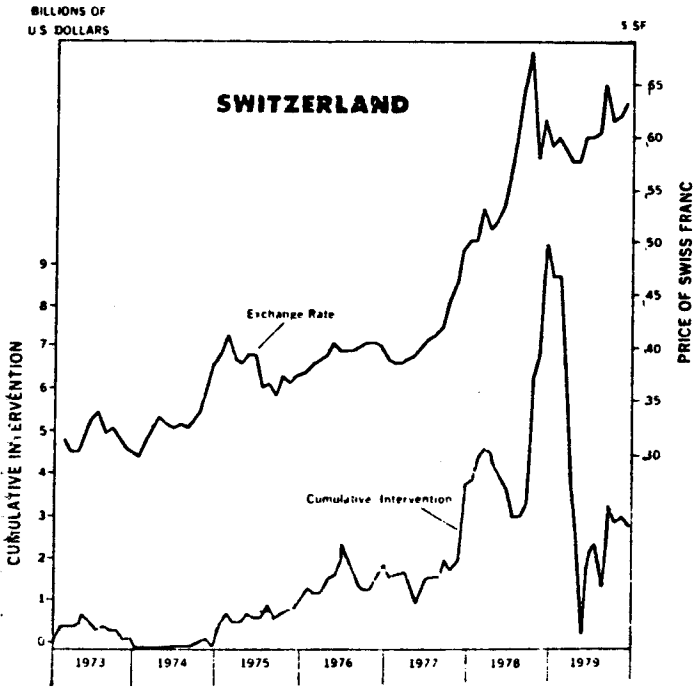
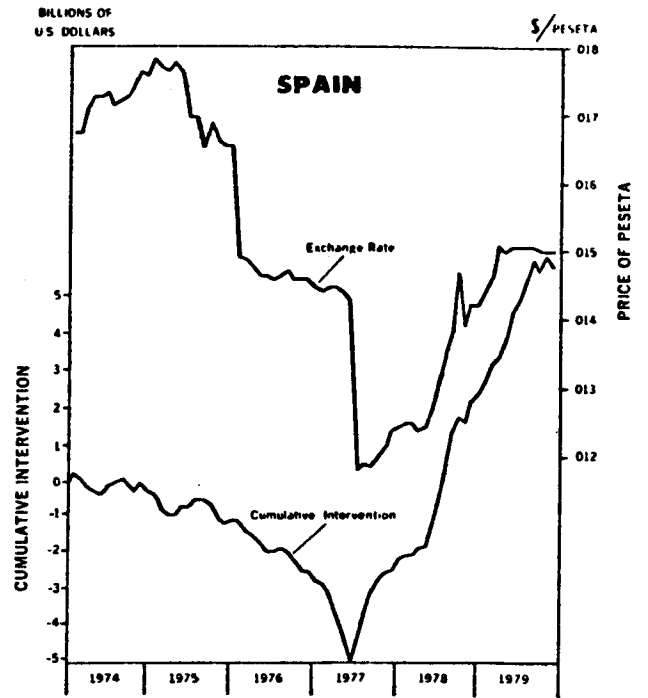
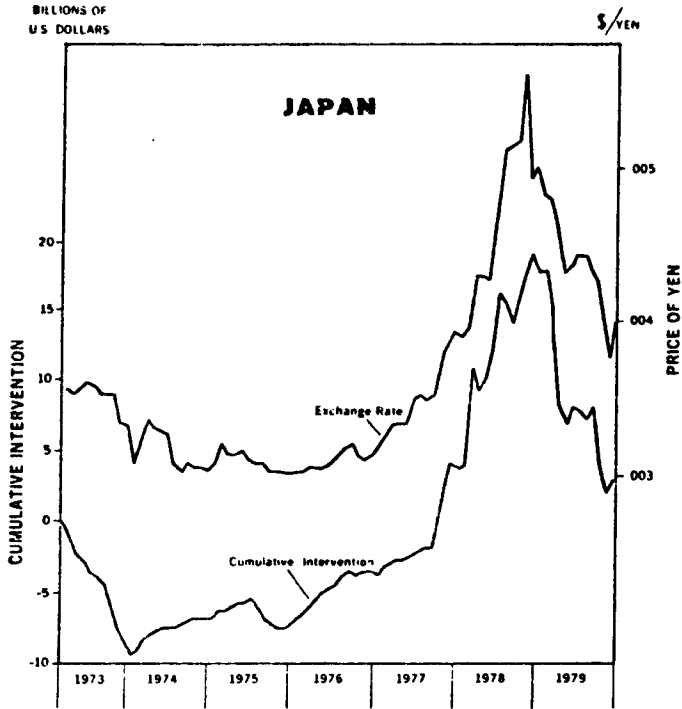


Figure 1a

Fig 1a



buying the dollars back at a much higher lira price.

From January 1974 when Spain allowed the peseta to float until July 1977 the Spanish authorities used \$5 billion in reserves to buy pesetas. Despite these purchases to support it, the price of the peseta gradually began to decline. The authorities only prolonged the fall in the exchange rate. In July 1977 they reversed their policy and the exchange rate dropped. During the following years the Spanish authorities increased reserves by \$10 billion buying dollars back at substantially higher prices.

From June 1973 through May 1975, the U.K. authorities used \$7.5 billion in reserves to buy pounds in support operations. The pound then began to drop despite additional purchases in support of its price. By October 1976 when the pound had reached its lowest point the authorities had spent an additional \$7.5 billion in reserves. In the following year the authorities reversed their policy and increased reserves by \$13 billion and did not allow the exchange rate to appreciate.

The remaining countries resisted exchange rate adjustments but allowed more movement when there was a lot of pressure in one direction or the other. For this reason their patterns of exchange movements are more similar to the patterns of cumulative intervention.

The correlation between intervention and the percentage change in the exchange rate is shown in Table II. For Italy and Spain the correlation is low on a month to month basis because the central banks strongly resisted exchange rate movements and the change occurred abruptly at a later date.

For three countries, Germany, Canada and France, the losses calculated in Table I would vary according to the end point chosen since most of their losses as of December 1979 are the valuation losses on the dollars they have accumulated or sold off. The dollar would have to appreciate by 21 percent in order to remove Germany's unrealized loss of 3.4 billion from their \$16.5 billion in accumulated reserves.

Table II

Correlation between Intervention and Change  
in the end of the Month Exchange Rate

Country	r	t-Statistic
Canada	.67	9.6
France <sup>1</sup>	.17 (.16)	1.5 (1.4)
Germany	.35	3.3
Italy	.22	2.0
Japan	.61	6.9
Spain	.08	.7
Switzerland	.30	2.8
United Kingdom	.43	4.4

<sup>1</sup>For France the statistics are calculated using both the dollar and mark exchange rate. The statistics calculated using the mark are shown in parenthesis.

France, on the other hand, has sold the equivalent of \$7.5 billion over the decade. The dollar would have to appreciate by 16.5 percent to remove their dollar profit.<sup>8</sup> Canada's results would also vary according to the final exchange rate used. The remaining countries have both accumulated and decumulated dollars closing out their position. Their losses, therefore, are not sensitive to the choice of the end of the decade as the terminating point in the calculations.

The first column of Table III gives the probability of losses resulting from random purchases and sales of foreign exchange being equivalent to the losses of the central banks as listed in the first column of Table I.<sup>9</sup>

A probability distribution for gains and losses can be determined assuming that random purchases and sales of dollars, with the same standard deviation as the actual intervention figures, were made at the historically prevailing exchange rate. If the values of  $n$  are assumed independent and drawn from a distribution with a zero mean<sup>10</sup> and a variance  $\sigma^2$  equal to the variance of official intervention, the variance of total profit will be

$$\sum_i \text{var} \left[ n_i \left( 1 - \frac{e_i}{e_f} \right) \right] = \sigma^2 \sum_i \left( 1 - \frac{e_i}{e_f} \right)^2 \quad (2)$$

This statistic is calculated using the sample variance of the intervention figures and the standard error of the result divided into the net profit or loss. With the assumption of normality, a one tail t-test gives the probability of losses occurring by random intervention being as large as those incurred by the central banks. Of the eight<sup>11</sup> countries for which there are data, four have losses of not only economic significance but of statistical significance as well.

The movements in these currency markets are essentially independent. With the assumption of independence, the joint probability that out of eight trials two will be in the .05% or less region, one in the 5.0% or less region, and one or more in the 25% or less region is equal to  $(8!/4!4!)(.0005)^2(.05)(.25) = 2.2 \times 10^{-7}$  or less than

Table III

Probability of the Same Loss for Random Intervention  
with the same Variability as the Central Banks

Country	Probability	t-ratio	Average Intervention (t-ratio)
Canada	*	-.20	-45 (-1.54)
France	**	**	**
Germany	less than 25.0%	-.70	203 (1.28)
Italy	less than .05%	-3.86	38 (.49)
Japan	*	-.14	37 (.24)
Spain	less than .05%	-3.58	80 (1.93)
Switzerland	*	-.26	35 (.38)
United Kingdom	less than 5.0%	-1.93	-13 - (.16)

\*Gain or loss statistical close to zero

\*\*France shows a dollar profit

one out of 4,5000,000. Random intervention is used only as a benchmark to show that the losses could hardly have occurred by chance. No intervention would be preferable to random intervention.

The consistent losses through foreign exchange intervention can be explained by the central banks having a degree of monopoly power in the foreign exchange markets and trying to maintain an exchange rate when there is a change in its fundamental equilibrium level. They are able to hold out for a limited period of time but are eventually forced to allow the adjustment and lose money in the process.

#### IV. Using the Profitability Criterion to Monitor Central Bank Performance

From the time they initially floated until the end of the 1970's, the central banks systematically lost in their attempts to manage the exchange market. Table IV shows the loss calculations for various subperiods.<sup>12</sup> Generally, the banks have lost money for sub-periods of four or five years. For an individual country, however, the results can vary substantially depending on what dates are used to begin and end the calculations. In other words, the magnitude of the profit or loss is sensitive to starting and ending points.

For example, Japan's loss calculated from the end of February 1973 to the end of 1979 is \$331 million, but if the calculation is terminated at the end of 1978 the loss is \$2,906 million. At the end of 1978, Japan held large dollar balances which they had acquired when they sold yen in an effort to keep the yen from appreciating. The value of Japan's dollar reserves at the end of 1978 was substantially lower than the price they had originally paid for the dollars. During 1979 the dollar increased in value, and Japan sold dollars at more favorable prices as their value rose. In addition, the accumulated dollar balances still held by the central bank at the end of 1979 were worth considerably more than they were in 1978. Japan's loss was substantially reduced by the end of 1979. On the other hand, if the first two years are excluded and the calculation begins at the end of 1974, rather than February 1973,

Table IV

Profits and Losses (-) for Various Time Periods  
in millions of dollars

Canada				France			
To the end of	From the end of May '70	1974	1976	To the end of	From the end of March '73	1974	1976
1973	-15			1973	-276		
1974	-19			1974	-26		
1975	5	0		1975	40	94	
1976	-16	-15		1976	-359	-3	
1977	22	-51	-49	1977	-6	192	37
1978	-193	-335	-344	1978	954	782	253
1979	-82	-211	-218	1979	1468	1165	501

Germany				Italy			
To the end of	From the end of March '73	1974	1976	To the end of	From the end of Feb. '73	1974	1976
1973	420			1973	-184		
1974	345			1974	-485		
1975	526	-25		1975	-1036	4	
1976	112	-185		1976	-3670	-319	
1977	-620	-685	-171	1977	-3657	-339	-25
1978	-2619	-2349	-1362	1978	-3484	-584	-340
1979	-3423	-3012	-1825	1979	-3724	-1012	-904

Japan				Spain			
To the end of	From the end of Feb. '73	1974	1976	To the end of	From the end of Jan. '74	1974	1976
1973	-318			1974	17		
1974	-747			1975	-34	-37	
1975	-800	24		1976	-191	-167	
1976	-607	-17		1977	-1004	-95	-438
1977	-450	-1129	-396	1978	-1127	-1098	-874
1978	-2906	-5229	-3568	1979	-1367	-1349	-1253
1979	-331	-1019	-281				

Switzerland				United Kingdom			
To the end of	From the end of Jan. '73	1974	1976	To the end of	From the end of June '72	1974	1976
1973	-62			1973	-86		
1974	-61			1974	-34		
1975	-32	29		1975	-1150	-293	
1976	-125	-63		1976	-2818	-1147	
1977	-613	-543	-35	1977	-2511	-1356	-1236
1978	-1543	-1469	-362	1978	-2222	-1392	-1919
1979	-1209	-1128	57	1979	-2147	-1797	-3280



Japan's loss at the end of 1979 is \$1019 million rather than \$331 million. To support the yen in 1973 and early 1974, Japan sold dollars at what was later to become a very favorable price. Therefore, excluding these early transactions substantially increases Japan's losses.

Another feature of the profit and loss calculations is that the sum of the gains or losses for two adjoining sub-periods does not necessarily equal the gain or loss for the whole period. The reason for the difference is that reserves accumulated in the first period can appreciate or depreciate in the second period. Switzerland shows a \$63 million loss from the end of 1974 to the end of 1976 and a \$57 million profit from the end of 1976 to the end of 1979. However, for the entire period, from the end of 1974 to the end of 1979, Switzerland incurred a loss of \$1,128 million. In other words, the sum of the loss in the first period and the profit in the second period is a loss of \$6 million but the loss for total period is \$1,128 million. The difference of \$1122 million is the appreciation in the second period of the Swiss francs that were sold in the first period.<sup>13</sup> The Swiss authorities sold 5,001 million Swiss francs during 1974 and 1975. These Swiss francs were worth \$2,042 million at the end of 1975 but by the end of 1979 they would have been worth \$3,164 million.

It is also possible to have a loss for each subperiod and a profit for the total period. For Canada, the two adjoining subperiods, from the end of May 1970 to the end of 1974 and from the end of 1974 to the end of 1977, both show losses of \$19 million and \$51 million respectively. The total period, however, shows a profit of \$22 million.

These examples illustrate why it is difficult to find a meaningful accounting measure that can be used to evaluate intervention on a quarter-by-quarter or even a year-by-year basis. The only way to insure that the sum of profits and losses for the subperiods is equal to the loss for the total period would be to require closure;

that is, the central bank would have to close out its position at the end of each accounting period. Without closure, there is no single number that can be reported each period that would give complete information.

The United States and Canada, the two countries that have reported profits and losses, have not provided sufficient information to convert their figures to calculate profits and losses for different periods. Canada annually reported profit or loss on trading, plus profit or loss on unmatched purchases or sales. It is necessary to know the volume of net purchases or sales in order to calculate the net profits or losses for a period of more than that individual year.

Before 1979, the Federal Reserve reported only realized profits and losses.<sup>14</sup> They showed a loss on the "liquidations of foreign currency debts outstanding as of August 15, 1971," but a small realized profit on "current" operations. However, in March 1979, when they started reporting the unrealized profit or the valuation losses on the outstanding assets and liabilities they showed an unrealized loss of \$548 million on the "current" operations. In calculating the realized profit, it is arbitrary which purchase is matched with which sale. The only meaningful profit or loss that can be considered is the sum of all past realized profit plus the profit or losses on currently outstanding assets or liabilities. There is no way to calculate the profit over shorter periods from their figures.

In addition to these practical problems, Eastman and Styholt (1957) have discussed theoretical problems concerning the profit criterion if the central bank is a monopolist with good foresight. The central bank would make zero profit if it could remove currency fluctuations completely. To maximize profit they would stabilize exchange rates only to the point where the price gave them a monopoly profit. A third rather contorted argument is that a central bank could reduce volatility and lose money if it was able to slightly reverse a cyclical exchange rate movement. This would occur if the central bank sold so much of its currency that it actually

depressed the price slightly below the fundamental value, when without intervention the price would be above the equilibrium. In other words, the intervention is in the right direction, but excessive in amount.

Empirically the banks have intervened in the wrong direction and have delayed equilibrium adjustments. Central banks have some degree of monopoly power but they are closer to a competitor than to a monopolist. Gross central bank intervention for all banks is \$100 billion to \$150 billion per day<sup>15</sup>, while gross transactions on the New York market alone average \$32 billion per day.<sup>16</sup> If central banks did have the ability to predict exchange rates, the monopoly profits would soon dissipate since other speculators would enter the market when central bank did.

Another theoretical argument against the profit criterion is that a central bank could make a profit by deceptively inflating or deflating the economy. If the bank purchased foreign assets and then inflated the money stock by buying domestic assets, the domestic currency would depreciate and the foreign assets would appreciate in terms of the domestic currency. The opposite, selling foreign assets and then deflating the economy, is also possible. It is unlikely, however, that monetary authorities would pursue a policy of producing unanticipated inflation or deflation in order to show a profit on their foreign exchange transactions. If countries were willing to let their monetary policies be dictated by foreign exchange transactions, they would be able to maintain a unified currency system, as under the gold standard, with truly fixed exchange rates. It is, in fact, because countries have independent monetary policies that fixed exchange rates are not possible.

## V. Currency Speculation as a Nationalized Industry

If speculators do not bet against the central bank, the loss in the overall economic welfare is equal to one-half the loss of the central bank. To the extent that speculators bet against the central bank they reduce the central bank's loss and they also reduce the loss in economic efficiency.

These propositions can be represented using framework developed by Johnson (1976). Figure IIa depicts the situation when speculators do not bet against the central bank. The price of dollars in home currency is  $P$ . The demand and supply of dollars (DD and SS) in the foreign exchange market is determined by the demand and supply for imports and exports. Dollars are demanded by the home country to buy imports and dollars are supplied by the rest of the world in exchange for home currency to buy the home countries exports. The supply of dollars also represents the demand for the home currency in the sense that the area of  $OP_eEQ_e$  represents the quantity of home currency demanded at the price of  $1/P_e$  dollars per unit of home currency.

If the central bank borrows  $VT$  dollars in the first period to intervene and then sells these dollars on the foreign exchange market, the sale of these dollars will depress the dollar in terms of the home currency and bolster the price of the home currency in terms of dollars. The supply of imports and the demand for exports are assumed to be perfectly elastic. The dollar price of imports remains the same but the home currency price falls and the quantity purchased increases. In Figure IIa the area  $P_eETP_1$  is the addition consumers' surplus from imports. The dollar price of exports does not change but home currency price falls and the quantity supplied decreases. The area  $P_eEVP_1$  is the reduction in producers' surplus from exports. The net gain in these two markets is  $VET$  in comparison with the cases when there is no intervention. The rest of the world has a balance surplus equal to  $VT$  dollars and the home country has a deficit  $OP_1$  times  $VT$  units of home currency.<sup>17</sup>

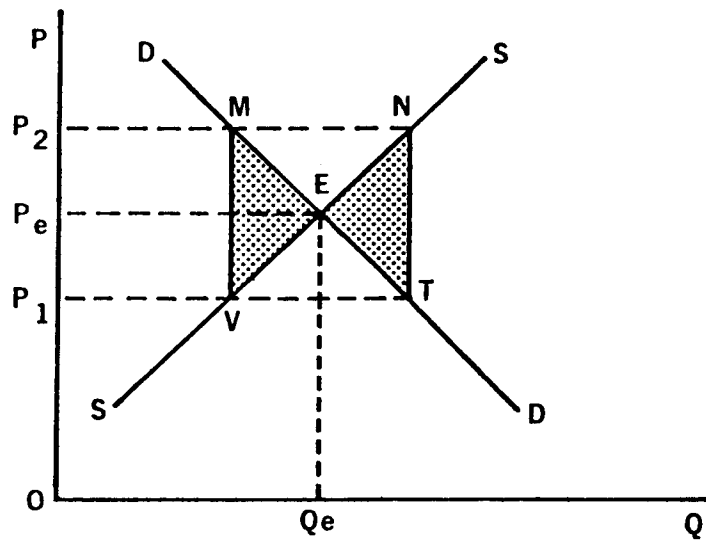


Fig. II a

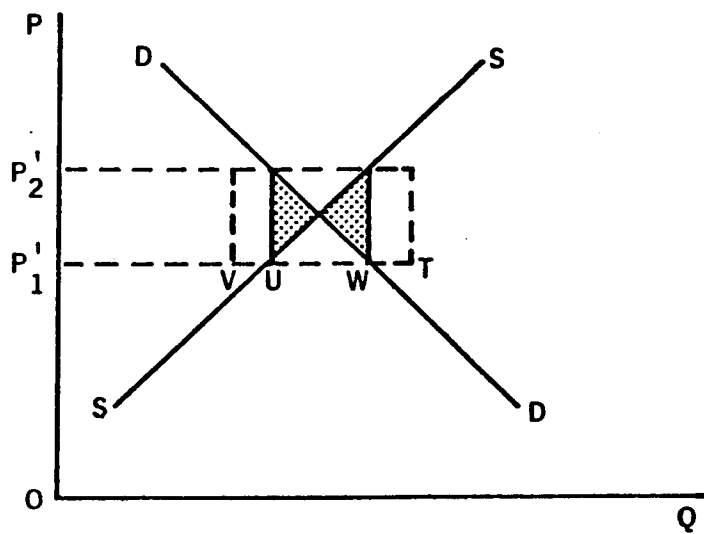


fig. II b

In the next period, the central bank buys back dollars on the foreign exchange market, bids the price of the dollar to  $P_2$  and depresses the price of home currency. Exports increase giving an increase in producer surplus equal to  $P_2NEP_e$ . Imports decrease giving a reduction in the consumers' surplus equal to  $P_2MEP_e$ . The net surplus is MNE. The rest of the world has a deficit of dollars equal to VT and the home country has a surplus equal to  $OP_2$  times MN.<sup>18</sup> The area MNVT represents the loss from central bank's intervention and also represents the amount the country has produced over what it has absorbed in the two periods. Half of this loss (MEN + VET) is transferred to consumers' and producers' surplus and the other half, the shaded area in Figure II, represents the welfare loss from the central bank's destabilizing speculation.<sup>19</sup> As Johnson (1976) states "when goods could be produced and consumed in a steady flow over time any activity that causes production and consumption to occur unevenly (and unequally) over time by transferring output between periods reduces welfare."

Figure IIIb shows the welfare loss when speculators bet against the central bank. In this case the central bank first sells VT dollars but speculators buy VU + WT dollars. The central bank's loss is decreased, variability is reduced, and the welfare loss is reduced to the shaded area. If  $r = (VU + WT)/VT$ , the ratio of counter-speculation to intervention, then the loss to the central bank is  $(1 - r)$  times the central bank's loss without counter-speculation. And the loss of economic efficiency is reduced to  $(1 - r)^2$  times the efficiency loss without counter-speculation.

Foreign currency speculation has become a costly nationalized industry for Germany, Italy, Spain, Switzerland, the United Kingdom and the United States but with little public notice. By contrast, the losses for British Steel received substantial attention in early 1978. British Steel's average annual losses for the six years ending in March, 1978 were about £ 120 million per year<sup>20</sup>, while Britain's

foreign exchange losses were averaging over \$400 million per year.

With other nationalized industries, losses primarily reflect income transfers from taxpayers to the industries' employees or the country's consumers of the subsidized products since the welfare triangle representing the loss in economic efficiency is small relative to the industry's loss. To the extent speculators do not offset central bank losses the loss in economic efficiency is one-half the central bank's loss. The ratio of the counter-speculation to central bank intervention is the fraction of the central bank losses that goes to speculators who are not necessarily nationals. So while funds lost by most national policies or programs, for the most part, benefit some group or agency in that country, foreign exchange losses do not.

There is no apparent political explanation for intervention and the consequent losses since no interest group consistently benefits from the intervention. The central banks intervene in both directions trying to prevent exchange rate changes. For example, exporters would benefit if the government was able to consistently depress the price of their currency and importers would benefit if government was able to consistently raise the price of their currency. Until late 1978, the explanation for Japan's intervention could be that they were maintaining a mercantilist policy and subsidizing exports by buying dollars and thereby running a surplus. However, when exchange rates began to decline they reversed their policy and began buying yen. The United Kingdom tried to prevent the pound from falling in 1976 and then tried to prevent the subsequent rise in value of the pound. Italy also supported their currency in 1975 and January 1976 and later reversed their policy. The authorities, therefore, are not subsidizing any political group in the countries consistently.

Only the inertia of institutions and the lack of public notice can explain the continuation of unsuccessful official foreign exchange speculation. The central banks

are still behaving as they did during the pegged exchange rate era by resisting exchange rate changes. That is, central banks have been trying to maintain an existing exchange rate when there is a change in its fundamental equilibrium level. They are able to hold out for a limited period of time, but are eventually forced to allow the adjustment to take place and lose money in the process.

#### VI. The Paradox of France

France's intervention in the foreign exchange market is paradoxical in that intervention appears to have been profitable in dollars but to have destabilized the mark-franc exchange rate. The profitability criterion is straight forward when there is only the domestic currency, the franc, and one other principle currency, the dollar. With two other currencies, the mark and the dollar, it is possible that in terms of the franc the dollar may be high when the mark is low; and the dollar low when the mark is high. When intervention is in dollars but the objective is to stabilize the mark the profitability rule is reversed. Making a profit in dollars destabilizes the mark.

Suppose the mark price of the franc is high in the first period and low in the second period and the dollar price of the franc is low in the first period and high in the second. If the authorities buy francs with dollars in the first period and sell francs and acquire dollars in the second period they will destabilize the franc-mark exchange rate and at the same time make a profit on their dollar-franc transactions. In terms of the mark, they have bought high and sold low, which is destabilizing. In terms of the dollar, they have bought low and sold high, which is profitable.

The objective of the French authorities has apparently been to stabilize the franc relative to the mark and other european currencies in the "snake". France was linked to the mark, through the snake, three separate times during the 1970's. Although France never stated an objective when floating separately from the snake,



their repeated membership in the "snake" indicates a desire to stabilize the franc relative to this block of countries. France has a stronger incentive to have a stable exchange rate with these European countries since the magnitude of trade with them is many times greater than it is with the U.S. The capital account, however, would give them some motivation to stabilize relative to the dollar since most capital account transactions are settled in dollars.

Obviously, when France was in the snake, the authorities were trying to stabilize the franc relative to the mark. During the periods when France was out of the snake, the behavior of the French authorities indicates that they were trying to stabilize against the mark. The pattern of intervention in Figure I suggests that the French monetary authorities have made the stabilization of the franc-mark exchange rate a priority over the stabilization of the franc-dollar rate. There is one dramatic episode with heavy intervention when the franc-dollar and franc-mark exchange rates were moving in opposite directions. Between September 1977 and March 1978 there was concern that the Leftist Coalition would win the legislative election. During this time the franc was depreciating relative to the mark and appreciating relative to the dollar. The authorities intervened by purchasing francs, thus resisting the movement in mark-franc rate but reinforcing the movement in dollar-franc rate. The authorities were clearly responding more to the mark than to the dollar.

If France is following a policy of "leaning against the wind" and resisting changes in the franc-mark exchange rate, there should be a relationship between this exchange rate and the intervention figures. For the period, April 1976 through February 1979, when France was out of the snake, the correlation between French intervention and changes in the end of month franc-mark exchange rate is .5 while the correlation between French intervention and the franc-dollar exchange rate is in the wrong direction and is -.1.

Even though France appears to have the objective of stabilizing the franc-mark rate, the intervention currency, for the most part, is probably the dollar. The funds which are borrowed by the public firms and converted into francs in order to affect the exchange rate are primarily dollars. Historically central banks have held almost all of their foreign currency reserves in dollars. The dollar is still used by most monetary authorities to intervene in the foreign exchange market. The French data, however, is available only in French francs and The Bank of France does not give a break down of foreign exchange by currency. Germany, in comparison, regularly reports what part of their foreign currency holdings is in dollars. Over 95% of their foreign currency reserves are usually held in dollars. The dollar is apparently used extensively for intervention by countries in the snake.<sup>21</sup> Therefore, it is most likely that France holds primarily dollars and that the dollar is their intervention currency.

The French authorities can use dollars, as readily as marks to influence the mark-franc (DM/FF) exchange rate. Assuming that the relationship between the mark and the dollar (DM/\$) will be unaffected by France buying and selling francs in the foreign exchange market, the French authorities can decrease the DM/FF exchange rate by buying dollars with French francs thereby decreasing the dollar-franc (\$/FF) exchange rate. Since triangular currency arbitrage will maintain the relationship  $(DM/)(\$/FF) = DM/FF$ , the dollar-franc rate will decrease in proportion to the mark-dollar rate. Therefore, from the viewpoint of stabilization it makes little difference whether the authorities intervene in dollars or marks.

From the point of view of profitability, however, the currency used for intervention can make a difference. If France intervened in dollars during the 1970's, they made a profit of \$1.2 billion dollars. If they intervened in marks during the 1970's, they lost the equivalent of \$2.0 billion.

In order to use the profitability criterion as a measure of stabilizing intervention, we must assume that France is intervening in the currency they are trying to

stabilize. The franc-mark exchange rate should be used to calculate a hypothetical profit when the authorities are intervening to stabilize the mark, regardless of what currency is actually used for intervention. If on average the francs are sold when their price in marks is high and are bought when their price in marks is low, the calculation would show a profit and intervention would be stabilizing. However, the calculations using franc-mark exchange rate show a significant loss of the equivalent of \$2.0 million. Therefore, France failed in its effort to stabilize the franc with the mark even though they inadvertently made a profit in dollars, the intervention currency.

#### Conclusion

Friedman's (1953) prediction has proven accurate:

"...to suppose that speculation by governments would generally be profitable is in most cases equivalent to supposing that government officials risking funds that they do not themselves own are better judges of the likely movements in foreign exchange markets than private individuals risking their own funds."

The objective of official intervention should be to promote economic efficiency by reducing deviations from the equilibrium exchange rate. Using this criterion, successful intervention will produce a profit. The record of individual central banks varies from time period to time period; but taken as a group the central banks have consistently lost. Some central banks have tried to maintain an existing exchange rate when there is a change in its fundamental equilibrium level. They are able to hold out for a limited period of time, but are eventually forced to allow the adjustment to take place, and they lose substantial sums in the process.

If speculators did not bet against the central bank, the loss in the overall economic efficiency would equal one-half the loss of the central bank. With speculators offsetting the central banks' intervention, the misallocation resources is greatly reduced and the central banks' losses become largely a subsidy to these foreign exchange traders.

## FOOTNOTES

1. From the era of the pegged exchange rate, the central banks have a tradition of trying to conceal their operations. Under this system, a decline in reserves could have produced a run on the currency since a devaluation would have been expected. Exchange traders, however, claim to be able to assess the order magnitude of central bank purchases and sales. Estimates appear daily on the wire service.
2. "Annual Report to the Parliament, on the Operation of the Exchange Fund Account 1977," Department of Finance, Canada, p. 10.
3. "Statements to Congress," Federal Reserve Bulletin, February 1978, p. 89.
4. Wonnacott (1957) and Eastman and Styholt (1957), discuss the objective of stabilization when there is a step change in the fundamental equilibrium.
5. For example, Germany has reported a loss on its external assets of 30.6 billion Deutsche marks since March 1973. The major part of this total, however, is due to the decline in the value of the dollars they held when the mark was allowed to float. Only a fraction of this loss is due to intervention.
6. If a country's exchange rate is expected to appreciate the currency will sell at a forward premium and the domestic interest rate will be lower than the dollar interest rate by the amount of the premium. If the country's exchange rate does appreciate by that amount, the additional interest earned on the dollar assets will offset the depreciation of the dollar.
7. The U.S. Treasury Bill rate is used for accumulated dollar holdings. For the other countries, the shortest term government security rate published in International Financial Statistics is used. The treasury bill rate is used for Canada and the United Kingdom, the medium term government bond rate is used for Italy, and the government bond rate is used for the remaining countries except Spain where only the discount rate is available.

## FOOTNOTES (con't.)

Only limited information is available on the interest rate paid on the borrowings. What information is available indicates that the rate paid is closest to the Baa corporate bond rate. Consequently, this rate was used. Some borrowing of foreign exchange was done in Deutsche marks and Swiss francs (see Borrowing on International Capital Markets and The Economist, March 27, 1976, p. 99). If the dollar appreciation of this borrowing were accounted for it would increase the loss for the five countries that borrowed in the international markets. For the countries that have accumulated dollars, Germany, Japan, and Switzerland, the opportunity cost of the domestic interest rate may be too high and the loss over estimated.

8. The mark would have to depreciate by 18 percent to remove their mark loss.
9. An analogy suggested by an employee of the Federal Reserve is "What are the chances that 'a monkey at a typewriter' would do as poorly as the central banks."
10. Despite some countries accumulating or decumulating dollar reserves the variances for the intervention figures are so large that the hypothesis that the mean is zero cannot be rejected for any of the countries. The average intervention and t-ratio is shown in the third column of Table III.
11. No measure of intervention on a monthly basis is available for the United States.
12. The interest differentials are not included.
13. The difference is also equal to the depreciation in the second period of the dollars that were accumulated and the dollars that were lost in the first period.
14. Reporting realized profit and losses creates an incentive to close out a position only if it shows a profit.

## FOOTNOTES (con't.)

15. Quarterly figures for gross intervention are released by the Federal Reserve. The central bank supply intervention figures among themselves but do not release the data.
16. See Federal Reserve Bank of Chicago, International Letter, No. 425, July 4, 1980, p. 3.
17. The reduction in the relative price of traded goods shifts consumption toward and production away from traded goods. With a lower price level, the real supply of money is increased producing an excess flow demand goods which is met by the balance of payments deficit. See Connolly and Taylor (1976). It is assumed that the effect on money stock from the deficit is sterilized by the creation of money which is a subsidy to the public and allows absorption to exceed production by the amount of the deficit.
18. The effect on the money supply through the balance of payments surplus is assumed to be sterilized by confiscation of money from the public and production exceeds absorption by the amount of the surplus.
19. This example is close to what actually happened in Italy, Spain, and the United Kingdom. The central bank borrowed and sold dollars to support their currency and then dropped their support and bought the dollars back at a substantially higher price.
20. Most of the loss (£ 443 million) occurred in the final year. Source: Annual Report and Accounts, British Steel Corporation. A more accurate comparison would take into account a required return on equity less appreciation of physical capital.
21. See, "The European System of Narrower Exchange Rate Margins." Monthly Report of the Bundesbank, January 1978, pp. 22-29.

## APPENDIX

In some countries intervention is carried out by some government agency other than the central bank such as a foreign exchange fund. In addition, various other methods of intervention are used; nationalized industries are sometimes instructed to borrow foreign exchange; the net foreign exchange position of banks is "managed" by the government; or the government maintains deposits at commercial banks.

The composition of reserves is taken into account where possible, since appreciation or depreciation of non-dollar assets may be mistaken for dollar intervention. Allocation of SDR's, revaluation of SDR's and the revaluation of the gold contribution to the European Monetary Cooperation are taken into account. Canada, Spain and the United Kingdom report reserves in dollars. Figures for France, Germany, Japan, and Switzerland are reported in home currency at acquisition cost. Italy reports currency reserves at market value.

With the exception of Switzerland, exchange rates are averages of daily figures for the relevant week or month as reported in International Financial Statistics since July 1974 and in The Wall Street Journal for previous dates. For France the commercial rate is used prior to March 20, 1974, when the exchange market was split in a two-tier system. For Switzerland, exchange rate data is the monthly average of daily figures taken from Monatsbericht, Schweizeische National Bank.

## CANADA

Canadian reserve figures are reported in U.S. dollars. The Department of Finance issues monthly reserve data in press releases. Daily data on reserves are made available with an eighteen month delay. For 1970-1976 the daily data are used and from 1977 onward monthly data are used, assuming that dollars are bought or sold at a constant rate during the month. (1)

A number of factors are taken into account which effect the level of reserves but do not reflect 1977 intervention. Canada had outstanding forward contracts to purchase U.S. \$360.3 million which were acquired while pegging the Canadian dollar, before it was allowed to float upward at the beginning of June 1970. These forward contracts were assumed to mature at a constant rate through the remainder of that year and were deducted from the increases in reserves. SDR allocations of \$117.7 million, \$116.6 million and \$183.9 million equivalent were made in January of 1970, 1971, and 1979, respectively. Reserves were drawn in June 1970 for the repayment of \$68 million to the Italian Exchange Office for debt incurred in 1968, and in June 1973 for the repayment of \$94 million for a German Mark denominated loan.

In May of 1972 and October of 1973, gold and SDR denominated assets were revalued by \$133.7 million and \$184.9 million, respectively, when gold was first revalued to \$38.00 per fine ounce and then to \$42.22 per fine ounce. Starting July 31, 1974 SDR denominated assets were valued according to the IMF method using market values of a composite basket of currencies. After that date the increase in the change in the dollar value of SDR denominated assets was deducted from the change in reserves when calculating intervention. (2) There were gold sales in March and August 1976 and in December of 1977 and 1978 there were small gold transfers to the Mint.

Beginning in 1978 Canada arranged credit facilities with Canadian chartered banks and also with U.S. and other foreign banks. (3) Various drawings and repayments were made on these facilities. Starting in May 1978 bond issues in the U.S., German, Japanese, and Swiss capital markets were also made as source of foreign exchange.

#### FRANCE

In March 1973, France floated jointly with the other European currencies. Since that time France left and rejoined the joint float twice. France first left and floated independently in January 1974 and then rejoined in July 1975. France left again in March 1976 and rejoined most recently in March 1979.

Changes in the net foreign assets of the Bank of France reflect only a part of official intervention activities. The Exchange Stabilization Fund (FSC from its French initials) rather than the Bank of France makes the official transactions in the foreign exchange market and these transactions are not necessarily reflected on the Bank of France balance sheet. The government also has a policy of having public and semi-public firms finance some of their activities by borrowing foreign funds and converting them on the foreign exchange market to effect the exchange rate. Finally, the net foreign exchange position of the commercial banks (which are in a large part owed by the government) is managed by the government.

The basic reason for the existence of the FSC is that the Bank of France is required to publish a weekly financial statement and would be unable to conceal its intervention. If the FSC intervenes in the market by using advances from the Bank of France or by selling the Bank of France foreign exchange to obtain francs, its operations show up one-for-one on the Bank of France balance sheet under the items "Liquid Reserve Assets" or "Advances to the FSC." If, however, the FSC uses its own resources or funds from the European Monetary Cooperation fund to intervene, the intervention is concealed since there are no transactions with the Bank of France. Data reported in the National Credit Council's Annual Report on the sources of the monetary base are used to measure intervention by the FSC. (4)

France borrowed and repayed the European Monetary System in September 1973 and in the first quarter of 1976. The major discrepancies between intervention, measured as changes in the monetary base due to changes in reserves, and intervention, reflected on the Bank of France balance sheet, is due to this borrowing since the FSC has limited resources of its own.



Beginning in mid-1974 nationalized industries have effectively intervened by borrowing foreign exchange which is used to purchase francs. (5) Since the majority of these nationalized firms realize their incomes in domestic currency, this policy adds the additional financial burden of exchange rate risks. The Treasury does not give the firms any guarantee against exchange rate risk. (6) Presumably the primary motivation to borrow foreign currency and assume the additional exchange rate risk is the encouragement from the Treasury.

To some extent the exchange rate can be influenced by the delay in the conversion of foreign exchange borrowing in francs. Exchange regulations set the maximum delay at one month from the date of receiving the funds. (7) Apparently, the timing of when these firms convert the proceeds of their borrowings is suggested by the public authorities, (either the Bank of France or the Ministry of Finance). (8)

Data for borrowing figures are obtained by computing the net inflow of capital (borrowing minus repayments). The data comes from Borrowing in International Capital Markets: Foreign and International Bond Issues, Publicized Euro-currency Credits (World Bank). The gross borrowings are calculated by summing the borrowings made by the public sector. The repayment schedule for each borrowing is also available. In general a fixed fraction of the total amount borrowed is repaid each year starting on a specified date and continues until the obligation is fulfilled. These repayments are deducted from the gross borrowing figures to obtain the net capital inflow figure.

The date on which the foreign exchange is assumed to be converted to francs varies according to whether or not the franc was under pressure. During the periods of relative stability of the franc, the conversion is 15 days after the offering date which is assumed to be the date the funds are received. During periods when the government is known to have resisted downward pressure on the franc, (9) the entire proceeds from the borrowings of that month are converted immediately. Since the four major commercial banks which carry the bulk of foreign exchange transactions are government owned, they apparently pursue a policy reinforcing the FSC rather than always speculating for a profit. Data used to measure the change in the net foreign position of the commercial banks are reported quarterly in the Ministry of Finance's publication: Statistiques et Etudes Financieres: Balance des Paiements entre La France et l'Exterier.

#### GERMANY

Until April 1979, Germany was the only country whose international reserve data reflected official intervention in the foreign exchange market. Germany has no official compensatory borrowing disguised as private capital flows or any other forms of hidden intervention. (10) Starting in April 1979, however, reserves changes are a poor indication of intervention because they also include foreign exchange swaps between the Bundesbank and the domestic banks. These swap transactions are used to effect the liquidity of the banking system but have no direct effect on the foreign exchange market. (11) In a swap the Bundesbank buys dollars with marks from domestic banks. To reverse the swap at the agreed upon future date the Bundesbank sells the dollars back to the banks for the same number of marks. In other words, when the Bundesbank buys

the dollars from the domestic banks there is a forward commitment to sell the dollars back to the domestic banks; however, this forward commitment is not entered in the Bundesbank's balance sheet. Therefore, net foreign exchange reserves of the Bundesbank increase even though there has been no intervention. At the same time the German monetary base increases since the mark reserve holdings of the domestic banks have increased. (12)

The Bundesbank has two objectives in its foreign exchange intervention. One is to influence the dollar-German mark rate; the other is to intervene in order to maintain exchange values within the European joint float. Apparently, the intervention against the dollar is the most important. (13) Although the intervention within the snake may account for some short-term movements in reserves, the Bundesbank has resisted changes in the dollar-mark rate so that large changes in reserves are related to movements in the dollar value of the mark.

Nearly all of Germany's foreign exchange is held in dollars. (14) The Bank Agreement of 1972 restricts the right to hold European currencies. When it is necessary to intervene within the snake using another European currency, short-term bilateral loans are employed which are normally settled at the end of the month following intervention. (15) For example, in order to maintain the European system of narrow exchange rate margins when the Dutch guilder was weak relative to the German mark, the German central bank would purchase guilders with marks and the Dutch central bank would sell marks (buy guilders). The equivalent operation is achieved by the Dutch selling dollars and the Germans buying dollars, without any consequent pressure on the dollar. Indications are that a large part of intervention is in dollars. However, this does not necessarily mean that the intervention is directed toward the dollar. The conclusion that the dollar is the most important consideration comes primarily from Bundesbank's reactions to movements in the dollar.

The change in the net external assets of the Bundesbank is used as the measure of intervention. This is the same measure that is used by the Bundesbank in discussions of the foreign exchange market and their intervention activities. The net external position of the Bundesbank consists of net monetary reserves plus net external loans and other external assets. Net monetary reserves consist of gold, the reserve position at the IMF and SDRs, claims on the European Monetary Cooperation Fund, foreign currency balances less liabilities arising from foreign business, and the counterpart to the re-valuation of gold contributed to the European Monetary Cooperation Fund. Changes due to valuation adjustments, allocations of SDR's, and foreign exchange swaps with domestic banks are excluded.

Information on the swaps is not always reported on a monthly basis and when figures are given, they are only approximations. Charts in some of the monthly reports compare the changes in the net external assets of the Bundesbank, excluding the swaps with the domestic banks. Precise swap figures are not reported. Monthly swap figures were estimated using these charts and statements in the text of the Monthly Report of the Deutsche Bundesbank. The results are not very sensitive to these approximations since they are made for only the last eight months of the sample period.

Using more frequently reported data makes some difference in the overall loss figures. Germany reports monetary international reserve assets on the 7th, 15th, and 23rd, and on the last day of the month, but does not report international liabilities on this basis. Using this gross monetary reserve data from March 1973 until the end of November 1978 gives a loss which is \$250 million less than when the monthly gross monetary reserve data is used. These calculations cannot be extended through 1979 since no information on the swaps is reported on less than a monthly basis.

## ITALY

In addition to official reserves, Italy intervenes in the foreign exchange market using "compensatory borrowing" of foreign currency by state controlled enterprises. Public corporations are instructed to borrow foreign currency abroad on behalf of the Bank of Italy and then sell the foreign exchange for lire which is used to meet their financing needs. These enterprises then receive full forward cover for their debt service payment and therefore are not subject to exchange risk. (16)

Italy also intervenes by "managing" the net foreign position of commercial banks. The government owns the principal banks (17) and the extent to which an Italian bank may take a net debtor or creditor position in foreign exchange is controlled by the Italian Exchange Office. (18) The monetary authorities do not intervene in the forward exchange market. (19)

Data on official reserves as well as compensatory borrowing and changes in the net foreign position of banks are available on a monthly basis in Bollettino, Banca d'Italia, and Supplemento al Bollettino. (20) The two latter forms of intervention are also frequently reported in official government statistics and reports. Changes in commercial banks, net foreign position are included below line in the balance of payments figures. Capital flows that are compensatory are reported as a separate item. (21)

Italy valued foreign currency at the central rate of 581.5 lire to the dollar until December 1973. Starting in December 1973 foreign currency is valued at market rates on the last working day of the month. (22) The breakdown of foreign currencies by currency is not available on a monthly basis. However, the Annual Reports (23) for the years 1973-75 gives a breakdown of currency holdings for eight different dates. Most of the variation in reserves is reflected in changes in dollar holdings and therefore, most intervention presumably takes place in dollars. Dollar holdings range from \$665 to \$2520 million while other currency holdings which consist of about two thirds German marks and one third Swiss francs, range from \$460 to \$680 million. Therefore, in the calculations, all foreign currency is treated as U.S. dollars.

The value of gold holdings has been revalued quarterly on the basis of free market prices since December 1976. Gold is excluded from the calculations since no important gold transactions are apparent. The data in International Financial Statistics shows that the variations in Italy's physical holdings of gold is very small except for March 1979. The monetary changes reported in the balance of payments figures in the Supplemento Bollettino shows the figure for the counter-part of the revaluation of the gold. When the gold stock is revalued in the last month of the quarter, the change in the value of the gold stock is matched by a change in the counter-part of the revaluation of gold except in March 1979 when Italy contributed gold and foreign exchange to the European Monetary Cooperation Fund. The revaluation of the gold stock is 3667.8 billion lire but the increase in the value of the gold stock is 555.4 billion lire. The difference 3112.4 billion lire is the value of the gold given to the European Monetary Cooperation Fund. This figure is deducted from the change in the European Monetary Cooperation Fund account for March 1979 since gold is not included in the reserve figure. The gold in the European monetary cooperation fund account was also revalued in July and October 1979. In these months the value of Italy's gold holdings does not change but the counter-part to the revaluation of gold increases by 383.6 billion lire in July and 526.4 billion lire in August. These amounts are deducted from the change in the European Monetary Cooperation Account.

The gold-based reserve assets of special drawing rights and the IMF reserve position are calculated on the basis of a gold price of 35 dollars per ounce and at an exchange rate of 625 lire to the dollar, until June 1974. Subsequently the value of these assets is made on the basis of the market rate of the last working day of the period. (24)

Short-term liabilities consist primarily of central bank swaps. Medium and long-term position included Foreign and Italian securities in foreign currency, the contra-entry liabilities for special Drawing Rights allocations, borrowings from the IMF under the standby agreement and the oil facility, (25) and other liabilities with the EEC and the Bundesbank.

Monthly lira figures are reported for compensatory borrowing starting in the second quarter of 1974 and quarterly figures are available before that time. Compensatory loans are converted to dollar figures by using the average exchange rate during the month. These calculated figures correspond to the dollar figures that are given in the Annual Reports. (26) The net position of the commercial banks is valued at market rates on the last working day of the month starting in December 1973 and valued at the central rate prior to that time.

Intervention is defined as the change in the net foreign position (excluding gold) of the Bank of Italy and Italian Exchange Office, (this is the sum of foreign exchange, SDR's, the IMF position, the balance at the European Monetary Cooperation Fund, less the short-term foreign liabilities plus the medium term position plus the net change in the net foreign position of the banks less compensatory borrowing (plus repayments). The Bollettino reports the global balance of payments as equal to the change in the foreign position of the Bank of Italy and the Italian exchange office plus the change in the net foreign positions of the banks. (27) The Bollettino also reports the autonomous balance of payments which excludes the compensatory borrowings and therefore equals the global balance of payments less compensatory borrowing.

This is the same definition as intervention defined above. If the autonomous balance of payments is converted to dollars at the average monthly exchange rate and compared to the intervention figures the correlation is .98. The two series show discrepancies from month to month but these discrepancies offset one another over time. Using the intervention series the number of dollars sold from March 1973 through June 1976 is \$15.1 billion while using autonomous balance of payments the dollar sales are \$15.4 billion. The total dollars purchased from June 1976 through December 1979 is \$18.2 billion using the intervention series and \$18.0 billion using the autonomous balance of payments series. The loss from foreign intervention using either series is \$3.72 billion.

## JAPAN

Japan uses both official reserves and "hidden reserves" to intervene in the foreign exchange market. There is apparently no intervention in the forward market and no significant borrowing to obtain funds for intervention since external liabilities are small and relatively stable. (28) The hidden reserves are official government deposits of foreign exchange with Japanese commercial banks. Japan can use these hidden reserves to conceal its spot purchases by using a commercial bank to buy or sell for the central bank in the commercial bank's name. For instance, during the oil crisis, the Bank of Japan was buying yen to prevent the exchange rate from falling. When it appeared they were running out of reserves, the Bank of Japan produced \$9 billion of "hidden reserves" which were accumulated when Japan was embarrassed by its surpluses. (29)

In a previous study, Quirk (1977) uses two measures of Japan's intervention: (1) changes in gross international reserves, and (2) changes in the Foreign Exchange Fund accounts. The latter is the counterpart of the Ministry of Finance's account that is used for all transactions in the foreign exchange market. The problem with the first measure is that it does not include official deposits of foreign exchange with commercial banks. The second measure also causes problems since it does not include transactions conducted outside the foreign exchange market. The relationship between these measures is  $\Delta FXF + XM \approx \Delta R + \Delta OD$  where  $\Delta FXF$  is changes in the Foreign Exchange Fund accounts,  $XM$  is extra-market transactions,  $\Delta R$  is changes in gross reserves and  $\Delta OD$  is changes in official deposits. The data Quirk (1977) uses are published monthly by the Bank of Japan. (30) There are no exact figures for extra-market transactions which are comprised of earnings on official reserve assets (gold accounts for only 5% of reserves) and receipts from U.S. military purchases. However, extra-market receipts are estimated at \$150 to \$160 million per month. (31) By excluding extra market transactions, changes in the Foreign Exchange Fund account gives a bias which underestimates intervention. In his empirical work, Quirk (1977) found that changes in the Foreign Exchange fund account was the better measure of intervention. As he shows, there is substantial use of the hidden reserves at times such as the oil crisis. Unfortunately, after September 1977, changes in the Foreign Exchange Fund is no longer a good measure of intervention since the Foreign Exchange Fund Bill held by the public is included in this series. (32)

The "hidden reserves" figures are published quarterly (semi-annually prior to 1976) in a disguised form by the Bank of Japan. (33) This data appears quarterly in the supplementary tables "Amount of Deposit by Depositors" in Economic Statistics Monthly. In the first table for "All Banks" the column labeled "Other Deposits" is actually foreign currency deposits and non-resident free yen deposits. These deposits are broken down by depositor. The official government foreign currency deposits appear in this column in row (f) "Government Funds." (The government holds no free-yen deposits, only foreign currency deposits.) The total of this column "Other Deposits" corresponds exactly with the third month of the quarter in the Monthly data series "Non-resident Free Yen Deposits, Foreign Currency Deposits in the table "Bank Accounts for all Banks" in Economic Statistics Monthly. The foreign currency deposits are reported in yen. Some reporting banks make the conversion using the basic rate and other banks used the end of period market rate. (34) According to these figures, the hidden reserves stood at \$8.3 billion in June 1973 and declined to 5.7 billion in June 1974 after the oil embargo and rose rapidly in late 1977 and 1978 to \$11.5 billion in December 1978.

A monthly data series of official government foreign currency deposits, is constructed from this quarterly and semi-annual data using a closely related monthly data series. As mentioned above, the total that is reported in the column "Other Deposits" is identical with the data "Non-resident Free Yen Accounts of All Banks" in Economic Statistics Monthly. The government deposits are a major component of the total reported in the column "Other Deposits". On average government deposits constitute over 65% of the total. Changes in government deposits correspond well with changes in Total Deposits. The correlation coefficient of the first differences of the two data series is .83.

The government foreign currency deposit data series is interpolated from a quarterly (and semi-annual) series to a monthly series using a variant of Friedman's (1962) correlation method. A straight-line trend is computed between the known values of the government foreign currency deposits. A straight-line trend is also computed between the corresponding values of the total foreign currency and free yen deposits. The difference between each monthly value of total foreign currency and free yen deposits and the corresponding trend value is computed. A fraction of this difference is then added to the trend value of the government foreign currency deposits. This fraction is chosen so as to produce the maximum correlation between changes in the Foreign Exchange Fund account ( $\Delta FXF$ ) and changes in official reserves plus government foreign currency deposits ( $\Delta R + \Delta OD$ ). The fraction giving the highest correlation is .75. The correlation between this measure of intervention ( $\Delta R + \Delta OD$ ) and  $\Delta FXF$  for the period when the series is valid, March 1973 through September 1977, is .92. (35)

## SPAIN

Spain allowed the peseta to float in January 1974. In addition to their official reserves Spain also uses "compensatory borrowing" to finance foreign exchange intervention. This compensatory borrowing consists of borrowing from banks, borrowing from the IMF, and borrowing by public enterprises. No mention of exchange rate guarantee for the public enterprises is made in the literature. During 1974 and 1975 relatively little foreign currency borrowing was undertaken by government owned enterprises. Then in 1976 and 1977 this type of borrowing increased considerably. There were substantial repayments in 1978, but little activity in 1979.

Figures for official reserves come from International Financial Statistics. These data do not correspond to the official reserve data presented in Boletin Estadistico because of different valuation procedures. (36) The Bank of Spain intervenes only in dollars. (37).

Spain has borrowed from the IMF under the oil facility drawings and compensatory drawings. Data on these borrowings comes from International Financial Statistics. A discussion of borrowing by government owned enterprise is given in the Annual Reports of the Bank of Spain. (38) In 1976 Spain greatly increased their compensatory financing. The 1976 Annual Report gives the most complete information of all the Reports. Annual figures are given which distinguish between autonomous capital movements and those movements which reflect balance of payments policy considerations. (39). Separate dollar figures are given for capital movements and external borrowing by the public sector. Public sector borrowing rose from \$30 million in 1975 to \$632 million in 1976. (40) These loans to the public sector are considered "accommodating" transactions (or below the line transactions) the same as borrowing from the IMF and a change in the reserves of the Bank of Spain. In 1977, public sector borrowing reached its peak of \$1267.1 million. (41) These dollar figures correspond to the peseta figures under "Capital public del exterior Espana". (42) In the Boletin Estadistico two monthly data series of public sector borrowing are reported. Net External Loans (found in the data section for public sector) and long-term public capital flows from the exterior to Spain (found in the data section for the exterior sector). (43) The first data series matches the annual data given in the annual reports more closely and is therefore used in the calculations.

#### SWITZERLAND

Switzerland intervenes in the foreign exchange market using only its official reserves; however the official reserves figures do not reflect official transactions in the foreign exchange market because they include dollar-franc swaps between the Swiss National Bank and the commercial banks. The swaps were introduced in 1959 and until the early seventies were employed by the banks as a window-dressing device.

In the last decade the swaps have been negotiated in order to provide additional liquidity to the banks at the end of the quarter. In a swap the Swiss National Bank buys dollars with francs from a commercial bank and, at the same time, makes a forward commitment to sell the dollars back to the bank at the same exchange rate. In this operation the official foreign reserves held by the Swiss National Bank increase even though there has been no intervention. At the same time there is a corresponding increase in the Swiss monetary base since the Swiss franc reserves held by the commercial banks are increased.

Assets and liabilities for the Swiss National Bank are reported four times a month in Monasbericht Schweizerische National Bank; however, foreign monetary reserves reported there include the dollar-franc swaps between the Swiss National Bank and the commercial banks. Due to the swaps the official reserves frequently

increase substantially at the end of quarter even without intervention. For instance in the fourth quarter of 1976 the swaps increased from less than 2 billion Swiss francs at the end of October and November to 7.7 billion Swiss francs at the end of December. This resulted in a similar increase in the official reserves without any substantial purchases in the foreign exchange market. (44) There are substantial but not so dramatic increases in the level of the swaps at the end of most quarters and usually a decline in the following quarter. The pattern however is not predictable.

In the calculation of the sources of the monetary base, the swaps are deducted from the international reserves figures that are reported. At the same time the swaps are added to the domestic assets held by the central bank. This treatment of swap operations reflects the idea that swap operations are an internal monetary policy similar to the Swiss National Bank purchasing domestic or Swiss assets for their portfolio. Therefore the monthly changes in these reserves, which excluded swaps, record foreign exchange intervention at prevailing market prices. As explained in appendix to Monasbericht, August 1975 (45) the changes in international reserves, recorded in the sources of the monetary base, also equal the current account balance plus net capital exports which equals the amount of intervention in Swiss Francs. (46)

#### THE UNITED KINGDOM

The United Kingdom floated the pound in June 1972. Intervention in the foreign exchange market is only partially reflected in the official foreign exchange reserves. Under the "exchange cover scheme" of 1969, nationalized industries and local authorities have been able to borrow foreign currency with an exchange rate guarantee by the Treasury. When local authorities or public corporations borrow foreign currency under this exchange cover scheme, they surrender the proceeds to the government in exchange for sterling. (47) When this occurs the foreign assets of the Bank of England will increase without intervention. Also, there will be no corresponding increase in the Bank of England's foreign liabilities. Alternatively if the Bank of England uses this foreign exchange to intervene there will be no corresponding change in official reserves.

This borrowing is currently recognized as a means of foreign exchange intervention and is reported by the Bank of England along with monthly reserve changes and other transactions. The Bank of England has more recently referred to official reserves less official short and medium-term borrowing from abroad as "net reserves." (48) This borrowing includes net foreign currency borrowing by the public sector under the exchange cover scheme, borrowing from the IMF under the oil facility or the stand-by credit arrangement, increases in short-term currency swaps with the Group Ten and the Bank for International Settlements, and government euro-dollar borrowings through commercial banks.



The United Kingdom has used these different sources of funds extensively to intervene. After the pound was floated in June 1972, net reserves were \$5.7 billion. The authorities used only official reserves to intervene until early 1973. In April 1973 when the exchange cover scheme was reintroduced, public sector borrowing steadily increased from \$.4 billion to \$3.0 billion by the end of the year. During 1974, foreign currency borrowing by nationalized industries and local authorities increased by \$2.6 billion and the central government borrowed \$1.5 billion in the Euro-dollar market. By the end of the year net reserves were negative \$.4 billion. During 1975, \$.8 billion was borrowed under the exchange cover scheme and \$1.0 billion was borrowed by the central government in the Euro-dollar market. Net reserves continued to fall to a negative \$3.5 billion.

By the end of November 1976, net reserves had fallen to their low of a negative \$10.4 billion. During the first eleven months of the year, there was additional borrowing of \$2.1 from the IMF, \$1.5 billion from other monetary authorities, and \$3.1 billion under the exchange cover scheme. The pound then began to strengthen and intervention was reversed so as to depress the price of the pound. By the end of 1977, gross reserves increased by \$15.4 billion and net reserves became positive even though official borrowing increased by \$2.4 billion. The U.K. started to repay their loans in 1978 and borrowing decreased from \$18.0 billion to \$15.8 billion by the end of 1978 and to \$14.6 billion by the end of 1979.

#### UNITED STATES

The United States is unique in two respects. It does not normally hold any substantial foreign exchange reserves, and profit and loss figures for official foreign exchange transactions are reported in the Federal Reserve Bulletin. This reporting, however, makes the misleading distinction between profits and losses on "current" operations and on liquidations of foreign currency debts outstanding as of August 15, 1971. Between 1973 and 1978 most foreign exchange transactions were connected with these pre-August 1971 foreign currency debts. The Federal Reserve treats the losses from these transactions as if they were inevitable and not determined by Federal Reserve and Treasury decisions after the dollar was allowed to float. The major part of the losses from the liquidation of this pre-August 1971 debt resulted from "current" transaction decisions during the managed float, not decisions made when the exchange rates were pegged.

In early 1973, the Federal Reserve and the Treasury had \$3.1 billion in foreign currency debts which had been incurred before the dollar was first devalued in 1971. The Treasury had foreign currency bonds while the Fed owed on their "swap" lines with other central banks. The major part of Fed and Treasury foreign currency transactions between 1973 and 1978 was their financing of this pre-August 1971 debt. Yet the Fed excluded these transactions from their profit and loss calculations on "current" operations. These debts were scheduled to be repaid in 1973 and early 1974. While some of the debts were paid on schedule, both the Federal Reserve and the Treasury refinanced their obligations with the Swiss National Bank and the Bank of International Settlements by borrowing Swiss francs. They continued to reborrow in following years. The debts were finally paid between 1977 and 1979 by which time the Swiss franc had nearly doubled in price. These refinancing transactions resulted in the additional loss of \$1.8 billion.

In March 1973, the Treasury had \$1578 million equivalent in foreign currency bonds outstanding. Switzerland the Bank of International Settlements held \$1425 million equivalent in Swiss franc bonds. Germany held \$153 million. The U.S. fulfilled its obligation to Germany by 1974 as scheduled. The Swiss franc bonds matured during 1973 and the first few months of 1974. Rather than repay these bonds the Treasury continuously refinanced the bonds, borrowing Swiss francs to meet their obligations. The sixteen bonds outstanding were refinanced an average of four times. The debts were finally repaid between 1977 and 1979. From 1978 through 1979 the Swiss franc almost continually appreciated against the dollar. As a consequence, the U.S. lost practically each time a bond was refinanced. Out of sixty-five decisions to refinance the Swiss franc bonds, sixty of the transactions resulted in losses. (49) The Treasury had to pay \$1182 or 67% more than if the debt had been paid when it was due in 1973 and 1974.

In March 1973, the Federal Reserve also had foreign currency debts of \$1555 million equivalent. (50) These were swap debts which originated prior to August 1971. The Swiss National Bank and the Bank for International Settlements were owed \$1165 million equivalent or 4761 million Swiss francs at the pre-August 1971 exchange rate of 4.087 Swiss francs per dollar. The remainder was owed to the Bank of Belgium in Belgium francs. The Federal Reserve kept refinancing these swaps. The Belgian debt was paid by the end of 1976 and had little effect on the losses. The Federal Reserve, however, made few payments on the Swiss franc swap until 1977, and the final payment did not take place until April 1979. Repayment of the Swiss franc swap at this late date resulted in a total dollar cost of \$2141 million. (51) If the swaps had been paid within a year after the dollar was allowed to float, the cost of repayment would have been \$1534 million. (52) By delaying the repayment of the Swiss franc swap the cost ballooned to \$2,141 million. Therefore, an additional loss of \$604 million resulted from the refinancing of the swaps beyond one year after the dollar floated.

The total additional loss to the Treasury and the Federal Reserve from refinancing and borrowing Swiss francs to meet their obligations comes to \$1772 million. The Swiss franc-dollar rate would have been more stable if the U.S. had purchased the Swiss francs in 1973 or early 1974 and bid up the price when it was relatively low. By delaying repayment, the United States bid up the price when the Swiss franc had almost doubled in terms of the dollar.

According to profit and loss statements in the Federal Reserve Bulletin, the sum of the losses for all pre-August 1971 foreign currency debts for the years 1971-1979 is \$2478 million. The footnotes reveal that only \$517 million is attributed to the two dollar devaluations. These calculations show that the difference is almost entirely due to Federal Reserve and Treasury transactions while attempting to "manage" the exchange rates.

Beginning in 1978, the U.S. increased their "current" intervention operations. The Treasury established its own swap lines, and also issued German marks and Swiss franc foreign currency bonds. The "current" operations of the Federal Reserve and Treasury have not been any more successful than the "non current" operations. The losses from 1973 to January 1980 are \$562 million. The total transaction loss from March 1973 to January 1980 for the Federal Reserve and the Treasury is \$2.3 billion.

## FOOTNOTES

1. Using monthly instead of daily figures for 1970-1976 period gives \$20 million less profit.
2. The sum of the adjustments for daily figures correspond to the adjustment figures given monthly by the Ministry of Finance.
3. A fee of 3/8 of one percent per annum and of 1/4 of one percent per annum was paid on the undrawn amount of the Canadian and foreign credit facilities respectively. These fees were not included in the calculations.
4. The European Monetary Cooperation Fund's liability is included in these figures. The revaluation of the gold component is excluded.
5. See *Statistiques et Etudes Financieres - Balance des Paiements entre La France et l'Exterieur*, (1976) the government has adopted the policy "to prevent drastic changes in official reserve assets or unwarranted levels of depreciation of the French franc" - p. 43, and *Banque de France Compte Rendu*, (1976) "Many French firms are encouraged by the monetary authorities to borrow foreign exchange in order to facilitate the financing of our balance of payments deficit." p. 31.
6. Statistiques et Etudes Financieres - Le Rapport d'ensemble sur les Entreprises Publiques, 1976, p. 14.
7. Statistiques et Etudes Financieres - Balance des Paiements entre La France et l'Exterieur, 1976, p. 59. This delay is two months according to International Monetary Fund, Exchange Arrangements and Exchange Restrictions. 1976, p. 225 and p. 248.
8. *Rapport Annuel du CNC* (1978). "During the year, the conversion of foreign exchange from borrowings abroad have been adapted to the movement of the franc on the foreign exchange market as much as possible - so, by the end of the year, a fraction of foreign exchange borrowed during the last quarter of 1977 has been kept in order to be converted into French francs only the 1st quarter of 1978" p. 46.
9. Periods of pressure on the French franc are September 1973; January 1974, the first quarter of 1976, July-August 1976, and the first quarter of 1978.
10. Artus (1976), p. 312.
11. Monthly Report of the Deutsche Bundesbank, September 1979, p. 37.
12. Foreign exchange swaps are also used as instruments of monetary policy by Switzerland.
13. In a previous study Artus (1976) found that specifications of intervention policy taking into account the European joint float were unsuccessful. His explanation was that the mark dominated the other snake currencies.
14. Monthly figures on dollar holdings are given in *Deutsche Bundesbank, Monthly Report*.
15. *Deutsche Bundesbank, Monthly Report*, January 1976.

## FOOTNOTES (continued)

16. See International Monetary Fund, Annual Report on Exchange Restrictions 1978, p. 225.
17. See Hodgman, Donald R., National Monetary Policies and International Monetary Cooperation (Little Brown: Boston), 1974, p. 90.
18. See International Monetary Fund, Annual Report on Exchange Restrictions 1978, p. 228.
19. See Ibid., p. 225.
20. The Italian data is often revised at a very late date. Therefore the most recent source that contains the data is used.
21. In the Bank of Italy Annual Reports, the balance of payments is usually reported with compensatory borrowing as both as an above the line item and a below the line item.
22. See Banca D'Italia, Abridged Version of the Report for the Year, 1973, p. 79.
23. Banca D'Italia, Abridged Version of the Report for the Year, 1973, p. 80, 1974, p. 87, 1975, p. 75.
24. Banca D'Italia, Abridged Version of the Report for the Year, 1974, p. 87.
25. No adjustment is made for the dollar appreciation or depreciation of the SDR denominated assets since SDR denominated assets and liabilities are of approximately same magnitude.
26. See Table 19 in Banca D'Italia, Abridged Version of the Report for the Year: 1975, p. 76; 1976, p. 63; 1977, p. 65.
27. The item "aggiustamenti di cambio" or "exchange rate adjustment" also appears below the line. This adjustment accounts for the change in the lira valuation of the foreign assets. The changes in official reserves and the net foreign assets of the banks are reported in lire. The change is obtained by converting the net foreign assets of these institutions from dollars to lire and taking the difference between month end values. Since the flows recorded above the line are converted into lira at their respective current exchange rates, a correction is needed for the valuation effect of a given stock of reserves at different exchange rates.
28. See Quirk (1977), p. 643.
29. See Wall Street Journal, January 25, 1974.
30. They appear in Bank of Japan Economic Statistics Monthly. Foreign Exchange Fund accounts are found in the table "Demand and Supply of Funds in Money Markets," which lists major sources of the monetary base. Reserves are found in the table "Gold and Foreign Exchange Reserves."

## FOOTNOTES (continued)

31. See "Yen is Not 'Cheap'," The Oriental Economist, Vol. 44 (October 1976), p. 6.
32. The Ministry of Finance publication Financial and Monetary Statistics Monthly: Special Issue on Treasury Expenditure gives monthly figures for the Foreign Exchange Fund Bill held by the public. Sometimes the non public holdings can be quite substantial. For instance in 1977, the holdings increased by 298 billion yen from September to October and decrease by 321 billion yen from November to December. These figures are of the same magnitude as those reported for the changes in the Foreign Exchange Fund. Because of the delay in publishing these numbers they could not be used to eliminate the public holdings of the Foreign Exchange Fund Bill from this data series.
33. I am indebted to Peter Quirk for referring me to Norman Klath who told me about this data. Employees of the Bank of Japan have confirmed that these figures represent the government deposits at commercial banks.
34. According to a source of the Bank of Japan, conversion back to dollars at the market rate for these deposits will give a good approximation of the changes that are occurring.
35. The interpolated data series that is constructed is an improvement over using the change in official reserves which is the other data series used by Quirk (1977). The correlation between changes in official reserves and the FXF is .81.
36. The Bank of Spain uses central rates in converting non-dollar foreign exchange into dollar terms. The International Financial Statistics use the market rate. The Bank of Spain also converts the SDR-denominated assets at the "pre-basket" dollar - SDR rate while the IFS uses the prevailing dollar-SDR rate. This information was kindly given to me by Joaquin Muns.
37. Banco de Espana, Informe Annual 1976, p. 139.
38. I am indebted to Maria Caban-Garcia for translating these reports.
39. See the table "Balanza de pagos," Banco de Espana, Informe Annual 1976, p. 133.
40. Ibid., p. 135. Of the \$632 million, \$500 million is from a loan to the government of Spain by an international syndicate of Banks. Ibid., p. 136.
41. Banco de Espana, Informe Annual 1977, p. 133.
42. Ibid. p. 131.
43. Table VIII-4. "Prestamos exteriores" and Table XIII-11 "Capital publico a largo plaza del exterior en Espana."
44. This figures comes from worksheets that show the construction of the monetary base and have the swap figures for the end of the month. They have been provided by a source at the Swiss National Bank.

## FOOTNOTES (continued)

45. In German on p. 4 and in French on p. 10.
46. The other factors which influence the stock of international reserves are interest payments and revaluations at the end of the year. These figures are not published. According to a source at the Swiss National Bank, however, the effect of interest payments on the stock of reserves is offset by the revaluations at end of the year. The exception is 1978, when the revaluation was a negative 4434 million Swiss francs while the interest payments on reserves was 1258 million Swiss francs.
47. Quarterly Bulletin, Bank of England, March 1975, p. 43.
48. Quarterly Bulletin, Bank of England, December 1977, p. 420.
49. Information on the value of various notes and certificate of indebtedness and their issue and maturity dates is available in Table PDO-90 Foreign Currency Series Securities in the Treasury Bulletin. Each time a security was refinanced the appreciation or depreciation to the time it was repaid or again refinanced was calculated to give a profit or loss figure. See Taylor and Deubert (1980).
50. Dollar equivalent figures are reported in the Federal Reserve Bulletin at the exchange rate at the time borrowing.
51. Data taken from the Tables in the reports "Treasury and Federal Reserve Foreign Operations" in various issues of the Federal Reserve Bulletin gives enough information to calculate borrowing or repayments in the first month of each quarter and the sum of borrowing and repayments in the last two months of each quarter. See Taylor and Deubert (1980) for the timing of the various repayments. The dollar equivalent payments are converted to Swiss francs and then back to dollars at average monthly exchange rates. In December 1975 the swap debt was revalued from \$971 million equivalent to \$1167 million equivalent to account for the two devaluations of the dollar. The dollar equivalent repayments after December 1975 are therefore multiplied times the ratio  $971/1167$  times 4,087 Swiss francs per dollar to obtain the number of Swiss francs repaid.
52. This statement assumes that 397 Swiss francs are paid per month from April 1973 to March 1974 at the average monthly exchange rate.

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