

# The Inaccuracy of Newspaper Reports of U.S. Foreign Exchange Intervention

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## Introduction

Central bank intervention in foreign exchange markets most recently came into prominence during the period of exchange-rate volatility in the autumn of 1992. Speculators doubted that European central banks would be able to defend the exchange rates agreed upon as part of the European Rate Mechanism. After massive intervention, central banks eventually capitulated, and several key exchange rates were allowed to fall radically against the German mark (DM). While this sequence of events would seem to have cast considerable doubt on the usefulness of sterilized intervention, disagreement continues both within policy circles and among researchers as to whether sterilized central bank intervention is a useful tool for exchange-rate management.<sup>1</sup>

Until recently, studies of intervention have been hampered by a lack of official data, as direct measures of central bank intervention

have usually not been made available to the public. Now, however, the Board of Governors of the Federal Reserve System provides a time series of U.S. dollar intervention vis-à-vis the DM and the Japanese yen from 1985 to 1992. One consequence of the former lack of immediately available and accurate intervention information has been the use of daily newspaper reports as proxies for actual intervention magnitudes in related studies.

The possibility that intervention is not reported accurately may have important implications for understanding the signaling mechanism of intervention. For example, such inaccuracy may call into question the ability of intervention to signal future monetary policy with precision. In addition, it may reflect differences in the information available to foreign exchange traders, suggesting that some traders may be able to profit from inside information.

In this paper, we begin with a discussion of issues regarding information about intervention. We then describe the data on actual intervention and newspaper reports. In the third section, we outline the procedure that we use to test for systematic differences between reported and actual intervention series. In the final section, we briefly discuss the implications of our results.

■ 1 Researchers would point out that this most recent period was not a good test of intervention's efficacy because exchange-rate management was not the sole objective of the central banks. In addition, some of the intervention may not have been sterilized, making it difficult to isolate its impact. "Sterilization" occurs when the effect of intervention on the money supply is offset by open market operations. Nonsterilized intervention is thus, in some sense, equivalent to monetary policy.

## I. Information about Intervention: Reported versus Actual Data

There is by now a substantial literature devoted to understanding the impact of central bank intervention on foreign exchange markets. Recent useful summaries of this literature have been provided by Dominguez and Frankel (1993), Edison (1993), Humpage (1991), and Obstfeld (1990).<sup>2</sup>

While most recent studies, such as Baillie and Humpage (1992), Baillie and Osterberg (1993), and Hung (1992), use official daily intervention data, others, such as Klein and Rosengren (1991) and Kaminsky and Lewis (1993), use daily newspaper reports of intervention.<sup>3</sup> If the focus of a given study is on the signaling role of intervention, then it makes sense to utilize newspaper reports that reflect the information available to the average trader.

One concern is that the choice of intervention data, reported or actual, may influence researchers' conclusions about the efficacy of intervention. However, we would like to raise two other possible concerns, namely, that if there is a systematic difference between actual and reported intervention, 1) the signals as represented by the newspaper reports may be misleading, and 2) some market participants may have more accurate information about intervention than do others. That the latter is possible can be seen simply by considering the mechanisms of intervention. U.S. intervention counterparties are either brokers or commercial banks. If brokers are utilized, they will not reveal that the transaction is official intervention. If commercial banks are utilized, the wire services should accurately reveal that the Federal Reserve has entered the market.<sup>4</sup> In either case, the only market participants with definitive knowledge are the counterparties chosen by the Federal Reserve Bank of New York.

If we are willing to assume that the newspaper reports indicate what is known about intervention by the uninformed trader, then a systematic difference between actual and reported intervention implies a systematic difference in knowledge among market participants. However, it is not clear how much time passes before all market participants learn of the intervention, or even if they ever obtain accurate information short of the official release one year later by U.S. authorities. In addition, it is unclear if the newspaper reports are written during the course of the day and are thus affected by changing and uncertain

views about intervention activity, or whether they represent a presumably more accurate, end-of-day assessment.

We know of only three previous comparisons of actual and reported U.S. intervention data. Klein (1993) uses multinomial logit analysis to calculate the probability that intervention is reported, conditional on the size of the intervention. He estimates that, without conditioning on size, the probability that actual intervention is reported is 72 percent, and the probability that reported intervention actually occurred is 88 percent. He also shows that newspaper reports are more likely if the intervention is relatively large. Dominguez (1992) examines the impacts of reported and "secret" intervention on the volatility of the DM/U.S. dollar exchange rate. She assumes that actual intervention not reported in the newspapers is "secret." No significant difference is seen between the impacts of the two categories of intervention on volatility. Dominguez and Frankel (1993) tabulate actual and reported interventions by the United States and Germany from November 1982 through October 1989. The accuracy of newspaper reports varied across different time periods. For example, while all 22 U.S. interventions in the period September through November 1985 were reported, only 73 percent of interventions from March 1989 through October 1989 appeared in the print media.<sup>5</sup>

We make two contributions to the literature on central bank intervention. First, we construct a comprehensive data set from newspaper reports of central bank intervention for the period January 2, 1985 to October 11, 1991. This data set improves on those constructed by other researchers by quantifying qualitative reports (such as "small" intervention) rather than disregarding them. Second, we test for the existence of systematic components in the differences between

■ 2 A consensus of the literature is that if sterilized intervention matters at all, it does so because it signals a change in information about monetary policy.

■ 3 Still others have 1) constructed monthly numbers intended to capture the shift in international portfolios due to intervention (for example, Ghosh [1992]), 2) attempted to define intervention in terms of the monetary authorities' balance sheets (see Danker et al. [1987]), or 3) used measures of central banks' foreign reserves (for example, Glick and Hutchison [1992] and Watanabe [1992]).

■ 4 However, the market sometimes seems to make guesses that confuse intervention operations with correspondent transactions.

■ 5 Dominguez (1992) and Dominguez and Frankel (1993) utilize reports of intervention from *The London Financial Times*, *The New York Times*, and *The Wall Street Journal*. Klein (1993) uses the first two sources.

actual and reported intervention, calculating these differences using either dummy variables or numerical magnitudes. We also either include "rumors" in the reported series or discard them. With few exceptions, we find that there are systematic components; that is, the differences are serially correlated.

## II. Data

### Actual

The Board of Governors of the Federal Reserve System provided us with time series of U.S. net daily dollar transactions from January 1985 to October 1991. All data are in dollars, representing the actual net dollar purchases (sales) rather than dollar equivalents that have been translated into dollars via application of the exchange rate.<sup>6</sup> These data are now publicly available, with a one-year lag, from the Board of Governors. We report the results of our analyses with three categories of intervention: U.S. intervention vis-à-vis unspecified currencies carried out in terms of U.S. dollars, U.S. intervention vis-à-vis the DM, and U.S. intervention vis-à-vis the yen.

Using these data, we created dummy variables, each of which equals +1 for positive net dollar purchases, -1 for negative net dollar purchases (positive sales), and 0 if the country did not intervene (its net dollar transaction was 0).

### Newspaper Reports

After having searched *The Wall Street Journal*, *The New York Times*, and *The Financial Times*, we ultimately decided to record the daily press reports of intervention from the foreign exchange column of *The Wall Street Journal*.<sup>7</sup> We recorded all mentions of intervention that were indicated as pertaining to the previous day or previous business day. Thus, if there was first mention of intervention a week after its occurrence, we do not record it, on the presumption that it would not have been known by the market at the time.

As in the case with the actual data, for each category of intervention, a buy/sell variable was created to indicate whether a country was a net buyer or seller of dollars. It equals +1 if the country bought dollars, -1 if it sold dollars, and 0 if it did not intervene. To correspond to the way in which the actual intervention data were constructed, we documented U.S. intervention in the DM/dollar and yen/dollar markets. A buy/sell variable was constructed for each mar-

ket, indicating whether the United States bought (+1) or sold (-1) dollars. Thus, reported U.S. intervention in each of these two markets is recorded in two places. For example, if the United States was reported to be buying yen, we would record this under the United States selling dollars vis-à-vis the yen, and also in the (overall) U.S. selling category described previously (and denoted as U.S. vs. \$U.S. in the tables). For all groups, we recorded the size of the intervention if given. This includes qualitative terms such as small, moderate, and large, as well as dollar magnitudes when given.

After all data were recorded, we calculated the minimum, median, and maximum of the reported dollar magnitudes for each U.S. intervention variable when such magnitudes were reported in the newspaper. We substituted for qualitative terms. For terms indicating "small," "light," or "token," we used the minimum for the particular category of intervention. For "modest" or "moderate," we substituted the median. For "large" or "heavy," we substituted the maximum. If no indication of size was given, we used the median. For example, if the United States was reported to be intervening heavily against the yen, we would substitute the maximum of all numeric reports of the United States buying or selling dollars against the yen. We then created a net transaction variable for each category by multiplying the buy/sell dummy variable by that amount. This variable is comparable to the actual net intervention variable. The minimums, maximums, and medians for all of the reported intervention variables are provided in table 1.

We also recorded specific mention of rumors.<sup>8</sup> For a given country A, two types of rumors are recorded: 1) whether country A intervened on its own behalf, and 2) whether country A intervened on behalf of country B (or whether country B intervened on behalf of country A). In the white noise tests that we describe below, we either disregard the rumors (treat them as being nonreports) or count them (treat them the same as other reports). The details of our treatment of rumors and "on behalf of" transactions are described in the appendix.

■ 6 Such a procedure would embed simultaneity into any subsequent analysis of the relation between intervention and exchange rates.

■ 7 This source is the most consistent of the three. While the use of only one source may seem to make our series less comprehensive than it would otherwise be, the amount of information that we obtain from this news report is greater. In addition, we avoid having to determine how to code reports when disparities arise among different sources.

■ 8 Thus, an erroneous report is not the same as an erroneous rumor.

**TABLE 1**

Minimum, Median, and Maximum Values for Reported Rumors (in millions of U.S. dollars)

	Minimum	Median	Maximum
U.S. vs. \$U.S.	35.00	150.00	600.00
U.S. vs. DM	60.00	118.33	250.00
U.S. vs. Yen	50.00	143.75	200.00

SOURCE: Authors' calculations based on newspaper reports from January 2, 1985 to December 31, 1991.

**BOX 1**

**Calculations of the White Noise Test Statistics**

The two test statistics utilized in this article are those calculated by the SAS/ETS routine SPECTRA. They are the Kappa ( $K$ ) statistic suggested by Fisher (1929) and the Kolmogorov-Smirnov ( $K-S$ ) statistics suggested by Bartlett (1966). Fuller (1976) presents their formulas as follows:

$$K = \left[ \frac{1}{m} \sum_{k=1}^m I_n(\omega_k) \right]^{-1} I_n(L)$$

$K-S$  = maximum absolute difference of  $C_k$ , the cumulative distribution function of a uniform random variable, where

$$C_k = \left[ \sum_{j=1}^m I_n(\omega_j) \right]^{-1} \sum_{j=1}^k I_n(\omega_j)$$

$I_n(L)$  is the largest periodogram of a sample of  $m$  periodogram ordinates with two degrees of freedom. Here,  $\omega$  indicates frequency, with  $m = (n-1)/2$  and  $n$  being the number of observations.

In both  $K$  and  $K-S$ , the periodogram is being used to search for periodicities of unspecified form.<sup>9</sup> Fuller (1976), p. 282, states that "for many nonnormal processes we may treat the periodogram ordinates as multiples of chi-squared random variables." He further discusses how this assumption helps to motivate the formulas given above. However, as we note in the text, the peculiar nature of the data here requires us to qualify our application of these test statistics to our data and to consider alternate sample periods and alternate calculations of the series. Fuller (1976), p. 284, gives the distribution of  $K$ , and Birnbaum (1952) gives the distribution of  $K-S$ .

<sup>9</sup> The concept of a periodogram is detailed in Fuller (1976), p. 275.

**III. White Noise Tests**

The white noise tests focus on the U.S. intervention categories. For each reported intervention variable, we vary the series along two dimensions: First, we either count all rumors (about whether there was intervention or rumored "on behalf of" intervention) or discount all rumors.<sup>9</sup> Second, we use either numerical values or dummy variables. The use of dummy variables may help to ameliorate some problems discussed below regarding the appropriate use of our statistical technique.

Although we could see if errors in reports of intervention were of economic significance by comparing the impacts of actual and reported intervention on exchange rates, that procedure would require us to specify a model of the interaction between intervention and exchange rates. Given the multiplicity of frameworks used to study intervention, we elected to utilize a technique that is not model-specific: testing for whether the differences between reported and actual intervention are white noise. A time series is white noise if it has a mean value equal to zero and if observations are serially uncorrelated.

The two statistics we report below are those of the Kolmogorov-Smirnov and Kappa tests, provided by the SAS/ETS (1990) version 6 routine SPECTRA. A detailed discussion of these tests is found in Fuller (1976), pp. 282-85. The exact calculations are described in box 1. In our application of the tests, a finding that a series is not white noise implies that the series contains serial correlation rather than that it lacks a nonzero average.<sup>10</sup> However, there are some limitations as to how one can interpret these test results.

First, the interpretation of the error equaling zero is ambiguous because it does so whenever 1) there was no intervention and no intervention was reported, and 2) there was intervention that was reported accurately. That this ambiguity is not a desirable characteristic of our procedure can be seen by comparing three scenarios. In one

<sup>9</sup> As an example, consider a report that "the Federal Reserve purchased 100 million yen, rumored to be on behalf of the Bank of Japan." In a series that counts rumors, this would be entered as a purchase of yen (sale of dollars) by the Japanese, while in the "no rumors" series, it would count as a U.S. purchase of yen.

<sup>10</sup> Utilizing the ADJMEAN option in the SPECTRA routine sets the average of the series to equal zero.

TABLE 2A

**Descriptive Statistics for Actual,  
Reported, and Rumored Intervention:  
Full Sample Period**

	Number of Occurrences			Average Size	
	Total	Buying	Selling	Buying	Selling
<b>Actual intervention</b>					
U.S. vs. \$U.S.	294	98	196	160.34	177.74
U.S. vs. DM	203	61	142	111.83	141.21
U.S. vs. Yen	185	66	119	134.73	124.25
<b>Reported intervention</b>					
U.S. vs. \$U.S.	184	52	132	148.08	148.56
U.S. vs. DM	38	6	32	140.28	108.64
U.S. vs. Yen	37	12	25	131.25	137.25
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	38	16	22	142.81	140.68
U.S. vs. DM	4	1	3	118.33	98.89
U.S. vs. Yen	3	1	2	143.75	143.75
<b>Errors in Reported Intervention</b>					
	Total		Actual but Not Reported	Reported but Not Actual	
<b>Reported intervention</b>					
U.S. vs. \$U.S.	160		135	25	
U.S. vs. DM	171		168	3	
U.S. vs. Yen	158		153	5	
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	24				
U.S. vs. DM	4				
U.S. vs. Yen	2				

**Categories of intervention:**

U.S. vs. \$U.S.: U.S. intervention vis-à-vis unspecified currencies, carried out in terms of U.S. dollars.

U.S. vs. DM: U.S. purchases or sales of DM in terms of U.S. dollars.

U.S. vs. Yen: U.S. purchases or sales of yen in terms of U.S. dollars.

NOTE: "Buying" and "Selling" columns are in terms of purchases and sales of millions of U.S. dollars.

SOURCE: Authors' calculations.

case, imagine a typical day in the midst of a long period in which there was no intervention and no reason to expect intervention. In the second case, imagine that the newspapers correctly report the cessation of intervention at the end of a period of turbulent markets and frequent intervention. In the third case, assume that a non-zero amount of intervention is correctly reported. In all three cases, the error is zero, although different information is provided in each case.<sup>11</sup>

We hope to ameliorate the impact of this factor on our result by varying the data in two

ways. First, we split the sample in half to control in part for changes in the frequency and patterns of intervention. Second, we calculate the errors using both dummy variables and numeric variables. Using dummy variables will reduce the number of errors if the newspapers seldom correctly report the amount of intervention.

Another limitation to our procedure is that our data may violate the maintained hypothesis that they are generated by a continuous random variable. Intervention either takes the value of zero (the vast majority of days) or jumps to a number of the magnitude of 100 (100 million U.S. dollars). Here again, we hope that by using dummy variables, which exhibit smaller jumps, we reduce the impact of such discontinuities.

#### IV. Intervention Data and Errors

Tables 2A–2C describe the actual intervention data, the reports of intervention, and rumored interventions.<sup>12</sup> The first line, "U.S. vs. \$U.S.," denotes U.S. purchases or sales of unspecified currencies. This includes the number of days that the United States intervened in all currencies, including the DM and yen, as indicated on the next two lines.<sup>13</sup> We use this measure in our assessment of the overall accuracy of reports about U.S. intervention, since newspaper reports often do not specify the foreign currency in which the United States is intervening.<sup>14</sup>

In table 2A, we see that there were 294 actual U.S. interventions for the full sample period, 184 reports of intervention, and 38 rumors of intervention. Thus, at most, 76 percent of interventions were mentioned in the newspaper ( $(184 + 38) / 294 = 0.76$ ). At the bottom of the table, we

■ 11 This problem would be ameliorated if we were able to model the joint process governing the intervention/exchange-rate interaction. This process presumably will yield an expected intervention variable and in turn will specify the significance of errors in reported intervention on the exchange rate.

■ 12 We compiled many more categories of reports than are analyzed in the tables. Our comparisons were restricted to those series for which we had actual intervention data.

■ 13 Note that the United States sometimes intervened with more than one currency within one day.

■ 14 The official data are in dollars, so in our comparison of reported and actual intervention, we have restricted ourselves to reports of dollar intervention. Fortunately, when reports specify amounts, they indicate the dollar magnitudes, eliminating the need to convert via application of the exchange rate.

TABLE 2B

	Number of Occurrences			Average Size	
	Total	Buying	Selling	Buying	Selling
<b>Actual intervention</b>					
U.S. vs. \$U.S.	100	61	39	176.68	119.99
U.S. vs. DM	60	33	27	116.83	115.41
U.S. vs. Yen	78	53	25	130.60	62.53
<b>Reported intervention</b>					
U.S. vs. \$U.S.	55	33	22	153.18	138.18
U.S. vs. DM	4	2	2	118.33	109.17
U.S. vs. Yen	8	8	0	132.03	0
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	20	12	8	140.42	124.38
U.S. vs. DM	2	0	2	0	89.17
U.S. vs. Yen	0	0	0	0	0
<b>Errors in Reported Intervention</b>					
	Total	Actual but Not Reported	Reported but Not Actual		
<b>Reported intervention</b>					
U.S. vs. \$U.S.	65	55	10		
U.S. vs. DM	56	56	0		
U.S. vs. Yen	72	71	1		
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	13				
U.S. vs. DM	2				
U.S. vs. Yen	0				

**Categories of intervention:**

U.S. vs. \$U.S.: U.S. intervention vis-à-vis unspecified currencies, carried out in terms of U.S. dollars.

U.S. vs. DM: U.S. purchases or sales of DM in terms of U.S. dollars.

U.S. vs. Yen: U.S. purchases or sales of yen in terms of U.S. dollars.

NOTE: "Buying" and "Selling" columns are in terms of purchases and sales of millions of U.S. dollars.

SOURCE: Authors' calculations.

report errors, either from comparing actual and reported or from comparing actual and rumored intervention. On the one hand, there were 135 days on which intervention occurred but was not reported, implying that it was reported only 54 percent of the time. On the other hand, only 25 of the 184 reports were erroneous (86 percent accuracy). In the case of rumors, however, most were in error: For 24 of 38 rumors, there was no actual intervention.

Tables 2B and 2C present similar information for the two sample halves.<sup>15</sup> Almost twice as much actual intervention in the U.S. vs. \$U.S. category occurred in the second half of the sample as in the first. In the U.S. vs. DM category, intervention was much heavier in the second half of the sample, as the United States shifted to buying DM (selling dollars). Reports of intervention appear to capture these patterns. However, in the U.S. vs. DM and U.S. vs. yen categories, occurrences of reports fall far short of the number of actual interventions. This finding stands in sharp contrast to the findings in the previous paragraph regarding the U.S. vs. \$U.S. category.

Table 3 presents the results of the white noise tests, separated by whether the reported series omits or includes rumors and by whether we use numeric or dummy variables.<sup>16</sup> All of the white noise tests were performed on both the full sample and on each half of the sample. Splitting the sample is an attempt to see if the results are sensitive to choosing sample periods that vary regarding either the intensity of intervention or its pattern. In this case, intervention activity was heavier during the second subsample.

Generally, with both tests, the full sample and split samples reject the hypothesis that the time series of errors are white noise. Thus, there are systematic components to the differences between actual and reported intervention. For dummy variables, we reject the hypothesis of white noise in all cases.

## V. Summary

Newspaper reports of central bank intervention are often used as if they are interchangeable with actual intervention data. Except in rare cases, actual data have become available only recently for the United States, with a one-year lag. Here we describe detailed time series culled from *The Wall Street Journal* and compare them to actual intervention data. We quantify qualitative reports of intervention for all of the series. To the best of

■ 15 We have also compiled analogous tables for the subperiods January 2–December 31, 1985; January 1, 1986–February 20, 1987; February 21, 1987–February 19, 1990; and February 20, 1990–October 11, 1991. These tables are available from the authors and facilitate comparison with previous research on the effectiveness of intervention over various subsamples.

■ 16 Rumored intervention includes rumors about both "own" and "on behalf of" intervention.

TABLE 2C

**Descriptive Statistics for Actual  
Reports and Rumored Interventions  
May 23, 1980 - October 1, 1980**

	Number of Occurrences			Average Size	
	Total	Buying	Selling	Buying	Selling
<b>Actual intervention</b>					
U.S. vs. \$U.S.	194	37	157	133.41	192.09
U.S. vs. DM	143	28	115	105.93	147.27
U.S. vs. Yen	107	13	94	151.54	140.66
<b>Reported intervention</b>					
U.S. vs. \$U.S.	129	19	110	139.21	150.64
U.S. vs. DM	34	4	30	151.25	108.61
U.S. vs. Yen	29	4	25	129.69	137.25
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	18	4	14	150.00	150.00
U.S. vs. DM	2	1	1	118.33	118.33
U.S. vs. Yen	3	1	2	143.75	143.75
<b>Errors in Reported Intervention</b>					
	Total	Actual but Not Reported	Reported but Not Actual		
<b>Reported intervention</b>					
U.S. vs. \$U.S.	95	80	15		
U.S. vs. DM	115	112	3		
U.S. vs. Yen	86	82	4		
<b>Rumored intervention</b>					
U.S. vs. \$U.S.	11				
U.S. vs. DM	2				
U.S. vs. Yen	2				

**Categories of intervention:**

U.S. vs. \$U.S.: U.S. intervention vis-à-vis unspecified currencies, carried out in terms of U.S. dollars.

U.S. vs. DM: U.S. purchases or sales of DM in terms of U.S. dollars.

U.S. vs. Yen: U.S. purchases or sales of yen in terms of U.S. dollars.

NOTE: "Buying" and "Selling" columns are in terms of purchases and sales of millions of U.S. dollars.

SOURCE: Authors' calculations.

our knowledge, this is the first such treatment of qualitative reports.

Whether we examine numeric values or dummy variables, count or discount rumors, or split the sample, we find that there usually are systematic components in the differences between the actual and reported intervention series. While the economic significance of any such differences is unclear, we believe that these findings may have important implications for understanding the signaling mechanism of intervention. If the newspaper reports reflect the markets' final assessment of intervention activity, then reporting errors imply that the market (with the exception of the intervention counterparties) is misinformed and that intervention is unlikely to signal monetary policy accurately.

TABLE 3

### White Noise Tests for Errors in Reported Intervention

Variable	Full Sample			First Half: January 2, 1985- May 20, 1988			Second Half: May 23, 1988- October 11, 1991		
	K	K-S	N	K	K-S	N	K	K-S	N
<b>No Rumors</b>									
U.S. vs. DM	35.3842 <sup>a</sup>	0.2656 <sup>a</sup>	884	10.2977 <sup>b</sup>	0.1936 <sup>a</sup>	442	27.5159 <sup>a</sup>	0.2916 <sup>d</sup>	442
U.S. vs. Yen	39.7927 <sup>a</sup>	0.4142 <sup>a</sup>	884	20.3109 <sup>a</sup>	0.3673 <sup>a</sup>	442	30.1626 <sup>a</sup>	0.4367 <sup>a</sup>	442
<b>With Rumors</b>									
U.S. vs. DM	33.6817 <sup>a</sup>	0.2588 <sup>a</sup>	884	8.6115	0.1834 <sup>a</sup>	442	27.2551 <sup>a</sup>	0.2897 <sup>a</sup>	442
U.S. vs. Yen	43.4345 <sup>a</sup>	0.4120 <sup>a</sup>	884	20.2056 <sup>a</sup>	0.3677 <sup>a</sup>	442	32.7564 <sup>a</sup>	0.4319 <sup>a</sup>	442
<b>Dummy Variables</b>									
<b>No Rumors</b>									
U.S. vs. DM	55.6083 <sup>a</sup>	0.3180 <sup>a</sup>	884	22.2064 <sup>a</sup>	0.2790 <sup>a</sup>	442	35.7343 <sup>a</sup>	0.3340 <sup>a</sup>	442
U.S. vs. Yen	58.9862 <sup>a</sup>	0.3472 <sup>a</sup>	884	39.4540 <sup>a</sup>	0.3814 <sup>a</sup>	442	27.4339 <sup>a</sup>	0.3069 <sup>a</sup>	442
<b>With Rumors</b>									
U.S. vs. DM	53.2813 <sup>a</sup>	0.3035 <sup>a</sup>	884	20.7967 <sup>a</sup>	0.2550 <sup>a</sup>	442	34.9908 <sup>a</sup>	0.3275 <sup>a</sup>	442
U.S. vs. Yen	62.6117 <sup>a</sup>	0.3479 <sup>a</sup>	884	39.1464 <sup>a</sup>	0.3866 <sup>a</sup>	442	32.4126 <sup>a</sup>	0.3013 <sup>a</sup>	442

#### Categories of intervention:

U.S. vs. DM: U.S. purchases or sales of DM in terms of U.S. dollars.

U.S. vs. Yen: U.S. purchases or sales of yen in terms of U.S. dollars.

NOTE: *N* = number of observations. For *K* and *K-S*, see box 1.

a. Significant at the 5 percent level.

b. Significant at the 10 percent level.

SOURCE: Authors' calculations.

## Appendix

### Treatment of Rumors and "On Behalf of" Intervention

We created two sets of variables from the reported intervention data: The first treats all rumors as true, and the second treats all rumors as false. The first step in the creation of both data sets was the formulation of the net dollar transaction variables for each category of intervention. For the U.S. intervention categories, this variable is equal to the amount variable, which is always non-negative, multiplied by the buy/sell dummy variable.

To compare reported and actual intervention data, we must transfer intervention that was reported as being on behalf of another country to that particular country. For example, if the United States actually purchased yen

on behalf of Japan, the data that we receive from the Federal Reserve's Board of Governors will attribute such intervention to Japan rather than to the United States. To accomplish this adjustment, we created two variables for each country, FOR1 and FOR2. FOR1 equals 1 if the country intervened on behalf of another country. FOR2 equals the number of countries reported to be intervening on its behalf.

There is also a third dummy variable, FORRUMOR, which equals 1 if intervention by the country was rumored to be on behalf of another country. To create the data set in which all rumors are considered true (false), we transferred (did not transfer) all of the intervention that was rumored to be on behalf of another country. Additional details regarding these procedures are available from the authors.

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