

# Intervention and the Dollar's Decline

by Owen F. Humpage

Owen F. Humpage is an economic advisor at the Federal Reserve Bank of Cleveland. The author gratefully acknowledges helpful comments from Michael Hutchison, William Osterberg, and James Thomson.

## Introduction

The past three years have witnessed a record decline in the exchange value of the U.S. dollar. This depreciation generally has been consistent with market fundamentals, such as the U.S. current-account deficit, movements in interest-rate spreads, changes in relative inflation rates, and divergent money-growth rates. A sharp increase in central-bank intervention, especially by the United States, also has accompanied the dollar's depreciation.

Many observers believe that this intervention contributed to the dollar's decline in 1985 and that it helped to stabilize the dollar in 1987. Indeed, at first glance, it might appear that the massive intervention of late 1985 pushed the dollar downward and that the heavy intervention in early 1987 helped to stabilize the dollar. As Copernicus demonstrated long ago, however, first glances can deceive.

This article takes a second look at our recent experiences, and asks if day-to-day intervention was related to day-to-day movements in dollar exchange rates. We find no systematic relationship, but we identify a few specific occasions when U.S. intervention seemed to alter exchange rates. Our review of circumstances surrounding these episodes suggests that intervention can produce a one-time shift in exchange rates by

providing new information to the market about monetary and fiscal policies or about official attitudes concerning the dollar.

Section I of the paper provides background information about the theoretical channels through which intervention might alter exchange rates. Section II discusses the empirical methodology. We use regression techniques that distinguish between "initial" and "subsequent" intervention in our search for systematic relationships between intervention and exchange-rate movements. Section III analyzes U.S. intervention from August 1984 to August 1987. A case study of specific episodes of intervention supplements the statistical analysis, and we present three subsections that correspond to three different U.S. approaches to intervention during this period. Section IV summarizes the results and offers some policy conclusions.

## I. Intervention and Exchange Rates

Exchange-market intervention refers to official purchases or sales of currencies designed to influence exchange rates. These transactions alter the net foreign-currency position of the monetary authorities' balance sheet. Economic theory offers three possible channels through

which intervention can alter exchange rates: the monetary channel, the portfolio-adjustment channel, and the expectations channel.<sup>1</sup>

The most understood and accepted of these is the monetary channel. Intervention can alter the money supplies of both countries whose currencies are involved in the transactions. Other things equal, intervention will contract the money supply of the currency that is purchased and will expand the money supply of the currency that is sold. Economists generally agree that relative rates of money growth exert a strong influence on exchange rates. Such intervention will tend to depreciate the currency that is sold relative to the currency that is purchased.

Since the inception of floating exchange rates in 1973, major countries routinely have "sterilized," or offset, the monetary effects of their exchange-market intervention through transactions with other, more conventional instruments of monetary policy. For example, if the Federal Reserve wishes to prevent an intervention purchase of West German marks from increasing the U.S. money supply, it can sell an equivalent dollar amount of Treasury bills through open-market operations. The sale of Treasury bills reduces the U.S. money supply. Countries sterilize intervention because they wish to focus their monetary policies on domestic objectives, such as inflation or growth, and because they believe that they can conduct independent intervention and monetary policies.

One cannot easily distinguish sterilized intervention from nonsterilized intervention. To sterilize intervention, the offset need not be dollar-for-dollar. A central bank need only prevent intervention from altering the amount of reserves in its banking system from their target level. Since exchange-rate considerations can influence monetary policy decisions, the very idea of an independent, sterilized intervention sometimes becomes fuzzy.

The second channel through which intervention can influence exchange rates, the portfolio-adjustment channel, is open to sterilized intervention. Although it does not change relative rates of money growth, sterilized intervention alters the supply of bonds denominated in one currency relative to the supply of bonds denominated in another currency. In our example, the Federal Reserve sold Treasury bills to sterilize its interven-

tion transactions and thereby increased the relative supply of U.S. Treasury bills in the market.

If international investors view securities with different currency denominations as imperfect substitutes, then the increase in Treasury bills could cause a portfolio diversification away from dollar-denominated assets. Interest rates would rise and the dollar would depreciate until international investors felt compensated for the risks of holding the now more abundant dollar-denominated assets. Although portfolio adjustment then provides a possible link between sterilized intervention and the spot exchange rate, empirical evidence suggests that it is at best a very weak link (see Hutchison, 1984).

Both sterilized and nonsterilized intervention can also influence exchange rates through a third channel, by altering expectations in the exchange market. The exchange market, like other financial-asset markets, is a highly efficient information processor.<sup>2</sup> Currency traders use all available information, including information about predictable future events and anticipated policies, in establishing current exchange quotes.

An empirical implication of market efficiency is that exchange rates will follow a "fair game":<sup>3</sup>

$$S_{t+1} = S_t + E(\Delta S_t | I_t) + a_t$$

The spot exchange rate tomorrow,  $S_{t+1}$ , will equal today's spot rate,  $S_t$ , plus any expected change,  $E(\Delta S_t | I_t)$ , given all information,  $I_t$ , available today plus a random component  $a_t$ , that reflects unanticipated events, or "news." Empirical research often has found that log changes in exchange rates follow fair-game processes, specifically a random-walk process, where  $E(\Delta S_t | I_t) = 0$ , or a near random-walk process, where  $E(\Delta S_t | I_t) = \text{a constant}$ .<sup>4</sup>

Intervention, to the extent that it improves the flow of information in a "disorderly" market, or to the extent that it provides new information about future policies, can alter current exchange rates. One would expect a one-time permanent shift in the exchange rate when the new information is received. If, however, the intervention provided no new information about pending changes in policy or in official attitudes about exchange markets, it would have no impact in an efficient market.

■ 2 See Fama (1970)

3 For a discussion of the relationship between efficiency, "fair games," and random walks, see Levich (1985).

■ 4 See Meese and Rogoff (1983)

■ 1 Humpage (1986) discusses these channels and reviews some important empirical literature.

## B O X 1

## Regression Analysis

**Data**

The exchange rates are daily opening New York quotes obtained from Bank of America through the DRIFACS service. Intervention dummies are constructed from internal documents on U.S. intervention.

Because the exchange quotes are morning quotes on day " $t$ ," and because intervention pertains to purchases or sales throughout day " $t$ ," we lag intervention one period to ensure that the exchange-rate movements follow intervention.

Each equation is estimated from approximately one month before the first intervention transaction to approximately one month after the last intervention transaction. We indicate the exact dates on each table.

**Equation**

We estimate the following equation in all cases, but we omit certain dummies when they are not relevant to a particular episode:

$$DM\$ = BDA (-1) + BDB (-1) + SDA (-1) + SDB (-1) + DM\$ (-1)$$

and

$$Y\$ = BYA (-1) + BYB (-1) + SYA (-1) + SYB (-1) + Y/\$ (-1)$$

where the variables are defined as follows:

DM\$ = the log of the West German mark-U.S. dollar exchange rate;

Y/\$ = the log of the Japanese yen-U.S. dollar exchange rate;

BDA = initial intervention purchases of West German marks;

BDB = subsequent intervention purchases of West German marks;

SDA = initial intervention sales of West German marks;

SDB = subsequent intervention sales of West German marks;

BYA = initial intervention purchases of Japanese yen;

BYB = subsequent intervention purchases of Japanese yen;

SYA = initial intervention sales of Japanese yen;

SYB = subsequent intervention sales of Japanese yen;

and where (-1) indicates a one-period lag.

The dummy variables for initial intervention take a value of 1 when the United States intervened after five previous business days during which no intervention took place, and the variables take a value of 0 at all other times. The dummy variables for subsequent intervention take a value of 1 when the United States has intervened within the previous five business days. This dummy is set equal to 0 at all other times. Each table lists the number of times per episode that each dummy takes a value of 1.

**II. Empirical Methodology**

This paper uses an empirical methodology consistent with the efficient market view of exchange rates. Over each period of intervention, we regressed the log of the spot mark-dollar and/or yen-dollar exchange rate on its previous day's value and on two sets of dummy variables, corresponding to types of U.S. intervention (see box 1). One set of dummies measures "initial" U.S. intervention purchases or sales of dollars, and a second set measures "subsequent" U.S. intervention.

We distinguish between initial and subsequent intervention because the former could have an announcement effect that is not associated with the latter. We arbitrarily define initial intervention as an official transaction that follows a period of five business days with no intervention. The remaining transactions are classified as subsequent intervention. We do not include dummies for foreign intervention.

The coefficients associated with the dummy variables measure the average percentage change in the exchange rate on days of initial and subsequent intervention over each interven-

tion episode. If the coefficient on the intervention dummy is significantly different from zero, it suggests that intervention provided new information to the market that was not contained in the previous day's quote.

In splitting the dummy variables, we test to see if the information content of initial intervention is different from that of subsequent intervention. In all cases except one, the average dollar value of initial intervention was not greater than the average daily amount of subsequent intervention. Nevertheless, the "news" content of initial intervention could be substantially greater. The coefficients on the dummy variables should reflect differences in the news content and not dollar amounts.

We adopted this regression technique as a means of summarizing the day-to-day exchange-rate response to intervention. We consider five distinct time periods, rather than running a single regression over the entire period, to avoid having the coefficients on the dummy variables average the responses to different circumstances. Nevertheless, such regressions, even over very short time periods, risk this problem, as will shortly become apparent. Consequently, we also base our conclusions on a day-to-day inspection of events surrounding each episode of U.S. intervention.<sup>5</sup>

### III. Three Case Studies of Intervention: August 1984 to August 1987

Between August 1984 and August 1987, the United States seemed to adopt three different approaches to exchange-market intervention. Prior to the Group of Five (G5) meeting in September 1985, the U.S. approach to intervention seemed to be a continuation of the policy established in March 1981.<sup>6</sup> This approach viewed intervention as appropriate only on relatively few occasions to "calm disorderly markets." From August 1984 to the G5 meeting in September 1985, the United States intervened on two occasions, each of which was short in duration. U.S. intervention prior to the G5 agreement often was not closely coordinated with that of other central banks and

often was not highly visible. The total dollar value of U.S. intervention over this period was \$938 million.

U.S. intervention immediately following the G5 meeting departed from this earlier approach by encouraging a dollar depreciation through large, persistent dollar sales against West German marks and Japanese yen. This intervention, which amounted to approximately \$3.2 billion, was more closely coordinated with that of other central banks and was very visible. The G5 episode of intervention lasted through November 1985; thereafter the United States did not intervene until early 1987.

A third intervention regime followed the Group of Seven (G7) meeting in February 1987.<sup>7</sup> In most respects the G7 approach to intervention was not much different from the G5 approach, except that central banks now aimed at stabilizing the dollar rather than promoting a further dollar depreciation. Rumors following the meeting suggested that the G7 countries were attempting to maintain reference zones for the mark-dollar and yen-dollar exchange rates. The United States intervened on two occasions following the G7 meeting, with gross intervention (purchases plus sales) over both periods exceeding \$4.0 billion. The first lasted from March to June 1987, and the second occurred in August 1987.

In sum, the three-year period between August 1984 and August 1987 provides us with five examples of U.S. intervention within three broad U.S. intervention regimes. Two episodes occurred prior to the G5 meeting, one immediately followed the G5 meeting, and two followed the G7 meeting.

#### Intervention Prior to the Group of Five Meeting

By late 1984, the dollar increasingly seemed overvalued in terms of purchasing power parity or trade considerations. The growing U.S. current-account deficit reached a record \$30 billion in the fourth quarter, bringing the deficit for all of 1984 to \$106.0 billion, up sharply from \$46.6 billion in the previous year.

The Federal Reserve System began to inject reserves into the banking system, as evidenced by a sharp reduction in the federal funds rate late in the year. The average effective federal

■ 5 Three other case studies of intervention are by Greene: (1984a), (1984b), and (1984c).

6 The Group of Five industrial countries are France, West Germany, Japan, the United Kingdom, and the United States.

□ 7 The Group of Seven industrial countries are the G5 countries plus Canada and Italy.

T A B L E 1

## I. Estimation Period: August 7, 1984 to November 19, 1984

Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(3)	-0.008	-1.518 <sup>a</sup>
Subsequent purchases	(2)	0.002	0.342
Initial sales	(0)	—	—
Subsequent sales	(0)	—	—
Lagged dependent		1.000	1001.5 <sup>b</sup>

Sum of Squared Residuals = 0.006

R<sup>2</sup> = 0.893

n = 74

## II. Estimation Period: December 21, 1984 to April 9, 1985

Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(3)	0.004	0.776
Subsequent purchases	(4)	0.005	1.183
Initial sales	(0)	—	—
Subsequent sales	(0)	—	—
Lagged dependent		0.999	1067.4 <sup>b</sup>

Sum of Squared Residuals = 0.005

R<sup>2</sup> = 0.920

n = 69

NOTE: Intervention refers to U.S. purchases or sales of foreign currencies. Numbers in parentheses indicate the number of times the dummy equals 1.

a. Significant at the 10% confidence level, using a one-tail test.

b. Significant at the 1% confidence level.

SOURCE: Author's calculations.

funds rate dropped from 11.6 percent in August to 8.4 percent in December. The Federal Reserve also cut its discount rate on two occasions, bringing it down to 8 percent from 9 percent. Slower economic activity and an easier monetary policy stance resulted in reduced U.S. long-term and short-term interest rates relative to similar rates in West Germany and Japan. Both long-term and short-term interest-rate spreads began to narrow in favor of a dollar depreciation.

Nevertheless, the dollar did not immediately depreciate. Strong inflows of foreign private savings continued to support the dollar, and real and nominal U.S. interest rates remained high relative to rates in West Germany and Japan.

Many observers believed that further reductions in interest-rate differentials were unlikely and that U.S. interest rates could rise again, primarily because of the prospects for continued large U.S. budget deficits. Many economists also believed that foreign central banks, especially in Europe, would lower interest rates along with the declines in U.S. interest rates to offset any appreciation of their currency against the dollar and to spur real growth in their economies.

The first episode of U.S. intervention, in September and October 1984, involved sporadic sales of dollars. In September 1984, as the dollar rose above 3 Deutsche marks (DM) for the first time, the Bundesbank aggressively sold dollars in the foreign-exchange market. Dollar sales by the Bundesbank amounted to DM 6.1 billion.<sup>8</sup> Some other large central banks also sold dollars, but Japan rarely intervened during this period.<sup>9</sup> The United States intervened three times in September 1984 and twice in October 1984, buying a moderate \$279 million worth of DM (Cross, Spring 1985, p. 60).

The regression equations for this episode suggest that intervention influenced the mark-dollar exchange rate. The coefficient associated with the dummy variable for initial U.S. purchases of marks is statistically significant and correctly signed (see table 1). This coefficient suggests that, on average, initial intervention contributed to a 0.8 percent depreciation of the dollar.

An inspection of the day-to-day pattern, however, suggests that all of this influence reflects activity on a single day (September 24) when U.S. intervention followed very large, highly visible West German purchases of dollars (see figure 1). Outside of this one day, the dollar did not depreciate following initial intervention.

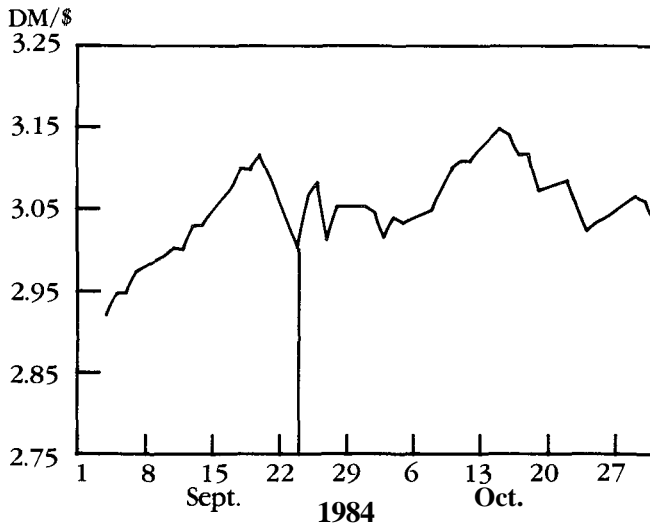
The coefficient associated with subsequent U.S. intervention, of which there was little, was not statistically significant. Subsequent intervention seemed to have no effect on exchange-rate movements. On balance, the dollar appreciated during this period.

<sup>8</sup> West German data are changes in foreign-exchange reserves. Changes in foreign-exchange reserves are only a proxy for intervention because they are influenced by various commercial transactions, by the receipt of "troop dollars" in West Germany, and by the receipt of interest earnings on these reserves and currency valuations. Nevertheless, one can infer the general magnitude of intervention from sharp changes in foreign-currency holdings at times when intervention is known to have occurred. Data on West German intervention versus dollars is from "Report of the Deutsche Bundesbank for the Year 1984," pp. 66-67.

<sup>9</sup> See Cross (Spring 1985).

**FIGURE 1**

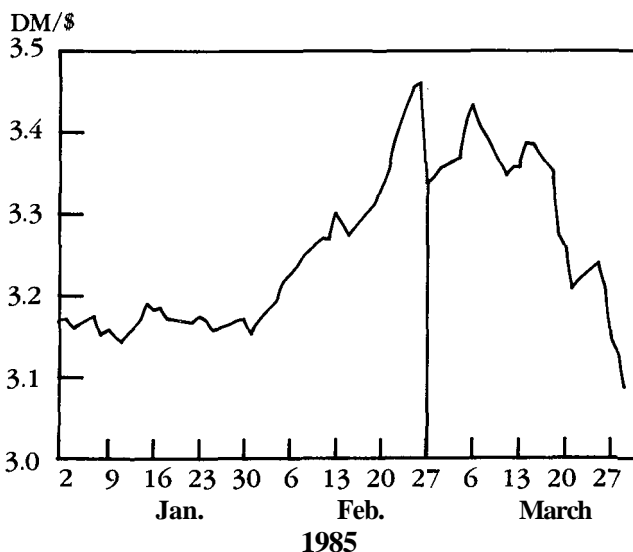
Exchange Rate, DM/\$,  
September 1 to October 31, 1984



SOURCES: Bank of America, DRI-FACS; and Federal Reserve Bank of Cleveland.

**FIGURE 2**

Exchange Rate, DM/\$,  
January 2 to March 31, 1985



SOURCES: Bank of America, DRI-FACS; and Federal Reserve Bank of Cleveland.

The second episode of U.S. intervention began in late January 1985 and continued through early March. Preceded by rumors of massive intervention and possible capital controls in West Germany and Japan, central-bank intervention increased sharply in January 1985. The volume of intervention from January through March was the heaviest since the floating-exchange-rate period began. Between late January and early March, the United States sold \$659 million, and the other large central banks collectively sold approximately \$10 billion.<sup>10</sup> Dollar sales by the West German Bundesbank amounted to nearly DM 13 billion, or approximately \$4 billion, in the first quarter of 1985.<sup>11</sup> The Japanese also entered the market.

During this period, the United States intervened intermittently. On two occasions in late January, the United States bought \$94 million worth of marks (Cross, Spring 1985, p. 60). On three occasions in the first three weeks of February, the Federal Reserve System bought \$242.6 million worth of marks, \$48.8 million of yen, and \$16.4 million equivalent in British pounds (Cross, Autumn 1985, p. 58). In the last week of February and the first week of March, central-bank intervention was very heavy and included U.S. purchases of \$257.6 million equivalent in marks (Cross, Autumn 1985, p. 58).

As summarized in our regression equations, U.S. intervention over this time frame had no perceptible impact on the day-to-day movements in the mark-dollar exchange rate (see table 1). Neither the coefficient on the dummy variable for initial intervention nor the coefficient on the dummy variable for subsequent intervention was statistically different from zero at standard confidence intervals.

These results, however, mask events on February 27. Prior to this episode, Federal Reserve Chairman Paul Volcker indicated in a statement to the House Banking Committee that intervention in January and early February had not been sufficient to influence exchange rates. He seemed to suggest that a larger volume of intervention was necessary on those occasions when central banks intervened.

European central banks began intervening heavily on February 27, and the United States began intervening when the New York market opened. The opening mark-dollar quote was 3.5 percent lower than the previous day's opening quote (see figure 2). The dollar began appreciating on February 28, reversing much of the depreciation over the next week. Thereafter, however, the dollar began a sustained depreciation against the West German mark and the Japanese yen.

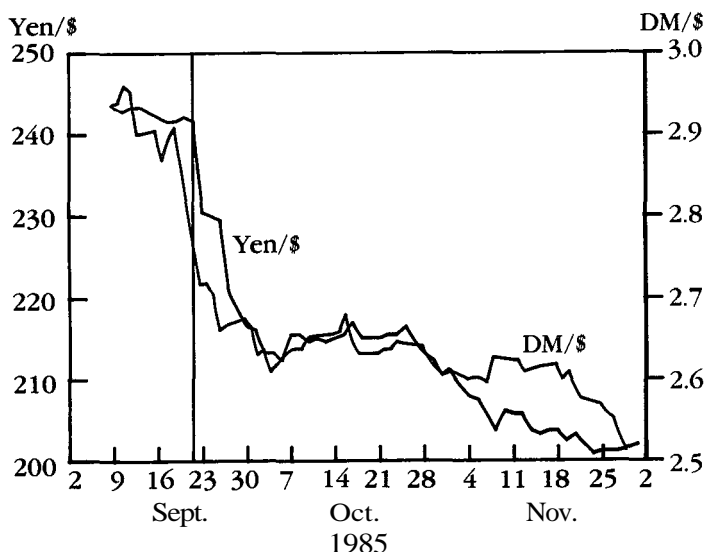
In both of these pre-G5 intervention episodes, U.S. intervention did not have a systematic

<sup>10</sup> See Cross: (Spring 1985), (Summer 1985), and (Autumn 1985).

<sup>11</sup> See "Report of the Deutsche Bundesbank for the Year 1984," pp. 66-67; and "Monthly Report of the Deutsche Bundesbank," vol. 37, no. 4.

**FIGURE 3**

Exchange Rates: Yen/\$ and DM/\$  
(Foreign currency units per dollar)



SOURCES: Bank of America, DRI-FACS; and Federal Reserve Bank of Cleveland.

impact on day-to-day exchange-rate movements. Unlike foreign intervention, U.S. intervention was not very visible, nor was it closely coordinated with foreign intervention during this period. For the two occasions on which we note an appropriate change in the exchange rate, the response seems to be a reaction to foreign intervention and/or to remarks of the Federal Reserve Chairman rather than to U.S. intervention.

U.S. intervention over this period did not seem to represent a departure from previous U.S. intervention policy and did not signal a change in U.S. monetary or fiscal policies. Despite his comments about the volume of intervention, Chairman Volcker had reiterated his view that intervention by itself was of limited usefulness in affecting exchange rates, and the U.S. Treasury did not seem to favor increased intervention.

From mid-March 1985 through late August 1985, as the dollar depreciated against all of the major currencies, central banks generally did not intervene in the foreign-exchange market to influence the dollar's exchange value. Most foreign central banks bought dollars fairly steadily in moderate amounts to bolster foreign reserves. The United States, West Germany, and Japan did not enter the market during this period.<sup>12</sup>

■ 12 See Cross (Autumn 1985); and "Report of the Deutsche Bundesbank for the Year 1985."

**Group of Five Intervention:  
September 1985-  
December 1985**

Economic developments continued to favor a dollar depreciation, especially during the first half of 1985. Interest rates continued to decline in the United States, but European central banks initially did not follow suit. International interest-rate spreads narrowed and promoted a dollar depreciation.

By mid-year, however, the exchange market seemed to become uncertain about the short-term prospects for further dollar depreciation. As economic growth abroad began to weaken, foreign central banks eased monetary policy through an injection of reserves and reductions in official interest rates. Interest-rate spreads began to flatten and reverse themselves. In addition, U.S. money growth (M1) remained well above target, suggesting that at some point the Federal Reserve System might tighten policy, and Chairman Volcker began to warn about the dangers of a too-rapid decline in the dollar. In late August and early September 1985, the dollar began to strengthen against the mark as expectations began to change.

The finance ministers of the G5 nations met in New York over the weekend of September 22 to discuss policies to resolve the huge international trade imbalances. The communique issued at the meeting suggested closer cooperation among the participants and listed a number of policies that individual countries would undertake to help correct existing trade imbalances. The communique also reaffirmed the participants' support for exchange-market intervention.

Immediately following the G5 meeting, the dollar fell sharply as news of the communique circulated. On Monday morning, September 23, the dollar had fallen 5.0 percent against the mark and 4.6 percent against the yen since the previous Friday (see figure 3). West Germany began intervening on Monday as trade opened. This was the first German intervention since March, and it confirmed expectations about intervention. The United States began intervening on Monday against the yen. With the Japanese market closed on the Monday following the G5 meeting, the Japanese began intervening on Tuesday (see Cross, Winter 1985-86). Combined dollar sales for the first three days of the G5 intervention were very heavy.

The dollar depreciated sharply against both the mark (8.7 percent) and the yen (12.1 percent) until October 4. The United States sold a total of \$199 million against the West German mark and \$262 million against the Japanese yen during the last week of September and the first week of

October (Cross, Winter 1985-86, p. 48). Japan's published foreign-exchange reserves dropped by nearly \$1 billion during September (Cross, Winter 1985-86, p. 48). West Germany's foreign-exchange reserves declined DM 664 million in September and DM 2.0 billion in October (Bundesbank, 1985). As the dollar began to firm again after October 4, the United States intensified its intervention efforts, selling nearly \$1.6 billion against marks and \$617.6 million against yen during the middle two weeks of October (Cross, Winter 1985-86, p. 47).

After the week of November 20, all three countries ceased intervention. During the entire G5 episode, the United States sold \$3.2 billion against the mark and yen. The other G5 nations

sold approximately \$5 billion, and the other large industrial countries sold approximately \$2 billion.

Despite the difference in the approach to intervention over this period, the regression results are strikingly similar to those in the pre-G5 intervention regime (see table 2A). The G5 results suggest that the primary influence of intervention on the mark-dollar and the yen-dollar exchange rates came through the announcement effect of the G5 communique. Subsequent intervention was largely ineffectual.

In the regression for the mark-dollar exchange rate, the coefficient for initial intervention is not statistically significant at acceptable confidence intervals, unless the lag on the dummy variable is removed. When the lag is removed, the coefficient is highly significant and suggests that the G5 announcement resulted in an immediate 5 percent depreciation of the mark-dollar exchange rate. With the lag removed, the dummy variable captures the announcement of the G5 intentions and foreign and U.S. intervention in the Far Eastern and European markets that occurred on Monday, September 22, prior to the opening of the New York market.

As in the previous episodes, the coefficient on the variable for subsequent U.S. intervention purchases of marks was not statistically significant at conventional confidence intervals, nor does it have the expected sign. Unlike the previous episodes, intervention was more persistent throughout the September 22 to November 20 period.

We obtain similar results in the equation for the yen-dollar exchange rate. When the dummy variable for initial intervention is lagged, the coefficient is not statistically significant at acceptable confidence intervals. When the dummy variable is not lagged, the coefficient is highly significant and indicates that the initial intervention resulted in an average 2.7 percent depreciation of the dollar relative to the yen. Again, the coefficient on the term for subsequent U.S. intervention is not statistically significant.

An inspection of day-to-day events surrounding the G5 period, however, suggests some possible amendments to the results of the regression analysis. As figure 3 indicates, the dollar fell sharply relative to the mark and yen between September 22 and October 4. This decline seems related to the G5 intervention.

If, however, we split the dummy variables for subsequent intervention into periods before and after October 4, the results are not altered (see table 2B). The coefficients for subsequent intervention before October 4 are not significantly different from zero at acceptable confidence intervals. The G5 announcement could have produced this sharp decline in both the mark-

**T A B L E 2 A**

I. Estimation Period: August 23, 1985 to December 9, 1985

A. Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases <sup>a</sup>	(1)	-0.052	-6.455 <sup>b</sup>
Subsequent purchases	(13)	0.002	0.824
Initial sales	(0)	—	—
Subsequent sales	(0)	—	—
Lagged dependent		0.999	1003.3 <sup>b</sup>

Sum of Squared Residuals = 0.00427

$R^2 = 0.970$

$n = 75$

B. Dependent Variable: yen-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases <sup>a</sup>	(2)	-0.027	-4.996 <sup>b</sup>
Subsequent purchases	(17)	-0.0002	-0.101
Initial sales	(0)	—	—
Subsequent sales	(0)	—	—
lagged dependent		0.999	5272.1 <sup>b</sup>

Sum of Squared Residuals = 0.00421

$R^2 = 0.987$

$n = 75$

NOTE: Intervention refers to U.S. purchases or sales of foreign currencies. Numbers in parentheses indicate the number of times the dummy equals 1.  
a. No lag on dummy.

b. Significant at the 1% confidence level.

SOURCE: Author's calculations.



T A B L E 2 B

G5 Intervention  
(Dummies: 100, 0010, and 0100)

I. Estimation Period: August 23, 1985 to December 9, 1985

A. Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(1)	-0.052	-6.420
Subsequent purchases before/on 10/4	(3)	0.004	0.837
Subsequent purchases after 10/4	(10)	0.001	0.517
Lagged dependent		0.999	998.0 <sup>a</sup>

Sum of Squared Residuals = 0.00426

 $R^2 = 0.970$ 

n = 75

B. Dependent Variable: yen-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(2)	0.027	-4.964 <sup>a</sup>
Subsequent purchases before/on 10/4	(5)	-0.001	-0.290
Subsequent purchases after 10/4	(12)	0.0001	0.054
Lagged dependent		0.999	5238.4 <sup>a</sup>

Sum of Squared Residuals = 0.00421

 $R^2 = 0.897$ 

n = 75

NOTE: Intervention refers to U.S. purchases or sales of foreign currencies. Numbers in parentheses indicate the number of times the dummy equals 1.  
a. Significant at the 1% confidence level.

SOURCE: Author's calculations.

dollar and yen-dollar exchange rates prior to October 4, but the day-to-day movements in these exchange rates are not correlated with subsequent U.S. intervention before October 4. It is not clear that subsequent intervention prior to October 4 reinforced any announcement effect.

Thus, the G5 intervention seems to have been partially successful in producing a downward shift in the dollar.<sup>13</sup> It appears that intervention

had a strong announcement effect on both the mark-dollar and yen-dollar exchange rates, which could have lasted through early October. Day-to-day movements in the dollar, however, were not correlated with day-to-day intervention. After October 4, intervention did not seem to contribute to the dollar's depreciation.

A number of events may explain this result. The G5 communique, which the U.S. reportedly initiated, seemed to have a major effect on market expectations. It appeared to represent a major departure from the previous U.S. position on intervention and a change in the administration's attitude toward a strong dollar. Previous official discussions of intervention typically indicated that operational goals were "to counter disorderly market conditions" or to prevent disruptive speculation. The communique now suggested that exchange rates were not correctly reflecting market developments:

"Ministers and Governors were of the view that recent shifts in fundamental economic conditions among their countries, together with policy commitments for the future, have not been reflected fully in exchange markets."<sup>14</sup>

In addition, the G5 agreement seemed to eliminate any possibility that the Federal Reserve would tighten monetary policy in the near term, even though the aggregates were growing well above target. The communique indicated that the United States would take steps to reduce its federal budget deficit and that West Germany and Japan would adopt policies to stimulate their economies.

The intervention operations following the G5 agreement were large and highly visible. The degree of cooperation among West Germany, Japan, and the United States was greater than in the previous intervention episodes. In addition, the intervention was "leaning with the wind"; the dollar already had been depreciating, and market fundamentals generally favored a depreciation.

The effects of intervention began to wear off by early October, however, because policymakers in the G5 countries were no longer reinforcing or substantiating expectations of additional policy initiatives to drive the dollar lower. The dollar actually appreciated 3 percent against the mark between October 4 and October 16. The market, which anticipated additional policy initiatives on the part of the G5 countries at the International Monetary Fund/International Bank for Reconstruction and Development meetings

■ 13 Feldstein (1986) considers G5 intervention using similar regression techniques and using models that employ a time trend, "shift" dummies, and "slope" dummies. He finds evidence of a shift effect, but no evidence of a change in slope.

■ 14 See "Daily Report for Executives, No. 185." Washington, D.C.: The Bureau of National Affairs (September 24, 1985): M-1.

in Seoul, Korea, began to lose confidence that the G5 countries would take additional steps to encourage the dollar's depreciation when the meeting focused on the international-debt situation. Moreover, Bundesbank President Karl Otto Poehl expressed satisfaction with the extent of the dollar depreciation to date.

Monetary policies in the United States and in West Germany did not seem to support intervention, and central-bank officials did not actively promote the policy. The recently released August 1985 FOMC minutes indicated that the Federal Reserve Board did not want to supply additional reserves to the banking system, because the aggregates were well above the upper-target bound. Equally influential, the minutes expressed Chairman Volcker's concern about the speed of the dollar's depreciation.<sup>15</sup> By early November, central banks in both the United States and West Germany were busy denying the existence of any agreement to encourage a dollar depreciation by manipulating international interest-rate spreads (Cross, Winter 1985-86, p. 47).

The situation relative to the Japanese yen was similar. The yen gave up approximately 1 percent of its gains against the dollar between October 4 and October 7. Thereafter, through November 24, the yen-dollar exchange rate remained little changed. The slight difference between this rate and the mark-dollar exchange rate might have resulted because the Japanese monetary authorities were not as quick as their West German counterparts to disavow their currency's appreciation. Officials at the Bank of Japan and at the Japanese Finance Ministry had announced on October 15 additional policy changes to encourage a yen appreciation. Moreover, yen interest rates rose, especially short-term interest rates.

By late November, West Germany, Japan, and the United States had ceased intervention. The yen continued to appreciate against the dollar, as interest rates on yen-denominated assets rose relative to interest rates on dollar-denominated assets. The mark appreciation quickened because it now seemed out of line compared to the yen. Nominal interest rates in West Germany tended to firm, supporting a mark appreciation. In December 1985, the yen-dollar rate fell below Y200, and the mark-dollar rate broke DM 2.5.

The dollar depreciated on balance in a relatively orderly manner against all major currencies throughout 1986. The depreciation seemed consistent with the continuing worldwide trade

imbalances and with general trends in interest-rate differentials. The United States did not intervene in 1986.

### **Group of Seven Intervention: February 1987 to August 1987**

Throughout 1987, the nominal U.S. current-account deficit continued to grow, but private foreigners were becoming increasingly reluctant to finance the current-account deficit.<sup>16</sup> The dollar continued to depreciate, but at a more modest pace, and interest-rate spreads widened to attract private capital. Money growth in the United States began to slow relative to money growth in West Germany and Japan as concerns about inflation increased.

West Germany and Japan became increasingly hesitant to stimulate their economies or to encourage further dollar depreciation. Both countries were experiencing money growth above target levels, and both began to see an increase in consumer prices, which had been falling.

In January 1987, the dollar came under heavy selling pressure and contributed to a realignment of the central rates in the European Monetary System (EMS). Despite the problems in the EMS, much of the dollar's movement in January occurred in relation to the Japanese yen. This prompted heavy Japanese intervention, and on January 28, the United States intervened in a "hectic and nervous" market, selling a small amount of yen (Cross, Spring 1987a). This intervention followed statements reaffirming cooperation among the major central banks and was followed by a 1.2 percent appreciation of the dollar relative to the yen. The appreciation was not offset in the day immediately following intervention; the yen remained relatively stable through mid-March.

The dollar seemed to stabilize in February, following the release of favorable trade data late in January. Over the weekend of February 20, the G7

<sup>16</sup> Private foreign investors acquired \$20.6 billion in marketable Treasury securities in 1985, but acquired only \$6.8 billion in 1986. During the first half of 1987, private foreign investors reduced their holdings of marketable Treasury securities by \$1.3 billion. The data also indicate that increased official purchases offset much of the reduction in private foreign holdings of marketable U.S. Treasury securities. Official acquisitions of marketable U.S. Treasury securities increased from \$8.1 billion in 1985, to \$14.4 billion in 1986, to \$18.7 billion during the first half of 1987. See Federal Reserve Bulletin, October 1987, p. A66. Loopesko and Johnson (1987) discuss these data.

<sup>15</sup> See Board of Governors of the Federal Reserve System, Annual Report 1985, p. 119.

T A B L E 3

G7 Intervention

I. Estimation Period: February 23, 1987 to July 2, 1987

A. Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(1)	-0.007	-1.258
Subsequent purchases	(0)	—	—
Initial sales	(3)	-0.006	-1.911 <sup>a</sup>
Subsequent sales	(2)	-0.008	1.468
Lagged dependent		1.001	985.3 <sup>b</sup>

Sum of Squared Residuals = 0.0027

R<sup>2</sup> = 0.796

n = 90

B. Dependent Variable: yen-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(0)	—	—
Subsequent purchases	(0)	—	—
Initial sales	(2)	-0.008	-1.207
Subsequent sales	(16)	-0.003	-2.115 <sup>c</sup>
Lagged dependent		1.000	0.766 <sup>b</sup>

Sum of Squared Residuals = 0.0034

R<sup>2</sup> = 0.9636

n = 90

NOTE: Intervention refers to U.S. purchases or sales of foreign currencies. Numbers in parentheses indicate the number of times the dummy equals 1

a. Significant at the 10% confidence level.

b. Significant at the 1% confidence level (two-tailed).

c. Significant at the 5% confidence level (two-tailed).

SOURCE: Author's calculations.

countries met in Paris. The resulting communique, the Louvre agreement, suggested that the participants had agreed informally to a set of reference zones for the yen-dollar and mark-dollar exchange rates. The market's belief that the G7 countries had adopted a set of reference zones for the major exchange rates seems to have reduced perceptions of exchange risk and seems to have increased demand for currencies with relatively high interest rates, including the dollar.<sup>17</sup>

Following the Paris meeting, the volume of foreign central-bank intervention increased and reinforced the market's belief in reference zones. The United States intervened on March 11, buying \$30 million equivalent of West German marks as the dollar temporarily rose above 1.85 marks per dollar (Cross, Spring 1987b, p. 59). Less than two weeks later, the United States began to intervene frequently and very heavily in the foreign-exchange markets, as the dollar depreciated below 150 yen on fears of a trade war between the United States and Japan. Between March 23 and April 6, the United States sold \$3 billion equivalent in yen, and foreign central banks bought an "extraordinary" amount of dollars (Cross, Spring 1987b, p. 62). Intervention continued intermittently throughout May and in early June, with the United States selling a small amount of yen (\$123 million equivalent) and a relatively moderate amount of marks (\$680 million equivalent) (Cross, Autumn 1987).

We estimated our regression over the period late February through early July (see table 3). For the West German mark, the regression coefficient on the dummy variable for initial *purchases* of marks was not statistically significant. The coefficient of the dummy variable for initial *sales* of marks was statistically different from zero, but its negative sign indicates that the dollar depreciated, on average, after the sales of marks. If intervention stabilized the exchange rate, one would expect a positive sign on coefficients associated with sales of foreign currencies for dollars. The coefficient for subsequent mark sales was not significantly different from zero.

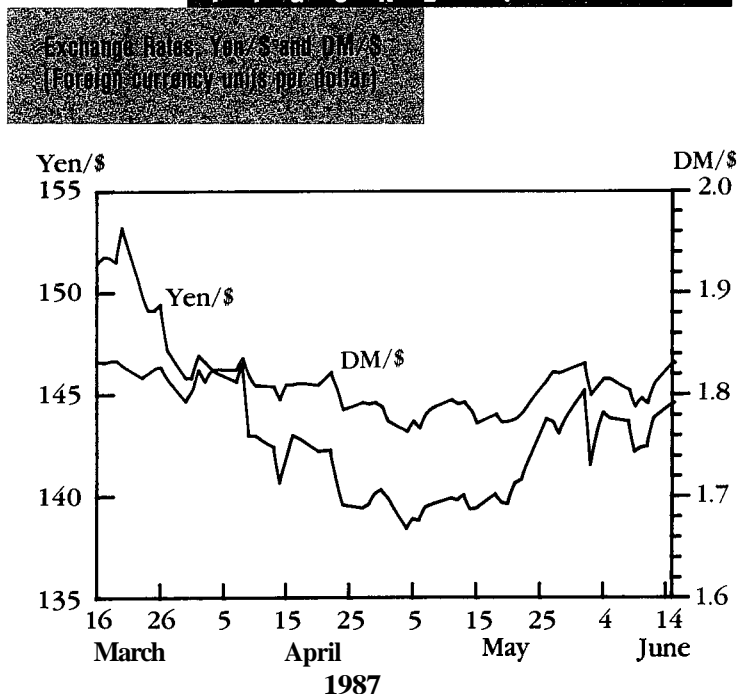
For the Japanese yen, the coefficient on initial intervention was not significantly different from zero at standard confidence levels. The coefficient on subsequent intervention was significant at the 5 percent confidence range, but the sign of the coefficient was negative. This indicates that the depreciation of the dollar was larger, on average, on the days following subsequent intervention against the yen.

As in the G5 episode, the major central banks closely coordinated their intervention efforts during this period. Intervention also was highly visible; at various times, Chairman Volcker, Vice-Chairman Martin and U.S. Treasury Secretary Baker acknowledged that intervention was under way.

Unlike the G5 episode, however, the central banks were leaning against the wind instead of with it. During March and April, the G7 indicated no changes in monetary or fiscal policies that might have altered the fundamentals in the exchange market. Moreover, a clear signal about the administration's views on the dollar's depreciation did not emerge. Treasury Secretary Baker

attempted to convince the market that the United States did not wish to see a further depreciation of the dollar, but U.S. trade representative Yeuter appeared to contradict this statement. Consequently, intervention did not appear to have an effect on the dollar's exchange rate. The dollar continued to depreciate against the yen at a rapid pace through April (see figure 4).

**FIGURE 4**



SOURCES: Bank of America, DRIFACS; and Federal Reserve Bank of Cleveland.

At the end of April, Chairman Volcker indicated that the Federal Reserve System was "snugging" monetary policy, and Japanese Prime Minister Nakasone indicated that Japan would ease monetary policy. In May, the West German Bundesbank lowered some of its official money market rates. The dollar firmed on the belief that these changes in monetary policy would promote wider interest-rate spreads that favored dollar-denominated assets. In late May, the Japanese announced a sizable fiscal package designed to stimulate their economy and help reduce their trade surplus.

The United States intervened in May and June to counter the impact on the dollar of specific events, such as the announcement in May that money-center banks were adding loan-loss reserves against their outstanding developing-country loans, and the announcement in June that Chairman Volcker would not seek an additional term (Cross, Autumn 1987). Intervention may have affected the dollar in the former

instance, but not in the latter. In any case, the effects of these announcements on the dollar were short-lived.

The dollar continued to firm until early August. Then, as the dollar rose above 1.85 marks, the United States intervened against marks. The United States sold \$631 million against marks between August 4 and August 10 (Cross, Winter 1987-88, p. 48). By mid-August, following the release of merchandise trade data showing an unexpectedly large deficit for June, the dollar began depreciating again. The United States undertook intervention purchases of dollars against yen late in August, buying \$389.5 million against yen between August 24 and September 2.<sup>18</sup>

U.S. intervention in August had no obvious influence on the dollar; neither the coefficients for initial intervention nor the coefficients for subsequent intervention in the mark-dollar and yen-dollar equations were significantly different from zero at acceptable confidence levels (see table 4). The market did not seem to associate this intervention with any change in U.S. or foreign policies.

#### IV. Conclusion

Between August 1984 and August 1987, the dollar depreciated sharply in response to a large and persistent current-account deficit and to changes in other market fundamentals, especially long-term interest-rate differentials. During this period, central-bank intervention also increased dramatically. We have identified three U.S. intervention regimes over this period, each of which is distinct in terms of the direction of intervention, the size and duration of intervention, the degree of visibility, or the extent of central-bank cooperation. The response of the exchange rate to intervention was not uniform over this period, but a pattern seems to emerge.

Generally, this study suggests that intervention *can* have a temporary announcement effect on the exchange rate. This announcement effect, however, is not universal. Between August 1984 and August 1987, it was associated with initial interventions that were highly visible or that were coordinated with visible foreign intervention. This was the case in September 1984, when U.S. intervention accompanied a highly visible West German intervention, and in February 1985, when Chairman Volcker's comments about intervention and a highly visible West German transaction preceded U.S. intervention.

18 Our sample period ends on August 28, 1987.

T A B L E 4

## G7 Intervention

I. Estimation Period: July 5, 1987 to August 28, 1987

A. Dependent Variable: mark-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(1)	-0.002	-0.344
Subsequent purchases	(3)	0.003	1.031
Initial sales	(0)	—	—
Subsequent sales	(0)	—	—
Lagged dependent		0.9994	728.9"

Sum of Squared Residuals = 0.0009

R<sup>2</sup> = 0.808

n = 38

B. Dependent Variable: yen-dollar exchange rate

Independent Variables		Coefficient	T-statistic
Intervention dummies			
Initial purchases	(0)	—	—
Subsequent purchases	(0)	—	—
Initial sales	(1)	-0.0093	1.186
Subsequent sales	(0)	—	—
Lagged dependent		0.9999	3941.1"

Sum of Squared Residuals = 0.00215

R<sup>2</sup> = 0.794

n = 38

NOTE: Intervention refers to U.S. purchases or sales of foreign currencies. Numbers in parentheses indicate the number of times the dummy equals 1. a. Significant at the 1% confidence level.

SOURCE: Author's calculations.

The size and duration of any announcement effect seems greater when the market associates intervention with a change in monetary and fiscal policies. The biggest impact occurred during the G5 episode, when the market thought that the G5 countries would undertake more substantial monetary and fiscal policies to lower the exchange value of the dollar and reduce their trade imbalances.

An announcement effect is more likely to occur if market fundamentals are moving or just beginning to move in a manner consistent with the thrust of intervention. No apparent announcement effect was associated with intervention in 1987, when the United States attempted to lean against the wind. The dollar stabilized only after U.S., West German, and Japanese policymakers

indicated changes in monetary policies that possibly could alter the direction of the wind.

In nearly all cases, the duration of any announcement effect is short, generally lasting only one day. An exception might be the G5 episode, when the market seemed to expect major policy changes; hence the dollar depreciated from September 20 through October 4, 1985. Nevertheless, our data show that subsequent intervention prior to October 4 was not related to day-to-day exchange-rate movements.

Beyond this temporary announcement effect, however, U.S. intervention had no apparent impact on the exchange value of the dollar. In nearly all instances, subsequent intervention did not appear to influence exchange rates. In the one exception, the G7 period, the coefficient did not have the expected sign. The dollar's depreciation during the period might have been much sharper in the absence of intervention, but this hypothesis is not testable.

Our results are consistent with previous empirical investigations of intervention, which find little support for a systematic exchange-rate response to intervention.<sup>19</sup> Our results for the G5 period also seem to agree with Feldstein (1986), who found that G5 intervention resulted in a one-time shift in exchange rates, but not a shift in the slope of the exchange-rate path. This seems consistent with the view that sterilized intervention operates through an expectations channel.

Finally, we find some support for the view that coordinated intervention is more effective than uncoordinated intervention. Loopesko (1983) found mixed results when testing the importance of coordination, but Greene (1984a) suggests that coordination increases the effectiveness of intervention.

Our conclusions about intervention also are consistent—in direction, if not in degree—with many of the official views expressed in the Jurgensen Report (1983). These views undoubtedly reflect the opinions and experiences of individuals who conduct intervention for major industrial countries. The Jurgensen Report indicates that intervention does not have a lasting effect on exchange rates, especially when the thrust of intervention is inconsistent with market fundamentals. Our failure to find a correlation between subsequent intervention and exchange-rate movements, or any correctly signed correlation during the G7 period, is consistent with this view. The

<sup>19</sup> Humpage (1986) summarizes important empirical studies of intervention.

Jurgensen Report does maintain that intervention can have a temporary effect and suggests that this effect works primarily through an expectations channel. Our results tend to verify this view, but indicate that the times when intervention can have a temporary impact seem rare and depend on expectations about other policy developments.

The policy implications of these results are not substantially different from those found in the Jurgensen Report. First, exchange-market intervention does not afford countries an additional policy lever with which to influence exchange rates over the long term, independent of monetary and fiscal policies. Second, frequent or otherwise systematic intervention that does not provide new information to the market will not affect exchange rates. The size and duration of any announcement effect seems to depend on the extent to which the intervention creates expectations of changes in monetary and fiscal policies. Because this announcement effect has a very short duration, monetary authorities must reinforce intervention quickly with other policy initiatives. Third, beyond possible announcement effect, exchange-market intervention has no apparent influence on day-to-day exchange-rate movements.

## References

- Bundesbank. "Monthly Report of the Deutsche Bundesbank." Vols. 36 through 39, nos. 1 through 12.
- . "Report of the Deutsche Bundesbank for the Year 1986."
- . "Report of the Deutsche Bundesbank for the Year 1985."
- . "Report of the Deutsche Bundesbank for the Year 1984."
- Cross, Sam Y. "Treasury and Federal Reserve Foreign Exchange Operations, August-October 1987 Report." *Quarterly Review!* Federal Reserve Bank of New York. (Winter 1987-88): 48-59.
- . "Treasury and Federal Reserve Foreign Exchange Operations, May-July 1987 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Autumn 1987): 49-54.
- . "Treasury and Federal Reserve Foreign Exchange Operations, November 1986-January 1987 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Spring 1987a): 64-70.
- . "Treasury and Federal Reserve Foreign Exchange Operations, February-April 1987 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Spring 1987b): 57-63.
- . "Treasury and Federal Reserve Foreign Exchange Operations, May-July 1986 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Autumn 1986a): 43-47.
- . "Treasury and Federal Reserve Foreign Exchange Operations, August-October 1986 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Autumn 1986b): 36-42.
- \_\_\_\_\_. "Treasury and Federal Reserve Foreign Exchange Operations, February-April 1986 Report." *Quarterly Review*. Federal Reserve Bank of New York. (Summer 1986): 47-51.
- . "Treasury and Federal Reserve Foreign Exchange Operations, August-October 1985 Interim Report." *Quarterly Review*. Federal Reserve Bank of New York. (Winter 1985-86): 45-48.
- . "Treasury and Federal Reserve Foreign Exchange Operations, February-July 1985 Semiannual Report." *Quarterly Review!* Federal Reserve Bank of New York. (Autumn 1985): 50-64.

- . "Treasury and Federal Reserve Foreign Exchange Operations, February-April 1985 Interim Report." *Quarterly Review*. Federal Reserve Bank of New York. (Summer 1985): 58-59.
- . "Treasury and Federal Reserve Foreign Exchange Operations, August 1984-January 1985 Semiannual Report." *Quarterly Review*. Federal Reserve Bank of New York. (Spring 1985): 57-70.
- Fama**, Eugene F. "Efficient Capital Markets: A Review of Theory and Empirical Work." *The Journal of Finance*. 25 (May 1970): 383-417.
- Feldstein, Martin. "New Evidence on the Effects of Exchange Rate Intervention." National Bureau of Economic Research Working Paper No. 2052, October 1986.
- Greene, Margaret L. "U.S. Experience With Exchange Market Intervention: January-March 1975." *Staff Studies No. 127*, Board of Governors of the Federal Reserve System, August 1984a.
- . "U.S. Experience With Exchange Market Intervention: September 1977-December 1979." *Staff Studies No. 128*, Board of Governors of the Federal Reserve System, August 1984b.
- \_\_\_\_\_. "U.S. Experience With Exchange Market Intervention: October 1980-September 1981." *Staff Studies No. 129*, Board of Governors of the Federal Reserve System, August 1984c.
- Humpage**, Owen. "Exchange-Market Intervention: The Channels of Influence." *Economic Review*. Federal Reserve Bank of Cleveland. (Quarter 3 1986): 2-13.
- Hutchison, Michael M. "Intervention, Deficit Finance and Real Exchange Rates: The Case of Japan." *Economic Review*. Federal Reserve Bank of San Francisco. (Winter 1984): 27-44.
- Jurgensen**, Philippe (Chairman). "Report of the Working Group on Exchange Market Intervention." Washington, D.C., mimeo, March 1983.
- Levich**, Richard M. "Empirical Studies of Exchange Rates: Price Behavior, Rate Determination and Market Efficiency," in Ronald W. Jones and Peter B. Kenen, eds., *Handbook of International Economics*, vol. 2. Amsterdam: Noah-Holland Publishing Co., 1985: 979-1040.
- Loopesko, Bonnie E. "Relationships Among Exchange Rates, Intervention, and Interest Rates: An Empirical Investigation." *Staff Studies No. 133*, Board of Governors of the Federal Reserve System, November 1983.
- \_\_\_\_\_, and Robert A. Johnson. "Realignment of the Yen-Dollar Exchange Rate: Aspects of the Adjustment Process in Japan." *International Finance Discussion Papers No. 311*, Board of Governors of the Federal Reserve System, August 1987.
- Meese, Richard A., and Kenneth Rogoff. "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?" *Journal of International Economics*. 14 (1983): 3-24.