THE INTERNATIONAL MONETARY SYSTEM

Edited by
Peter B. Kenen
Francesco Papadia
Fabrizio Saccomanni

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8 Concerted interventions and the dollar: an analysis of daily data

PIETRO CATTE, GIAMPAOLO GALLI, and SALVATORE REBECCHINI

1 Introduction

A decade ago several studies of the scope and effectiveness of foreign exchange intervention were undertaken within a working group of the major industrial countries chaired by Ph. Jurgensen (1983). The final report's conclusions were very cautiously stated. Overall, (sterilized) intervention was not viewed as an independent instrument of economic policy, in the sense in which this term is usually applied to monetary or fiscal policy; it was nonetheless seen as a useful complement to more fundamental policy tools, especially in the very short run.[1]

In the years following the publication of the Jurgensen Report, important changes have taken place in the international monetary system. Starting in 1985, coordinated efforts were made first to reverse and later (with the Louvre Agreement of February 1987) to stabilize the value of the dollar. Broadly speaking, 1985 marks a shift from a system of almost complete flexibility to a managed float. Intervention has played an important role; indeed, it has been argued that, in view of the authorities' greater control over this instrument, the commitments of the Group of Seven (G-7) in the area of foreign exchange intervention have been much more specific than in the domain of macro or structural policies (Dobson 1991). In view of these developments, it is important to determine the circumstances in which intervention is likely to be effective and how it can affect the functioning of the international monetary system. This chapter uses daily data from 1985 on the interventions of sixteen central banks participating in the 'concertation procedure'.[2] The focus is on the exchange rate of the dollar *vis-à-vis* the Deutsche mark and the yen. Using the methodology explained in section 2, we identify nineteen episodes in which there is evidence that intervention was coordinated among at least two of the three major countries. We then look at the behaviour of exchange rates, interest rates, and other potentially relevant variables in each of these episodes to assess whether intervention was effective.

The chapter is organized as follows. In section 2 we explain the methodology and the definition of intervention; in particular, we clarify the criteria adopted to identify episodes of coordinated intervention. In section 3 we summarize the main findings and in section 4 we assess the role of intervention in determining the major turning points in dollar rates. In section 5 we pool the evidence and assess the relative effectiveness of intervention and other policy tools in a variety of circumstances. Section 6 concludes with a view that is rather different from that of the Jurgensen Report.

2 Methodology: selection of the episodes and measurement of intervention

In principle, it should be possible to use econometrics to identify the effects of intervention on exchange rates by defining a model in which the exchange rate depends on a set of 'fundamental' variables as well as on intervention. It is well known, however, that such a model does not exist, or at any rate has not yet been found. The simple random walk model of Meese and Rogoff (1983) predicts exchange rates very poorly, but no worse than models which include contemporaneous variables, as well as measures of expectations, on the right-hand side. Simultaneity, measurement errors and other more fundamental problems (which we examine later) give rise to incorrectly signed or insignificant coefficients, low R-squared, and poor out of sample performance. As noted by Dornbusch and Frankel (1987), 'econometrically, all the action is in the error term'; even measures of actual or anticipated monetary policy do not improve regression results. For these reasons, which have been widely recognized in earlier studies of intervention (see, for instance, Dominguez 1989), we adopt a different approach and identify episodes in which interventions appear to have been coordinated among the largest countries and assess their impact on the exchange rate of the dollar (against the Deutsche mark and the yen) on a case by case basis. Though the focus is on sterilized intervention, no attempt is made to select episodes on the (statistically rather shaky) basis of whether offsetting operation were undertaken on the domestic market;[3] we prefer to look at the behaviour of interest rates in each of the selected episodes.

Our selection procedure is based on three important facts concerning the intervention policies of the United States, Japan, and Germany (Group of Three) (see figure 8.1).:

(1) Interventions by the Group of Three (G-3) are rare and concentrated in time. Between 1985 and 1991, each G-3 central bank was on the market for less than one out of six trading days, though with very different quantities; the average daily gross intervention ranged between $130 million and $300 million.

(2) The three countries never pursued conflicting intervention policies *vis-à-vis* the dollar.[4] Whenever one of the three was in the market, the other two were doing either the same thing or nothing. This can be seen clearly in figure 8.1 which shows that when, for example, the intervention figures of the Federal Reserve are positive (purchases of foreign assets), the other two central banks have either negative figures or zero.

(3) The timing of the clusters almost always coincides for at least two of the three countries. The major exceptions are in 1986, when there was considerable intervention by Japan or Germany alone, and in 1990 and 1991, when there were also some cases of non-simultaneous intervention by these two countries.

Given these features, it would be easy to identify the episodes of concerted intervention by inspection. However, we use the following quantitative criteria, which in fact give very similar results, but are more precise: (i) at least two of the G-3 central banks start to intervene together; (ii) at least one of these three central banks continues to intervene with interruptions lasting no more than five working days. Moreover, to avoid dealing with insignificant episodes, we have utilized a *de minimis* rule whereby daily interventions of 20 million dollars and less are disregarded, as are episodes that do not include at least two (not necessarily consecutive) days of simultaneous intervention or that do not last more than four working days. Criterion (i) defines the opening date of an episode. There are cases in which one central bank was in the market in the preceding days, but we consider that intervention becomes concerted when at least one other G-3 bank joins in. Criterion (ii) defines the closing date of the episode. This occurs when all G-3 central banks abstain from intervening for more than five working days.[5] All told, nineteen episodes (shown in figure 8.1) have been identified covering a total of 461 days; as can be seen, there is little intervention by the G-3 taking place outside these episodes (about 20 per cent for Germany and Japan and 5 per cent for the United States).

Clearly, our procedure is based on a minimal criterion for coordination. It leaves open a large number of issues concerning the degree of coordination among both G-3 and non-G-3 central banks. In the analysis of the episodes, we report whether all G-3 central banks (rather than just two of them) took action, what non-G-3 central banks did, and the amounts of each currency that were put on the market. We also try to assess the extent to which intervention was supported by domestic policies and/or by consistent statements by the authorities.[6]

In eighteen of the nineteen episodes the authorities countered the trend of the dollar ('leaning against the wind'). It is therefore relatively easy to judge whether the action was successful simply by looking at the exchange rate in the weeks following the intervention. If the trend was reversed, we label the

episode as successful.[7] There were however different degrees of success, depending on whether the trend was temporarily or definitely reversed. Here again, we adopt a simple criterion to discriminate between these two possibilities. We label an episode as definitely successful if it reversed the trend and, in the next episode, intervention was in the opposite direction.[8] This is a rather restrictive criterion since an episode may have been definitely successful, but followed by events that reversed the trend and induced central banks to intervene again in the same direction. Such an occurrence is difficult to evaluate on objective grounds, so we treat it informally, on a judgmental basis, in the description of the episodes.[9]

To take account of the fact that interventions may involve one or both of the currencies whose relative price we are interested in, we construct a synthetic variable that is reported in all the figures, except figure 8.1. In the case of the dollar/mark rate, the variable is defined as

$$Y=\frac{(\text{purchases of dollars}-\text{purchases of marks})}{2}$$

where the purchases are on a net basis and refer to either the entire universe of sixteen central banks in our sample or to the G-3.[10] The key assumption underlying this definition is that interventions in third currencies have the same effect (on the mark/dollar rate) whether they are done against dollars or against Deutsche marks; by implication, a direct exchange of dollars against Deutsche marks is worth twice as much as an exchange of either dollars or Deutsche marks against a third currency. When the Y variable is defined over the entire sample of central banks, the implicit assumption is that, given the currency composition and amounts of interventions, operations by third countries have the same effect as those of the United States or Germany.

3 The results

The nineteen episodes identified with the methodology described in the previous section are summarized in table 8.1, in figures 8.2 and 8.3 (which show weekly data for the periods 1984–6 and 1987–91), and figures 8.1 and 8.6 (daily data for each year after 1985). All the episodes were public knowledge in the sense that the interventions were reported in the financial press at the time.

The main findings of our analysis can be summarized as follows:

(a) The amount of intervention during the episodes varied considerably; the total dollar equivalent operations undertaken by all central banks (column 11 of table 8.1) ranged from less than $2 billion in episode 5 to over $35 billion in episode 4 (which followed the Louvre Agreement of

Table 8.1. *Summary of intervention episodes*

Episode	Start	End	Dollar purch. (+) or sale (−)	Number of working days	Percentage of days with simultaneous interventions by		Total G-3 purchases of			All central banks		Results	
					G-3	2 of G-3	$	DM	Yen	Total $ purchases (1)	Net/gross (2)	(3)	(4)
1	850201	850307	−	25	0.16	0.48	−4,039	3,464	560	−8,728	0.96	TS	139
2	850924	851108	−	33	0.36	0.67	−7,754	3,171	4,583	−11,901	0.87	DS	288
3	870107	870126	+	14	0.00	0.29	8,785	−3,900	−8,287	10,550	0.80	TS	41
4	870324	870505	+	29	0.17	0.59	20,723	−594	−20,129	38,511	0.85	DS	67
5	870806	870811	−	4	0.00	0.75	−869	869	0	−1,979	0.62	DS	13
6	870828	870909	+	9	0.11	0.56	1,538	−340	−1,198	2,908	0.89	TS	35
7	871028	871111	+	11	0.55	0.73	8,078	−2,595	−5,483	10,542	0.79	TS	13
8	871130	880121	+	35	0.31	0.43	8,970	−3,248	−5,722	19,223	0.82	TS	46
9	880325	880420	+	18	0.06	0.33	2,267	−390	−1,877	4,939	0.70	DS	47
10	880627	880825	−	43	0.00	0.49	−11,366	11,365	0	−21,311	0.87	DS	47
11	881031	881202	+	24	0.08	0.38	5,722	−988	−4,734	8,175	0.67	DS	22
12	890105	890206	−	21	0.00	0.52	−3,355	3,355	0	−5,898	0.79	TS	29
13	890317	890411	−	18	0.00	0.22	−1,453	1,238	130	−1,987	0.44	TS	13
14	890502	890721	−	59	0.10	0.53	−26,659	6,124	20,534	−35,230	0.82	TS	15
15	890811	891012	−	44	0.27	0.57	−13,079	3,579	9,420	−19,424	0.73	TS	53
16	900102	900119	−	14	0.00	0.29	−3,507	50	3,457	−4,040	0.57	TS	25
17	900223	900419	−	39	0.10	0.31	−12,627	890	11,738	−12,535	0.67	DS	200
18	910204	910212	+	7	0.00	0.57	1,612	−6,612	0	3,211	0.97	DS	19
19	910311	910328	−	14	0.14	0.43	−2,944	1,684	1,260	−6,555	0.90	DS	n.a.

Notes:
(1) Millions of dollars.
(2) Ratio of net interventions to sum of interventions in absolute value.
(3) TS = Temporarily successful (next episode is of the same sign); DS = Definitely successful (next episode is of opposite sign).
(4) Number of working days before next episode.

February 1987). The length of the episodes also varied significantly (from one week to three months); however, no clear relationship has been found between the effectiveness of episodes and their size or length.

(b) In most episodes the bulk of interventions was carried out by two of the G-3 central banks, one of which was the Federal Reserve (except for episode 3 in January 1987); of the 461 days covered by the nineteen episodes only sixty-six saw all the G-3 intervene simultaneously; non-G-3 central banks were generally cooperative, but in several cases (episodes 5, 11, 13, 16, 17) some of them acted at cross-purposes (see column 12 of table 8.1).

(c) All of the episodes were successful in the sense that interventions inverted the trend of the dollar and, in the case of the post-Plaza episode (episode 2), caused its fall to resume; in nine cases they were definitely successful, in the sense that in the next episode intervention was in the opposite direction (see column 13 of table 8.1). Figure 8.6 shows that of the remaining ten episodes (which we have labelled as temporarily successful) three had very short-lived effects lasting no more than three weeks (episodes 7, 13, and 14), while the remaining episodes (1, 3, 6, 8, 12, 15, and 16) should probably be considered as successful *tout court* because their effects either lasted for several months or were interrupted by minor rebounds that induced central banks to intervene again in the same direction (see section 4).

(d) All the major turning points of the dollar (except for that in July 1991)[11] coincided exactly with episodes of concerted intervention. This finding will be examined in more detail in section 4.

(e) In the majority of the episodes very short-term interest rate differentials (those that are most directly affected by short-run liquidity conditions and, therefore, by intervention – if not sterilized) moved according to the exchange rate objective pursued by the authorities (i.e., helped the interventions); however, in several cases they did not change or even moved in the wrong direction; there were five such occurrences in the case of the United States–Germany differential and five in the case of the United States–Japan differential (table 8.2). This is also true for differentials at longer maturities, which also moved in the wrong direction on several occasions (table 8.2; see in particular episodes 1, 6, 8, 10, 12, 13, 17, and 18).[12]

All things considered, the degree of coordination was probably higher than is usually perceived: almost all G-3 interventions took place during the nineteen concerted episodes and were never at cross-purposes; non-G-3 central banks were usually cooperative. However, coordination was clearly partial: in no less than eleven episodes one of the G-3 was either absent or intervened for token amounts.

Table 8.2. *Movement of interest rate differentials during intervention episodes (in per cent)*

Episode	Start	End	Dollar purch. (+) or sale (−)	Particip. central banks	Changes in discount rates	Δ Overnight rate differential (1)		Δ Short-term differentials (2)		Δ Long-term differentials (3)	
						US–Ger.	US–Jap.	US–Ger.	US–Jap.	US–Ger.	US–Jap.
1	850201	850307	−	US, G, J		−0.72	−0.44	0.82	1.12	0.30	0.12
2	850924	851108	−	US, G, J.		0.17	−0.68	−0.31	−1.37	−0.67	−1.39
3	870107	870126	+	G, J.	G−0.5	−2.30	−3.04	0.49	0.31	0.18	0.28
4	870324	870505	+	US, G, J.		0.91	1.51	1.01	1.13	1.34	1.68
5	870806	870811	−	US, G,		−0.28	−0.11	−0.18	−0.18	−0.01	0.37
6	870828	870909	+	US, G, J.		0.09	0.06	0.57	0.56	0.26	−0.27
7	871028	871111	+	US, G, J.		−0.23	−0.29	0.12	0.06	0.16	0.54
8	871130	880121	+	US, G, J.	G−0.5	0.21	0.19	−0.06	−0.25	−0.73	0.43
9	880325	880420	+	US, (G), J.		0.45	0.74	0.38	0.69	0.25	0.36
10	880627	880825	−	US, G	US+0.5 G+0.5	−0.60	0.14	−0.13	0.43	0.41	−0.45
11	881031	881202	+	US, (G), J.		−0.09	0.41	0.50	0.75	0.30	0.78
12	890105	890206	−	US, G	G+0.5	−0.59	0.06	−0.55	0.07	−0.42	−0.44
13	890317	890411	−	US, G		−0.02	−0.09	0.13	0.26	−0.03	−0.01
14	890502	890721	−	US, (G), J.	G+0.5 J+0.75	−2.03	−1.62	−1.50	−1.62	−0.81	−0.61
15	890811	891012	−	US, G, J.	G+1 J+0.5	−0.98	−0.43	−1.06	−1.13	−0.44	−0.35
16	900102	900119	−	US, J.		−0.24	−0.69	0	−0.25	−0.04	−0.87
17	900223	900419	−	US, (G), J	J+1	−0.08	−0.47	0.44	0.07	0.34	0.20
18	910204	910212	+	US, G		−0.91	−0.74	−0.38	−0.50	0.09	−0.02
19	910311	910328	−	US, G, J.		−0.38	−0.25	−0.57	−0.07	−0.32	−0.07

Notes:
(1) Federal funds rate (US), day-to-day money market rate (Germany), call money rate (Japan).
(2) 3-month Euro-market rates.
(3) 10-year government bond rates.

4 Concerted interventions and the turning points of the dollar

The following displays the major turning points of the dollar (obtained by inspection from figures 8.2 and 8.3 and then checked, for exact timing, with figure 8.6).

Turning points	Date	Episode of concerted intervention
1	February 1985	1
2	April 1987	4
3	August 1987	5
4	January 1988	8
5	August 1988	10
6	November 1988	11
7	October 1989 for mark; April 1990 for yen	15–17
8	February 1991	18
9	July 1991	—

The first turning point occurs in February 1985 and marks the end of the extraordinary appreciation of the dollar in the period 1980–4. Looking at quarterly data on foreign exchange reserves for the United States and Japan and on asset acquisitions (net of capital gains) for Germany, Obstfeld (1989) concludes that 'all told, the (pre-Plaza) period shows no sustained, coordinated attempt to drive the dollar down'. He therefore looks at other possible reasons (basically interest rates) for the fall of the dollar that started in February. On the other hand, Dini (1988, p. 6) and Frankel (1990) give considerable importance to the role of intervention. According to the latter, 'the February intervention was reported in the newspapers, and by virtue of timing appears to be a likely candidate for the instrument that pricked the bubble'. Frankel also notes a change in attitude towards exchange rate policy and coordination when the new Reagan administration took office; the two key advocates of *laissez faire*, Regan and Sprinkel, had just been replaced at the Treasury Department by Baker and Darman. The latter attended the Group of Five (G-5) Meeting of 17 January where it was agreed to use foreign exchange intervention (Funabashi 1988, p. 10). The communiqué was unambiguous: 'the Ministers and Governors reaffirmed their commitment made at Williamsburg to undertake coordinated intervention in the markets as necessary'. Our analysis lends support to Frankel's reading of this episode. Though Germany did the lion's share, all the G-3 central banks intervened against the dollar; two of them intervened simultaneously (i.e., on the same day) 50 per cent of the time, and most of the non-G-3 central banks participated actively in the episode. All told, between 1 February and 7 March central banks sold an unprecedented $8.7 billion; on both 27 February and 1 March about $1.5 billion were exchanged against the Deutsche mark.

Two years later, in April 1987, concerted intervention halted the fall of the dollar that had started in February 1985 and continued through 1986 in spite of sporadic uncoordinated purchases of dollars by Japan and, on a much smaller scale, by Germany. We take the end of April 1987, one month after the Louvre Accord, as the *second* major turning point. The importance of this episode (number 4), in terms of the amounts spent (more than $38 billion), its duration (more than a month), and the degree of coordination (especially between the Fed and the Bank of Japan) is well known. After this episode, the dollar appreciated rapidly until August, gaining about 7 per cent against the Deutsche mark and 10 per cent against the yen.

The *third* turning point in our chronology is in August 1987 when the dollar resumed a downward trend that continued, through the stock market crash, until February 1988; this is often seen as demonstrating the limited effectiveness of the Louvre Agreement and of the interventions undertaken in April (Bordo and Schwartz 1990). Obstfeld (1989) notes that the dollar fundamentals were weak throughout 1987, essentially because the trade balance was not improving, in spite of the depreciation of the preceding two years. This was the period in which pessimism prevailed regarding the prospects for US external adjustment and markets were nervously reacting to (very noisy and J-curve affected) monthly data on the US trade balance. It should be noted, however, that the August turning point coincided exactly with a short, highly concentrated episode of coordinated intervention (number 5). In this episode, the Fed played a major role, helped until 11 August by the Bundesbank and other central banks; non-G-3 countries continued to intervene until 18 August, the moment when the dollar started to fall (see figure 8.6c). Subsequently, there were sporadic interventions in the opposite direction. In less than ten working days, from 6 to 18 August, the sixteen central banks in the survey sold more than $4 billion.

The *fourth* turning point was in January 1988, when the decline in the dollar that had started in August 1987 halted and the US currency resumed an upward trend (episode 8). After the stock market crash of 22 October 1987 the dollar rebounded for a few days and then fell precipitously. Large-scale interventions by the G-3 central banks and all the others were initiated at the end of October. Obstfeld was to claim that: 'in spite of this heavy intervention, the dollar depreciated by 16.2 per cent against the mark, and by 18.5 per cent against the yen, between end-September and end-December 1987, before partially recovering and stabilizing in the last part of January'. With the benefit of daily data, we distinguish two distinct rounds of massive concerted intervention in the aftermath of the stock market crash: the first (episode 7) was very short (eleven working days), but

intense (more than $10 billion were purchased). This episode ended on 11 November, at the precise moment the dollar reversed its trend and started to appreciate. In the second half of November, however, the dollar weakened again following declarations by the United States and German authorities that seemed to welcome a decline of the dollar and because of mounting uncertainty about the prospects of an agreement between the US Administration and Congress on measures to reduce the budget deficit.

The second round lasted from 30 November until 21 January (episode 8); for almost two months, all the leading central banks intervened continuously purchasing about $20 billion. The dollar stabilized immediately at the beginning of the intervention episode, helped by a discount rate cut in Germany; nonetheless in mid December news of a record trade deficit in the United States sparked a new fall. On 22 December, G-7 representatives agreed over the phone on a communiqué that defined both a further decline and a rise in the dollar as counterproductive. The market reacted unfavourably to the G-7 statement, noting that it failed to announce concrete measures to support the dollar. On 28 December, however, interventions were stepped up and 'round-the-clock' continuous operations were undertaken for the first time and continued until the end of the episode (Gomel *et al.* 1990). Success was almost immediate, as the turnaround of the dollar occurred just a few days later, on 4 January. Thereafter, intervention continued until 21 January and underpinned a new phase of sustained appreciation of the dollar. According to Dobson (1991), the purpose of the coordinated interventions that followed the G-7 communiqué was to provide a bridge to the anticipated improvement of the US trade account, which indeed began to materialize in February 1988.

In the wake of the January episode, the dollar continued to appreciate until August 1988, with a minor interruption in April that was successfully countered by means of interventions that were coordinated mainly between the Fed and the Bank of Japan (episode 9). The rise of the dollar accelerated in June and in July, in spite of the renewed plea for stable exchange rates made at the Toronto Summit (19–21 June 1988). The perception of the state of health of the dollar had radically changed: both the budget and the trade balance were finally showing signs of adjustment and concern about the consequences of the October stock market crash for the real economy had vanished. The level of activity was rising and monetary policy was being tightened, after the loosening that had occurred in the period following the crash; markets came to be more impressed by the reputation of Fed Chairman Greenspan as an inflation fighter. As Frankel (1990, p. 32) recalls, there were also rumours that Japan favoured an appreciation of the dollar to help elect Bush in the following November, against more protectionist minded democrats. Why, then, did the upward trend of the dollar reverse in August? Concerted intervention again provides a plausible

explanation: episode 10 lasted from 27 June to 25 August and involved several central banks, though not the Bank of Japan. This action was reinforced by a discount rate rise in Germany on 26 August, though the dollar peaked against the Deutsche mark a few days before the German rate change and also began to fall against the yen, in spite of the United States–Japan interest differential moving in the wrong direction. We count this as the *fifth* turning point of the dollar.

The *sixth* occurred in November 1988 (episode 11), when intervention stopped the depreciation of the dollar (after it had fallen by about 10 per cent against the Deutsche mark and the yen since August) and started the rally of 1989. This episode has received little attention in the literature (though it was reported in the press, as were all the other episodes). The bulk of the interventions, carried out especially by the Bank of Japan, lasted until 25 November, the day on which both the dollar/yen and the dollar/mark rates started to recover from their troughs. The very short interest differential with Germany moved in the wrong direction during the episode. Finally, it is worth noting that the favourable US trade figures announced on 16 November did not break the downward fall of the dollar. The November episode marks the start of the dollar rally which was to last until October 1989 against the Deutsche mark and until April 1990 against the yen which defines the *seventh* turning point of our chronology. Two comments are in order. First, the interventions undertaken in the first half of 1989 to curb the dollar's rise were neither uncoordinated nor unsuccessful. On the other hand, Frankel (1990, p. 33) suggests that 'there is less evidence in 1989 that foreign exchange intervention succeeded in moving the market than there was in the 1985–8 period'. We basically agree with this statement. In fact, the first three episodes of the year (numbers 12, 13, and 14, respectively in January, March, and June) did not stop the rally, even though total intervention sales exceeded $40 billion. However, each episode was at least temporarily successful despite the first two having been accompanied by 'wrong' movements in interest differentials and non-G-3 central banks having intervened heavily at cross-purposes (especially during episode 13), as shown by the low ratio of net to gross interventions (see table 8.1). The second comment is that the definite end of the rally, against the Deutsche mark in October 1989 and the yen in April 1990, coincided with two major episodes of concerted intervention (numbers 15 and 17). Episode 15 was again very long, lasting from 11 August to 12 October. The dollar peaked on 11 September at DM 1.99 and yen 148. On Saturday 23 September the G-7 issued a communiqué stating that the value of the dollar was 'inconsistent with longer run fundamentals'. The following Monday a massive round of highly coordinated interventions was launched that lasted the whole week. All the major central banks conducted 'rolling intervention' around the clock, operating also on foreign financial

centres. The central banks sold a total $20 billion. When the episode ended, the dollar was set on a downward trend against the mark and well below its peak against the yen.

In the following months the dollar continued to fall against the Deutsche mark. On the other hand, it soon started to edge up again against the yen, in spite of the rapid narrowing of the interest differential. At the beginning of January 1990 concerted interventions were undertaken, mainly by the Bank of Japan, aimed at checking the dollar's appreciation against the yen (episode 16). At the end of February a new rally against the yen started (presumably linked to conflicts on monetary policy between the Bank of Japan, which favoured a tightening, and the Ministry of Finance, which opposed it on fears of financial fragility) and the yen fell almost to 160, reaching its lowest value since 1986. The intervention (episode 17) that stopped the weakening of the yen (and also a temporary fall of the Deutsche mark) was somewhat atypical, being perhaps the least coordinated in the whole 1985–91 period. The Fed and the Bank of Japan started to intervene on 23 February and were joined for just two days by the Bundesbank on 2 March. The dollar stopped rising with respect to the Deutsche mark on 7 March and started to fall on 28 March; thereafter, the Bank of Japan was left on its own to curb the continuing appreciation against the yen, which lasted until the end of the episode on 19 April. There was simultaneous intervention by at least two of the G-3 central banks only on one day in three; short-term interest differentials moved slightly in the wrong direction; several non-G-3 central banks acted at cross-purposes. Nonetheless, the episode was successful and marked the start of a sharp fall of the dollar from about 160 yen in April 1990 to 133 at the end of the year. In the same period, the dollar also fell against the Deutsche mark, from 1.71 to 1.48. The reasons for the subsequent fall of the dollar, which was especially rapid in the second half of 1990, are well known: the recession in the United States spurred expectations of lower interest rates, at a time when monetary policy was being tightened both in Germany, to counter the inflationary consequences of the unification, and in Japan, to correct the bubble in asset prices.

Episode 18 marks the *eighth* turning point of the dollar. It was very short, lasting from 4 to 12 February 1991, and closely coordinated among several central banks (with the exclusion, however, of the Bank of Japan). The episode started immediately after the outbreak of hostilities in Kuwait (which caused an immediate, precipitous fall of the dollar) and ended when the dollar was clearly set on an upward path. It is worth noting that the episode ended *before* the beginning of the land operations in the Persian Gulf (24 February), which rapidly demonstrated the military superiority of the allied forces and, together with optimistic forecasts regarding the American economy, underpinned the subsequent rise of the dollar.

The *ninth* and last turning point of the dollar occurred in July 1991, when it became clear that the long awaited US recovery was still not under way and the Fed accelerated the reduction of interest rates. This is the only turning point that does not coincide with an episode of concerted intervention.

5 Interpreting the evidence

Fundamentals or 'bouncing balls'?

The evidence examined in section 4 leaves little doubt about the importance of (even poorly) coordinated intervention. No satisfactory history of the dollar in the period 1985–91 can be written without reference to the episodes of concerted intervention. As we have seen they were all successful, though only temporarily in some cases; more importantly, all but one of the major turning points of the dollar coincided with one of the episodes. The evidence can be interpreted in various ways. At the least, concerted intervention can be seen as having determined the timing (say, within the year or the month) of the turning points, though these were the result of (actual or expected) fundamental changes in the economy or the stance of monetary policy. At the other extreme, the evidence suggests a sort of 'ping-pong' effect, with the exchange rate changing direction when hit by the central banks and continuing to move in that direction, almost without friction, until it is hit again in the opposite direction. It is not clear which is the right interpretation. The 'ping-pong' story is hard to justify on theoretical grounds; nonetheless, we believe that intervention did more than just determine the timing of the turning points. In this section we provide evidence supporting this claim; we also draw on some recent literature on asset prices to argue that exchange rates may deviate substantially from fundamentals, thereby leaving ample scope for intervention to operate as an expectations coordinating device.

Simplifying somewhat, the 'fundamentalist' interpretation of the broad trends of the dollar is more or less as follows.[13] The rise of the dollar from 1980 to 1984 is attributed to the combination of loose fiscal and tight monetary policies in the United States. The turning point at the beginning of 1985 is related to the sharp reduction in US interest rates in the second half of 1984 and to the growing awareness of the unsustainability of the US external position (Obstfeld 1989, p. 11). The subsequent weakness of the dollar through 1987 is explained by the large current account deficit, together with the turnaround of the budget that became apparent between 1986 and 1987. The dollar rallies of 1988–9 are attributed to the improvements in the US trade balance and the strong growth of domestic demand (in spite of the stock market crash), which induced a firming up of US

interest rates relative to Germany and Japan. In 1990, the dollar fell as the recession in the United States led markets to anticipate lower domestic interest rates; the weakness was accentuated between August 1990 and February 1991 by the crisis in the Persian Gulf. The US currency recovered in the spring, owing to expectations of a rapid recovery of the economy, and fell again in the summer with the second dip of the recession. This approach undoubtedly accounts for much of what happened in this period. It captures the factors that, in the end, were *perceived* by the markets as being the 'fundamental' determinants of the exchange rate. However, these perceptions changed over time as the emphasis shifted from one model of the economy to another,[14] a fact that is clearly brought out by the failure of econometricians to find statistical regularities linking the exchange rate to fundamentals.[15]

The scheme that is used to explain the 1980–4 rise of the dollar is probably an unnatural and imperfect blend of a short-run Dornbusch overshooting model and the Laffer curve (the latter serving to explain the belief that the budget deficit would redress itself automatically). In 1985 the emphasis shifted to the long-run sustainability of external deficits: the exchange rate was viewed as a key variable in the process leading to external equilibrium. This model had been largely abandoned by 1988, although the external debt of the United States was still growing at a very fast pace. Expectations about monetary policy, mainly determined by inflation and the level of activity, became the dominant paradigm.

Several objections have been raised with regard to this reconstruction (Dornbusch 1984, Krugman 1988, and Mussa 1990). Why, for example, did markets wait till 1985 to focus on sustainability, given that this issue was quite clear by the end of 1983, when the dollar was quoted at DM 2.72 and yen 232 and the trade balance had deteriorated by almost $50 billion in two years? And why has sustainability ceased to be an issue since 1988? Whatever answers are given to these questions, it has to be recognized that the sustainability of a given external position is very much an imponderable.[16] Writing in 1984, Dornbusch noted that his own explanation of the dollar's overvaluation (in terms of the US policy mix) took no account of the effects of current account imbalances on the exchange rate, for good reasons: 'the channel through which these effects operate and their quantitative magnitude make it empirically implausible that the market's belief that the current account does matter could lead to a collapse of the dollar'. But he then added for posterity: 'the uncomfortable part in this view is that the deficits have been so clearly predictable and predicted that the collapse should already have occurred' (Dornbusch 1984). As for the public debt or bank deposits, sustainability depends critically on strategic interactions between agents: a run on a currency occurs when agents believe that other agents will sell. The key task of each agent is thus to predict what other

agents will do, in order, at the very least, to avoid being the last to sell. Cass and Shell (1989) argue that we should expect indeterminacies and sunspot equilibria to be the rule rather than the exception in such circumstances.[17]

For the sake of concreteness, consider the situation of Japan and the United States today. Is the yen too strong or too weak relative to the dollar? It is much too weak for those who focus on the large, persistent, and recently increasing external surplus of Japan and worry about protectionist tendencies in the United States and elsewhere (see, for instance, Bergsten (1992), who would like to see the yen at 100). It is about right or too strong for those who look at a much longer time horizon and point to the reduction in private saving and the external surplus that is foreseen for the end of the century as a result of the rapid aging of the Japanese population (OECD 1991); it is definitely too strong for those who focus on financial fragility and falling real activity or look at Purchasing Power Parity and note that 200 yen are needed to buy the goods that can be bought with one dollar,[18] suggesting that, sooner or later, much cheaper US goods will beat Japanese competition. Given the scale of these uncertainties, it is hardly surprising that even weak signals, such as those provided by sterilized interventions, should be sufficient to coordinate agents' expectations, induce them to converge on a particular model of the economy, and pick a value of the exchange rate that is not too far from that targeted by the authorities. Likewise, wrong expectations may well be self-fulfilling, if not for ever, at least for very long periods, especially if noisy positive feedback traders (who buy when the market rises and *vice versa*) and chartists are present and prospering, as a wide literature has convincingly argued.[19] Perhaps the authorities were mistaken in 1987 when they concluded that the depreciation of the dollar had gone far enough. However, since they managed to convince the markets, dollar assets started to look attractive again and the exchange rate stopped falling; we can therefore say, but only *ex post*, that the external position of the United States was in fact sustainable (at least in the sense that it could be financed at the given exchange rate) and that the authorities' judgment was right.

To be sure, intervention is a much stronger signal than a pure sunspot. Agents know that when the authorities are determined, they have the option of moving the fundamentals, and in particular interest rates. If the threat is credible, the change in interest rates may subsequently prove unnecessary.[20]

Intervention and monetary policy

These considerations help overcome the 'substantial embarrassment' (to economic theory) stemming from the difficulty of demonstrating 'a consistent influence of monetary policy on the behaviour of exchange rates'

(Mussa 1990, p. 28). According to Dornbusch and Frankel (1987, p. 158), the fact that regression analysis can hardly beat a random walk 'tends to undermine any defense of exchange rate variability made on the ground that it is appropriate given changes in monetary policy'. In short, changes in the stance of monetary policy are seen as usually being motivated by domestic considerations, especially in the largest countries; they are not meant to be signals for the currency markets. Intervention is instead unambiguously aimed at the exchange rate.

In section 3, we noted that in several episodes intervention was successful despite interest differentials on short and long maturities having moved in the wrong direction (see table 8.2), a fact that contradicts the theory that intervention is effective only in so far as it signals monetary authorities' intentions. Looking at broader trends (figures 8.4 and 8.5), we find that changes in interest differentials played a minor role in determining the turning points of the dollar; the failures of monetary policy contrast sharply with the successes of interventions. A clear failure occurred in the second half of 1984, when fundamentals were hardly different from those of the following February. Short-term interest rates fell in the United States while remaining roughly unchanged in Germany and Japan; the US discount rate was cut twice by half a point, in November and December; as interest rates fell, the growth of M2, which had remained in the lower portion of the 6–9 per cent target range, jumped to the top at the end of the year. Nonetheless, until the turning point in February, the dollar rose at a record pace, gaining about 20 per cent against the mark and 10 per cent against the yen in less than four months. Strikingly, interest rates were firming in the United States from mid January to the end of the February episode, when the dollar finally turned.

Events between mid 1987 and 1989 are also of interest. Throughout the period, the United States–Germany short-term interest differential was stable or slowly drifting upwards, while the mark/dollar rate fluctuated widely. In spite of its 'fundamental' weakness, the dollar appreciated continuously after the post-Louvre April 1987 interventions (episode 5) until the following one in August. The subsequent fall, from August to the stock market crash, is not related to interest rate differentials, which were increasing (see figure 8.4b). Likewise, after the crash, the two spikes of the dollar from mid January 1988 to the end of February and from June to August occurred in spite of falling interest differentials with Germany and, in the first case, also with Japan. It is certainly true that optimism about the strength of the US economy and external adjustment was growing in this period, but this makes it all the more difficult to understand why the dollar kept on falling after the August episode (10) until the following November, when a new round of concerted intervention started the 1989 dollar rally (episode 11). In the analysis of the single episodes, we account for these

gyrations in terms of the standard *ex post* explanations that have been given (typically, news about the economy or the trade balance). It is nonetheless quite striking that neither interest differentials nor news about fundamentals were ever responsible for, or even coincident with, the main turning points (a fact that has been observed for stock prices by Cutler *et al.* 1989), while concerted interventions always were. It can be conjectured that *ex post* explanations suffer from selection bias: when the dollar falls, bad news is used as an explanation, while good news is neglected.

Another interesting case is the dollar's rally against the Deutsche mark in 1989 when German rates were increasing and the short-term differential in favour of the dollar was declining. After a temporary setback (coinciding with episode 14) the dollar climbed again in August and September, in spite of the interest differential having fallen by at least another percentage point since June.

Even more striking is the behaviour of the yen in 1989. At the time Japanese 'fundamentals' were perceived as being quite strong and residents appeared to be convinced that land and shares were not overpriced. Between February 1989 and April 1990, the Unite States–Japan short-term interest differential fell from 6 to 1 per cent, as the Bank of Japan started to worry about the economy overheating; nonetheless the dollar rose against the yen by over 17 per cent in this period. Only the April intervention (episode 17) finally stopped the US currency and started a precipitous fall, which lasted until October.

6 Conclusions

The evidence surveyed in this chapter leaves little doubt about the importance of concerted intervention in explaining the behaviour of the dollar from 1985 onwards. A few main facts stand out. First, interventions by the central banks of the G-3 were relatively infrequent and usually coordinated. The simultaneous presence in the markets of at least two of the three major central banks was therefore a notable event (and regularly reported by the financial press). Second, all nineteen episodes of concerted interventions were effective, though on four occasions their effects lasted only a few weeks. Third, during the episodes the behaviour of interest rates was not always consistent with the exchange rate objective; in several cases interest rate differentials did not change or changed in the wrong direction. Fourth, and most importantly, eight of the nine major turning points of the dollar between 1985 and 1991 coincided with an episode of concerted intervention. At the very least, concerted interventions appear to have determined the exact timing of the turning points, within the broad trends set by the development of fundamentals.

Econometrics should in principle be able to disentangle the separate

effects of interventions and fundamentals; we have not reported any results because, like all our predecessors, we failed to improve significantly on a simple random walk. With Dornbusch and Frankel (1987, p. 157), we argue that there may be something to learn from these failures; empirical regularities linking the exchange rate to fundamentals may be hard to find, precisely because the linkages are very weak. Markets may use different models at different times; the concept of the sustainability of an external deficit is hard to pin down empirically; strategic interactions, indeterminacies, and self-fulfilling expectations may be the norm rather than the exception; and positive feedback traders and chartists have been shown to prosper in very efficient markets. For any of the above reasons, which have been extensively studied in the literature, markets may deviate substantially and for long periods from fundamentals.[21] We see our chapter as providing further evidence in support of this proposition. In particular, we find it striking that major turning points should have coincided with episodes of intervention, while they appear to be unrelated to changes in interest rates (see section 5).

Overall, the evidence suggests that the traditional question (is intervention effective even when it is not accompanied by changes in domestic monetary conditions?) may need to be turned on its head: do changes in domestic monetary conditions affect the exchange rate, even when they are not accompanied by intervention? We suggest that changes in monetary conditions have usually been motivated by domestic considerations, especially in the largest countries; they were not meant to be signals for the currency markets. Intervention is instead unambiguously aimed at the exchange rate; it is effective when it helps to coordinate agents' expectations in an environment inevitably characterized by considerable uncertainty about the linkage between exchange rates and fundamentals. It is more than a pure sunspot or a conventional code of language between markets and central banks, because the latter can always threaten to resort to (possibly temporary) changes in interest rates and inflict losses on short-term speculators: if the threat is credible, the subsequent change in the interest rate need not take place.

Finally, a few words of caution. First, there are clearly limits to the effectiveness of even perfectly coordinated intervention. The following statement by Black (1986), a noted advocate of *laissez faire* and market efficiency, can perhaps serve as a benchmark: 'we might define an efficient market as one in which price is within a factor of two from value, i.e., the price is more than half the value and less than twice the value'. If, for instance, in February 1985 (at the peak of the bubble) the true (fundamental) value of $1 was DM 1.7, efficient markets could have produced pure 'noise' ranging anywhere from 3.4 (as in fact happened) to 0.85! Though we

are much colder on efficient markets than Black, we suspect that fundamentals put much tighter limits on exchange rates and, correspondingly, on the ability of central banks to affect them. Second, we do not believe that central banks can ever be successful if they act 'against' the markets; even very large interventions are tiny in comparison with the funds traded on the foreign exchange markets. Hence, the effectiveness of central banks' action hinges critically on their ability to persuade the markets that a given level or trend of the exchange rate is inconsistent with fundamentals; this is the sense in which we view intervention as an expectation coordination device. Thus, intervention is bound to fail if markets maintain that central banks are trying to defend 'unrealistic' parities. Ultimately, intervention is no substitute for appropriate domestic policies.

Likewise, intervention is likely to fail if different central banks are perceived as being imperfectly coordinated or pursuing different objectives. All the success stories discussed here involved some degree of coordination between at least two major central banks. The very few uncoordinated interventions that were undertaken in the 1985–91 period (mainly in 1986, 1990, and 1991) had hardly any effect on exchange rates. Intervention may fail because the authorities of one of the countries involved are perceived by markets as having 'second thoughts' about the objectives which have been set in an international agreement; their intentions or opinions may be revealed by words or movements of interest rates in a direction which is not consistent with the agreed objective. In these circumstances, interventions fail simply because no clear message is conveyed to the markets. Moreover, it is necessary to recognize the basic difference between intervening on an otherwise freely floating exchange rate and stabilizing it at a particular level or within very narrow margins. In almost all the cases we have analysed the objective of the authorities was to stabilize the dollar around current levels, not to reverse its trend, though intervention did in fact usually reverse the trend. While we leave the explanation of this fact for further research, we note an important implication: our findings cannot be mechanically extrapolated to suggest that coordinated intervention can be used to establish and defend a system of fixed exchange rates or even target zones.

In conclusion, intervention can be quite powerful when it helps to convey clear messages to the markets concerning the appropriate or sustainable level of the exchange rate. It has to be used very skilfully and in the right circumstances because its effectiveness depends critically on credibility, an asset that can easily evaporate. It is essential that intervention be used only when its objectives are truly shared by the authorities involved and there is a reasonable chance of persuading market participants that these objectives are consistent with the economic environment.

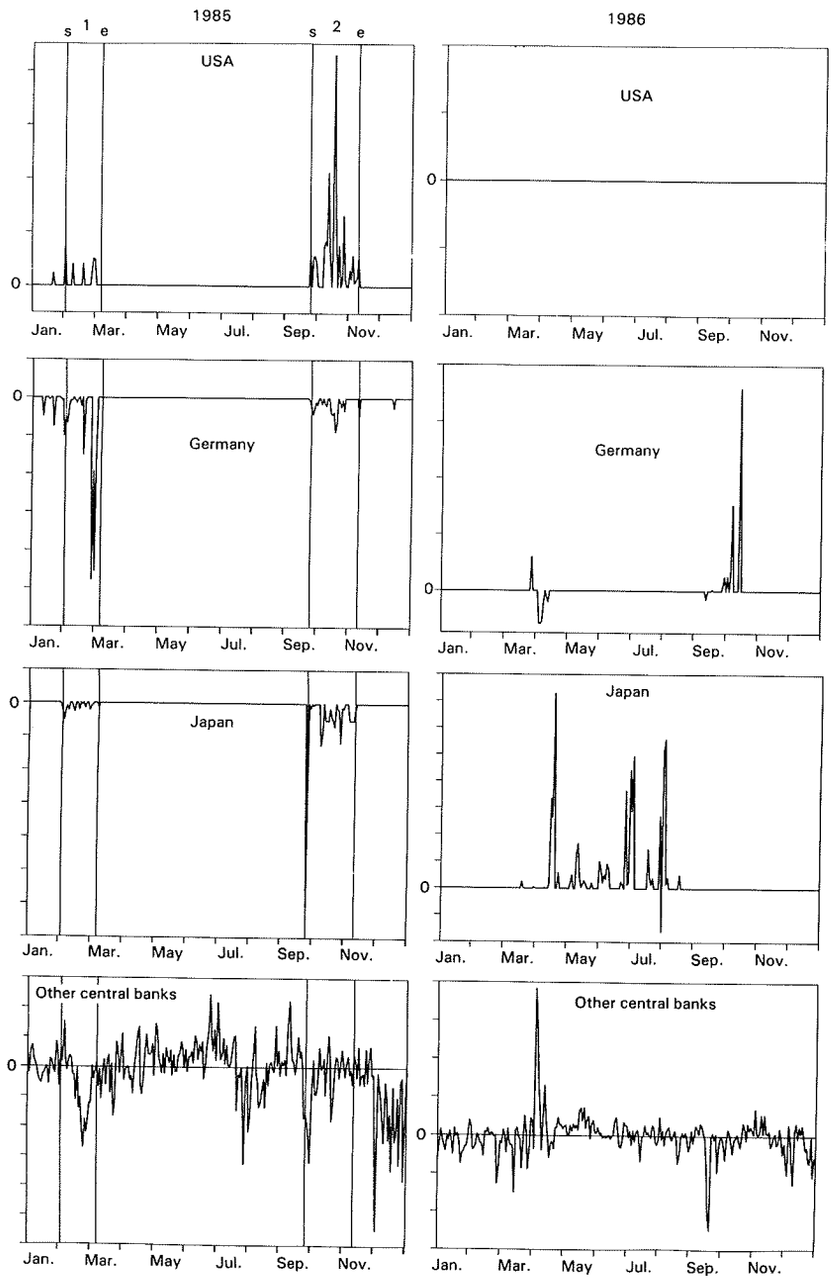

Figure 8.1A Daily intervention, 1985–6

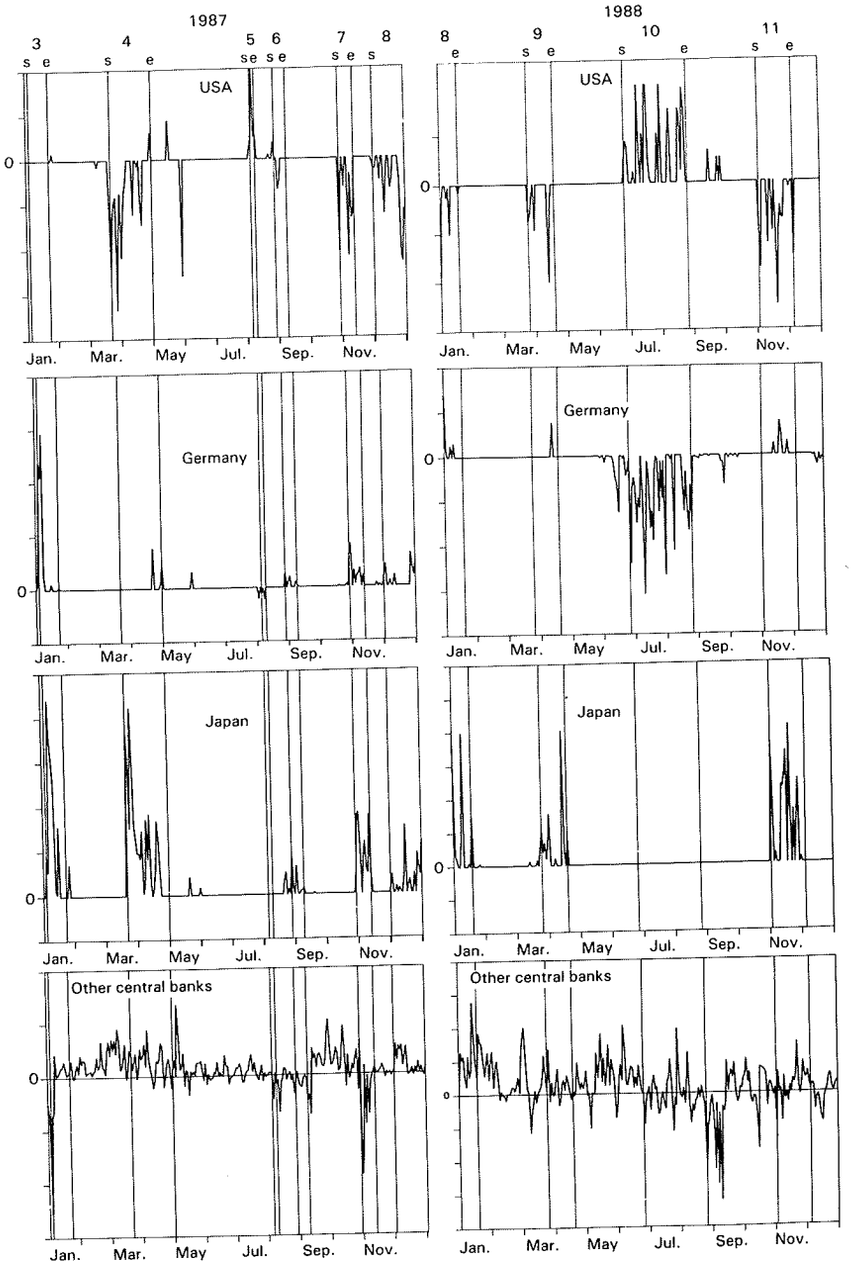

Figure 8.1B Daily intervention, 1987–8

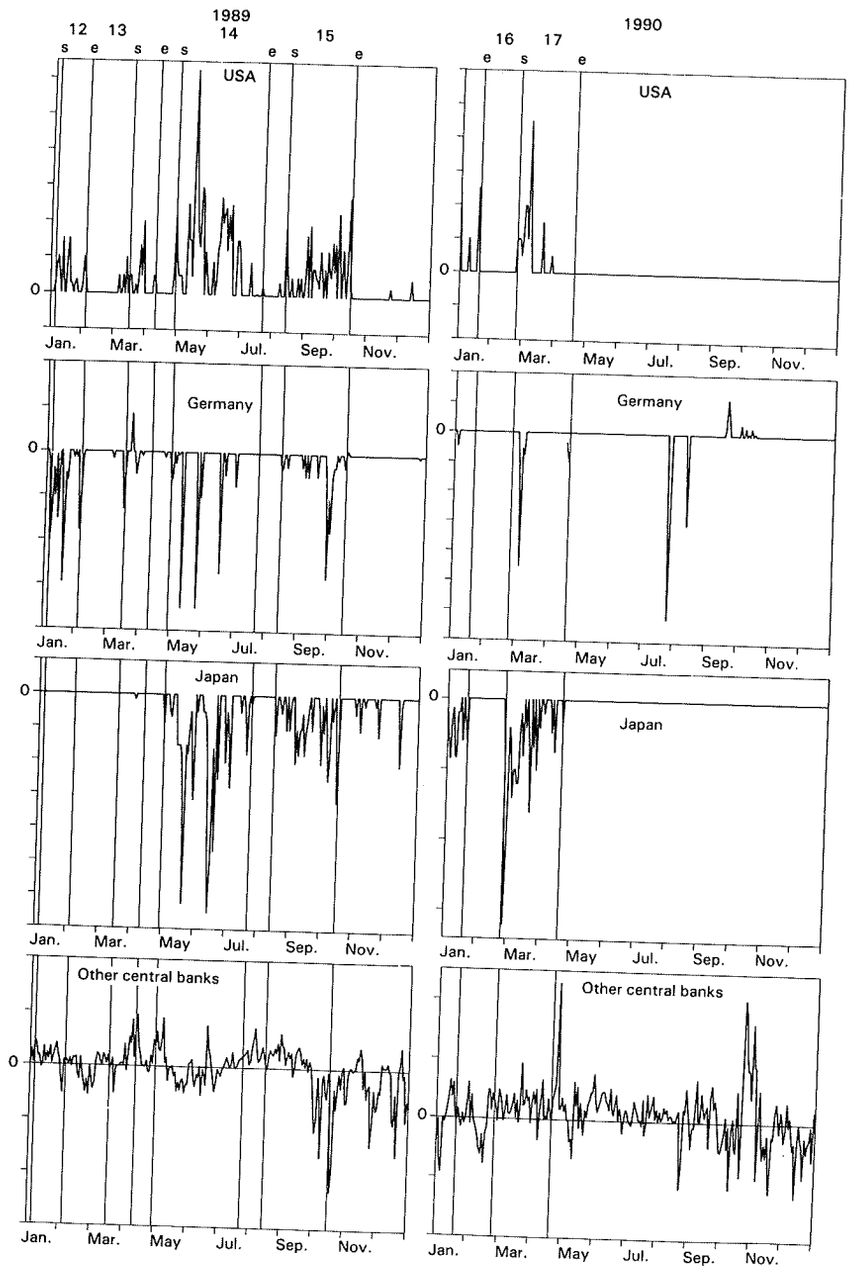

Figure 8.1C Daily intervention, 1989–90

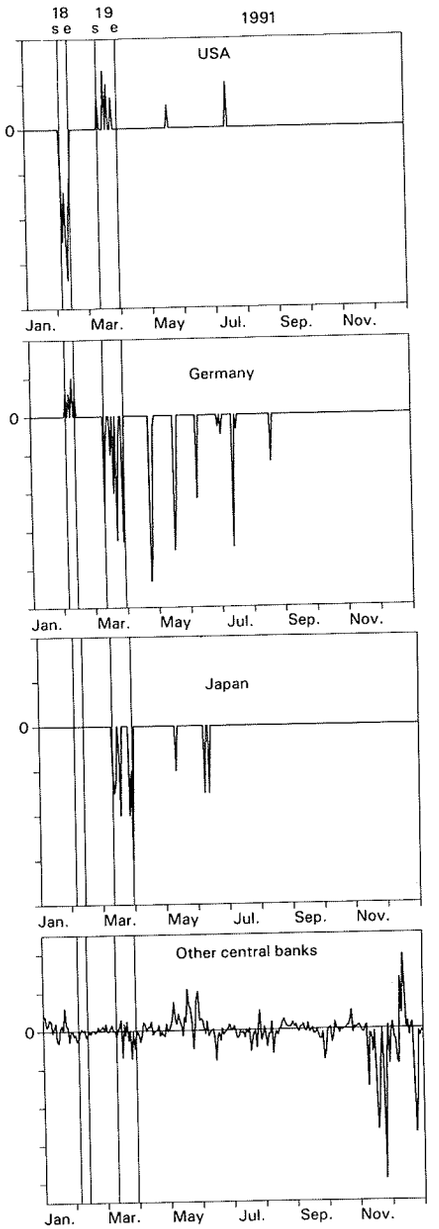

Figure 8.1D Daily intervention, 1991

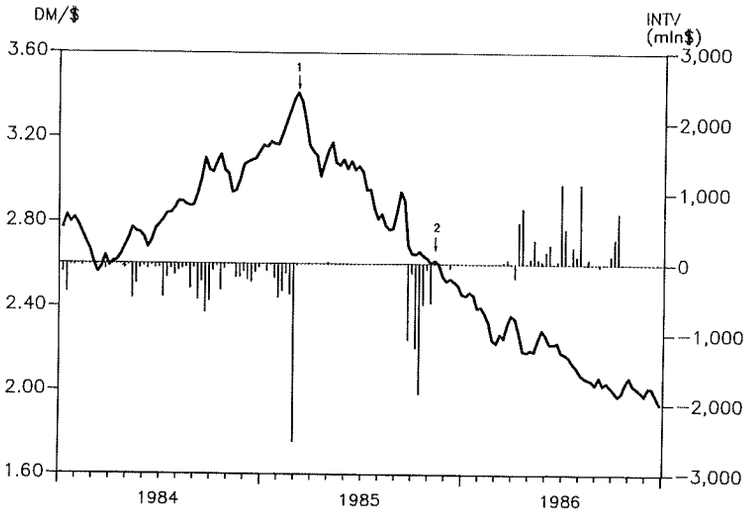

Figure 8.2A DM/$ exchange rate and interventions by G-3 central banks, 1984–6
Note: ($ purchases–DM purchases)/2. Weekly data.

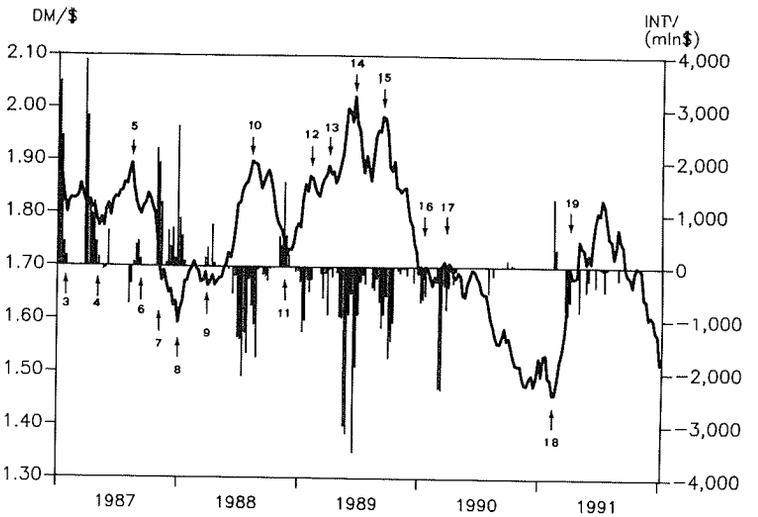

Figure 8.2B DM/$ exchange rate and interventions by G-3 central banks, 1987–91
Note: ($ purchases–DM purchases)/2. Weekly data.

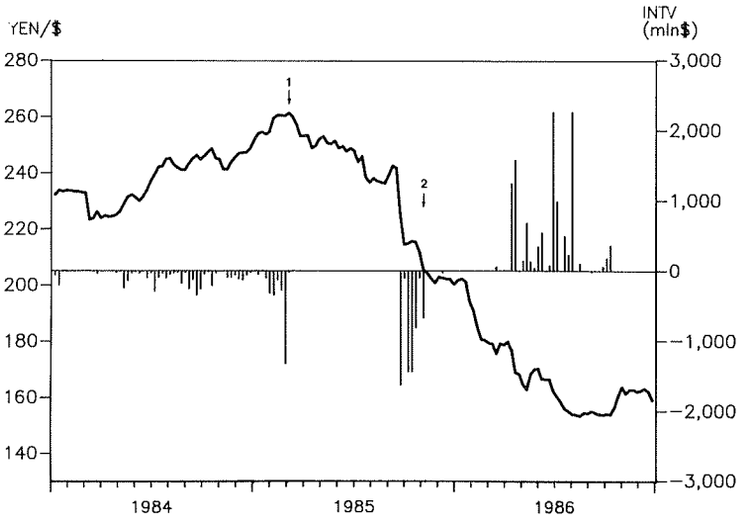

Figure 8.3A Yen/$ exchange rate and interventions by G-3 central banks, 1984–6
Note: ($ purchases–Yen purchases)/2. Weekly data.

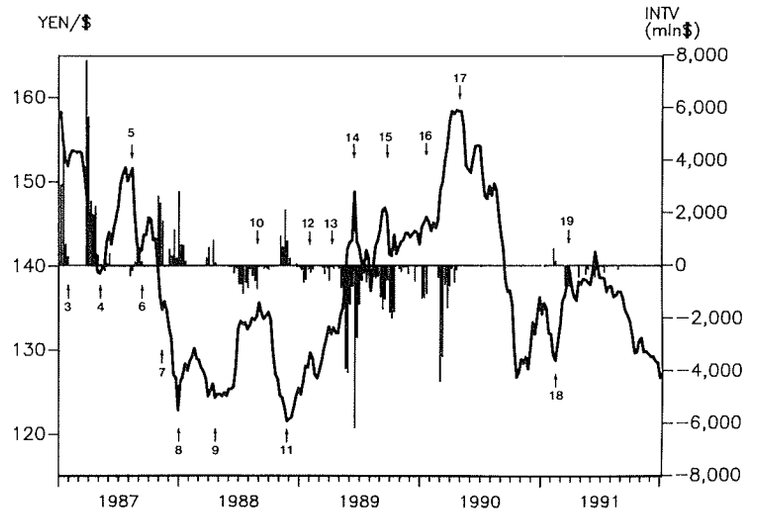

Figure 8.3B Yen/$ exchange rate and interventions by G-3 central banks, 1987–91
Note: ($ purchases–Yen purchases)/2. Weekly data.

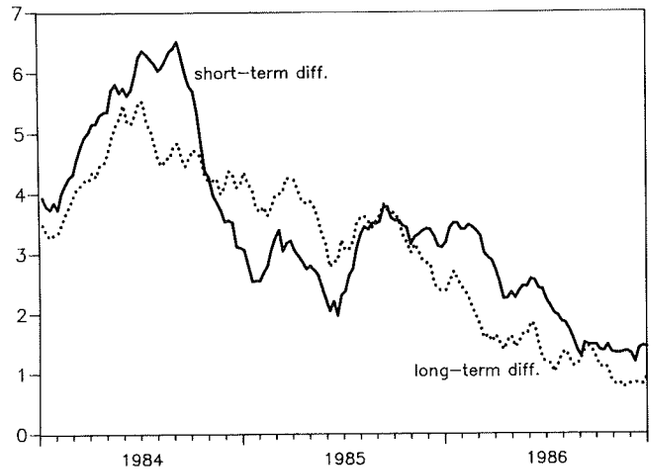

Figure 8.4A US–Germany interest rate differentials, 1984–6
Note: Short-term differentials are based on three-month Euro market interbank rates. Long-term differentials are based on ten-year government bond yields.

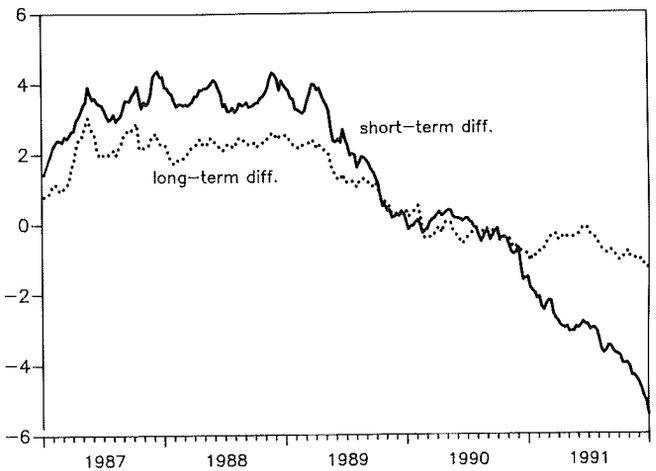

Figure 8.4B US–Germany interest rate differentials, 1987–91
Note: Short-term differentials are based on three-month Euro-market interbank rates. Long-term differentials are based on ten-year government bond yields.

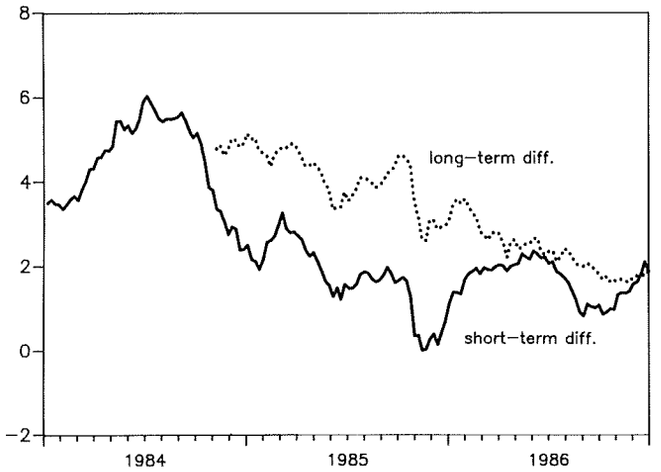

Figure 8.5A US–Japan interest rate differentials, 1984–6
Note: Short-term differentials are based on three-month Euro market interbank rates. Long-term differentials are based on ten-year government bond yields.

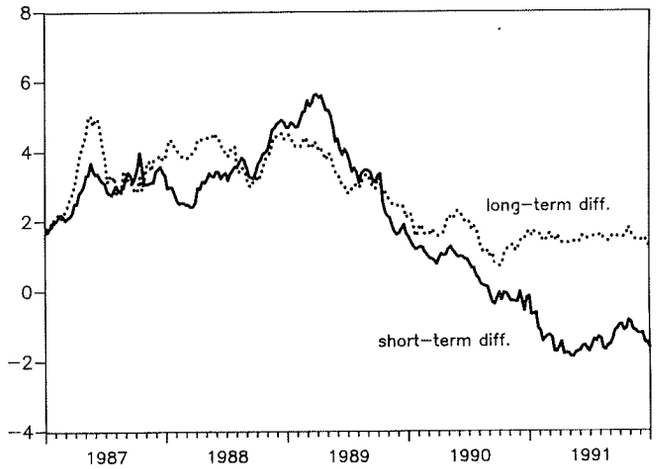

Figure 8.5B US–Japan interest rate differentials, 1987–91
Note: Short-term differentials are based on three-month Euro market interbank rates. Long-term differentials are based on ten-year government bond yields.

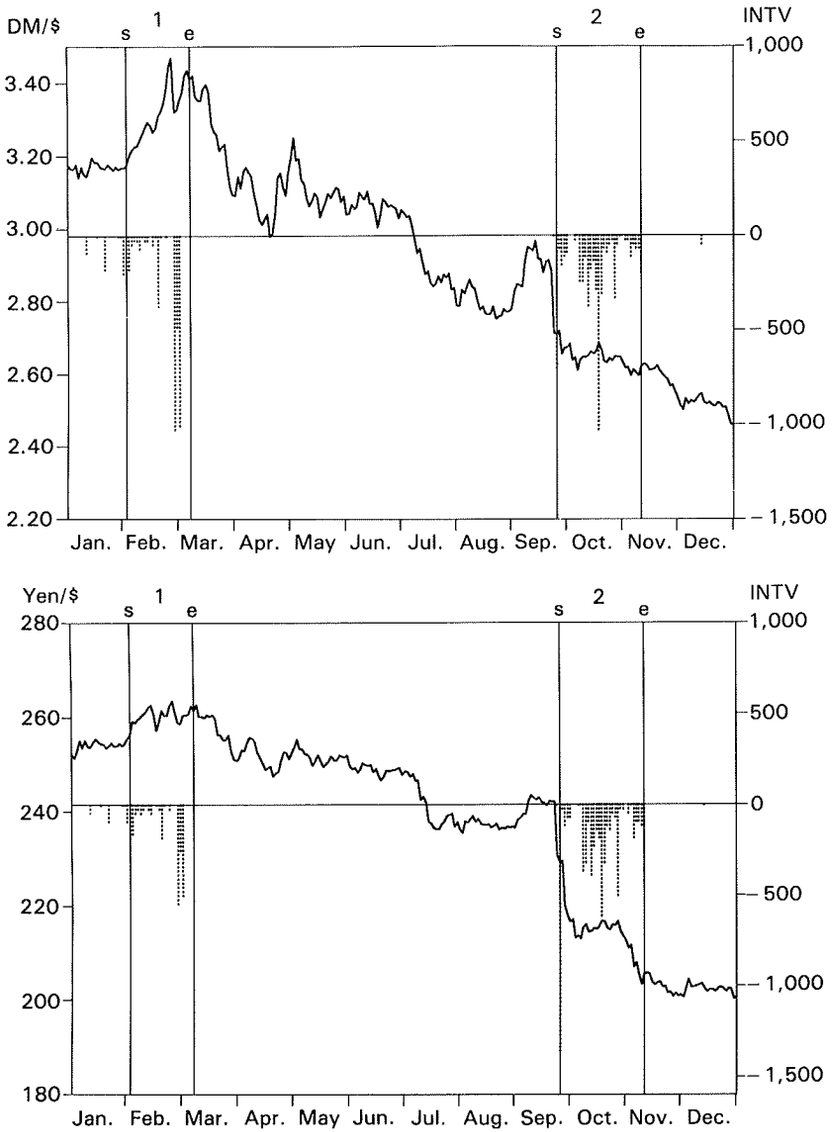

Figure 8.6A Exchange rate and daily interventions by G-3 central banks, 1985
Note: ($ purchases–DM or Yen purchases)/2.

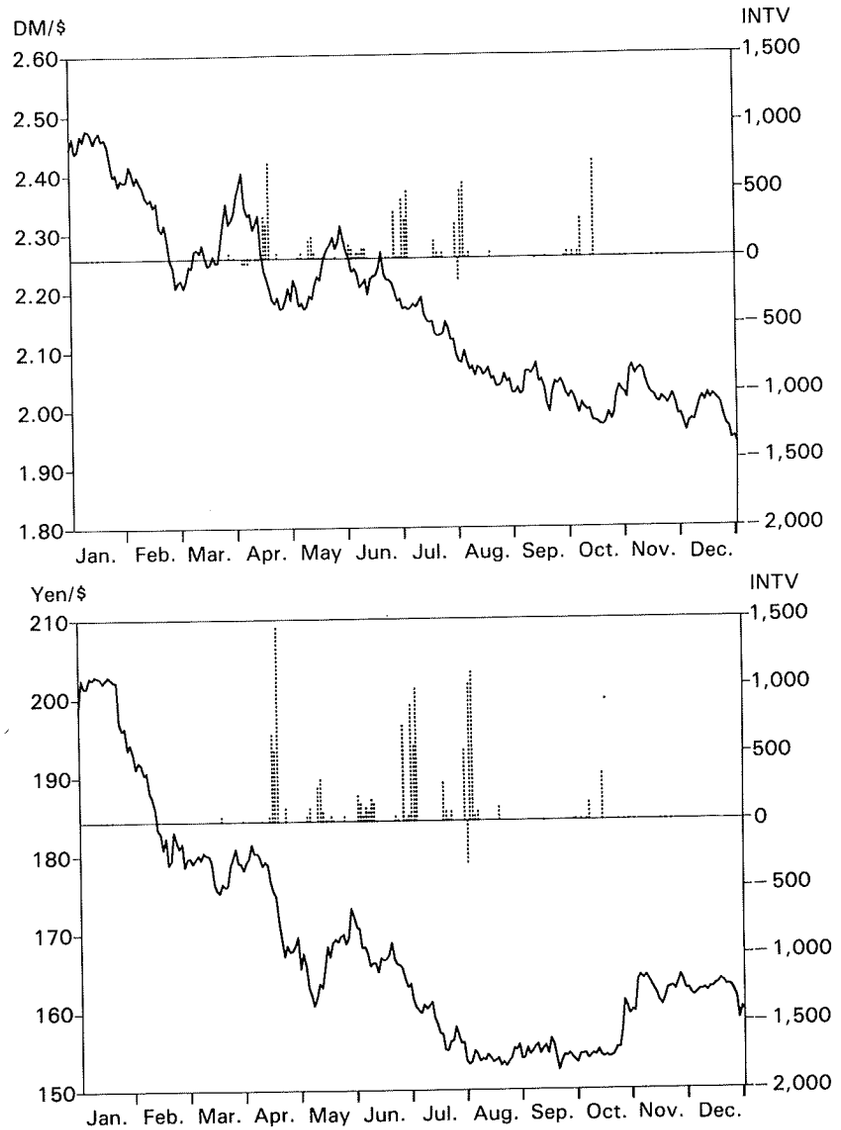

Figure 8.6B Exchange rate and daily interventions by G-3 central banks, 1986
Note: ($ purchases–DM or Yen purchases)/2.

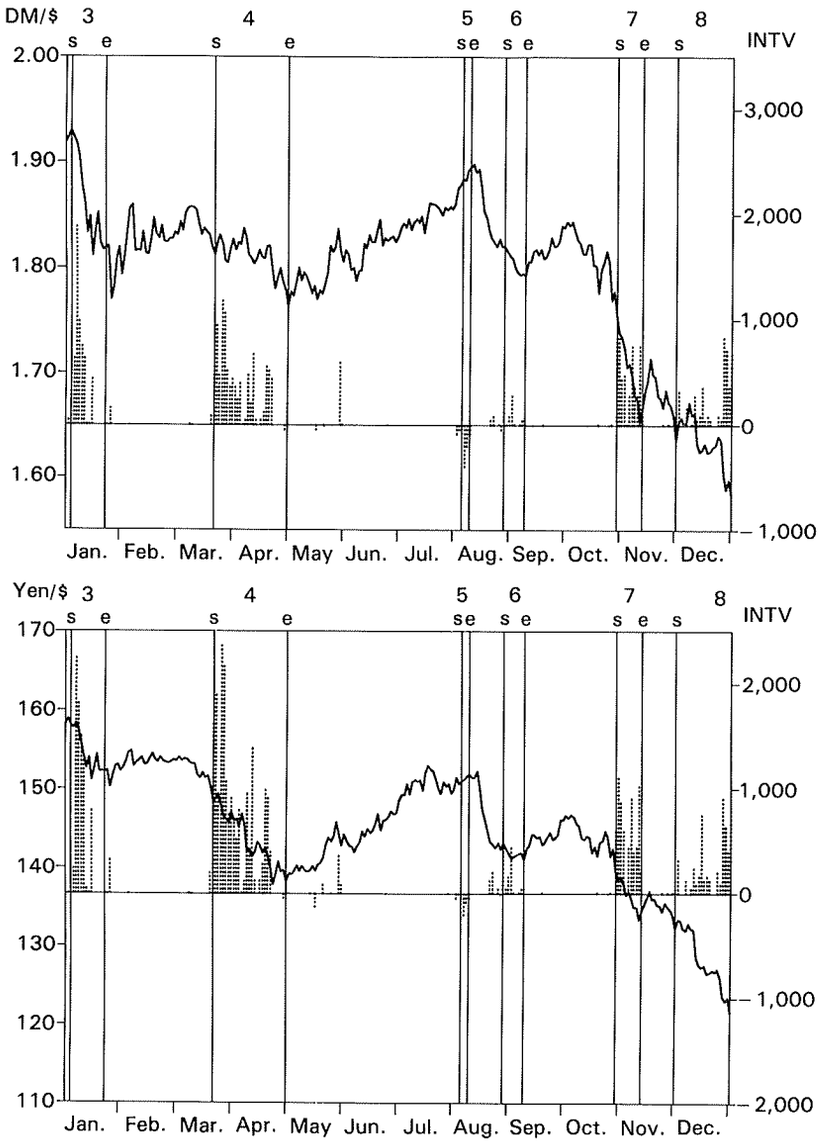

Figure 8.6C Exchange rate and daily interventions by G-3 central banks, 1987
Note: ($ purchases–DM or Yen purchases)/2.

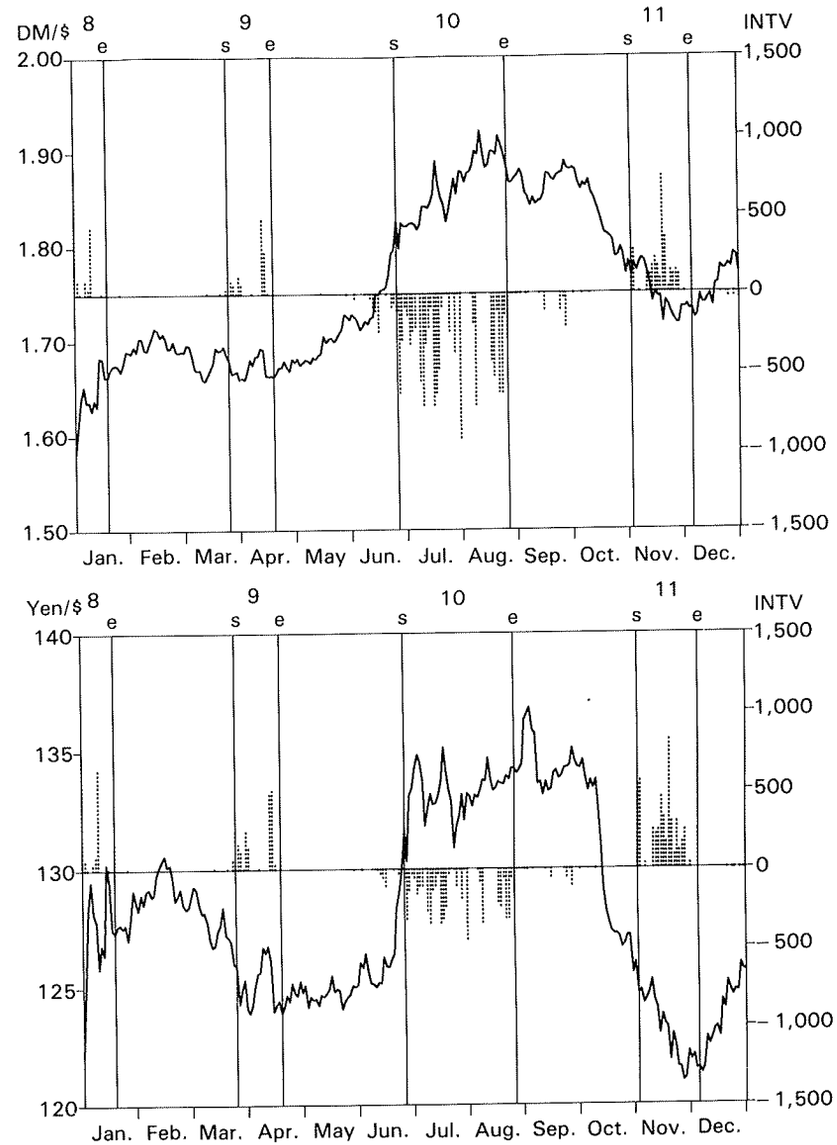

Figure 8.6D Exchange rate and daily interventions by G-3 central banks, 1988
Note: ($ purchases–DM or Yen purchases)/2.

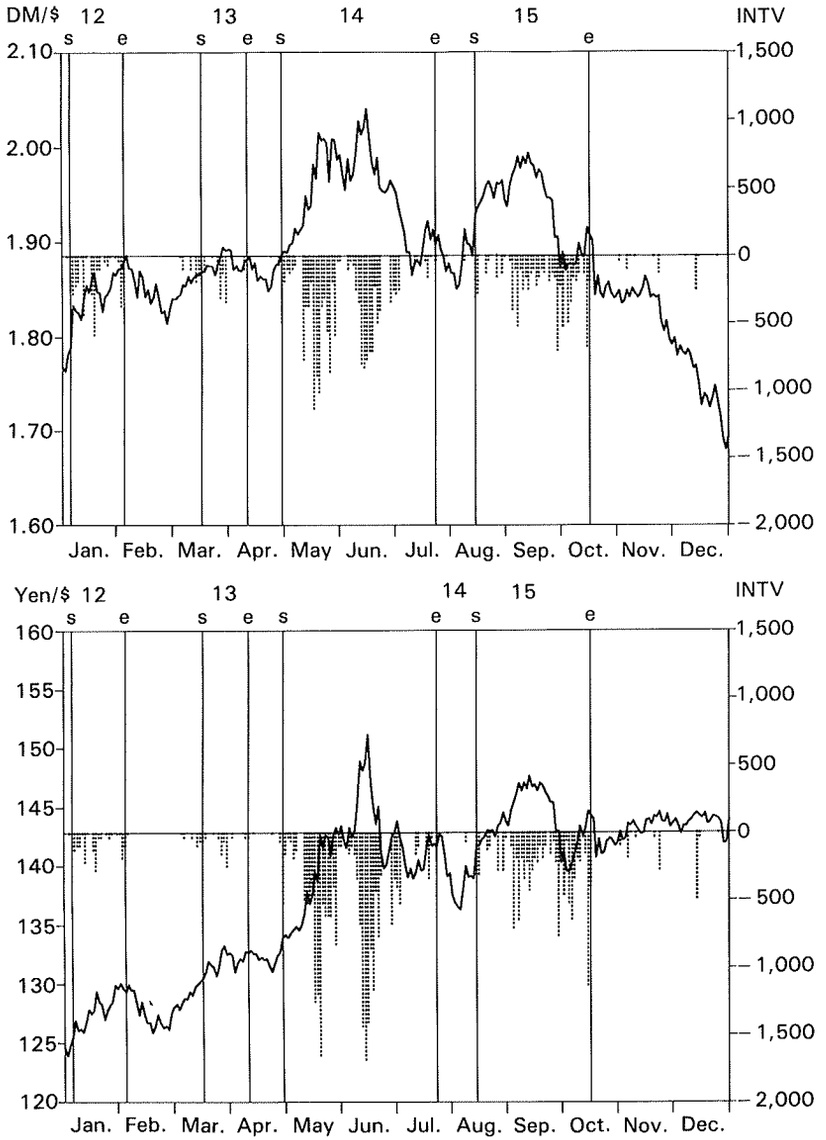

Figure 8.6E Exchange rate and daily interventions by G-3 central banks, 1989
Note: ($ purchases–DM or Yen purchases)/2.

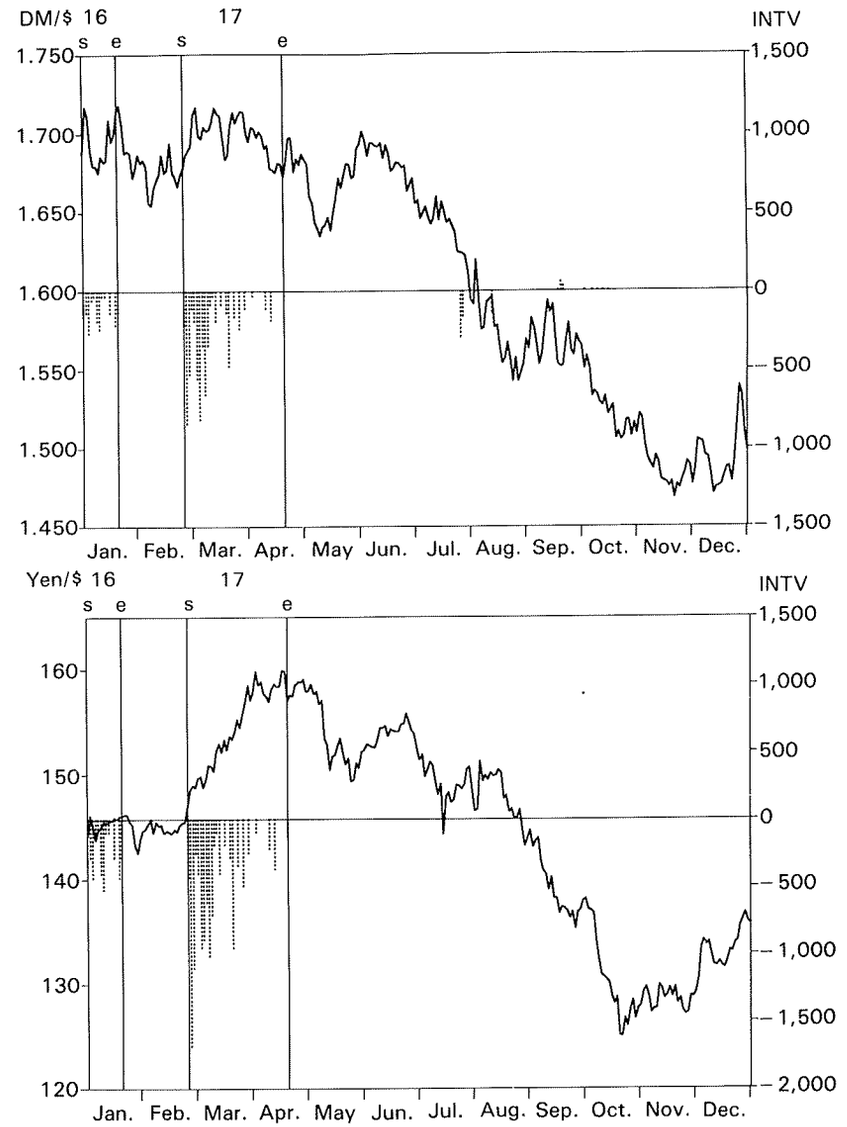

Figure 8.6F Exchange rate and daily interventions by G-3 central banks, 1990
Note: ($ purchases–DM or Yen purchases)/2.

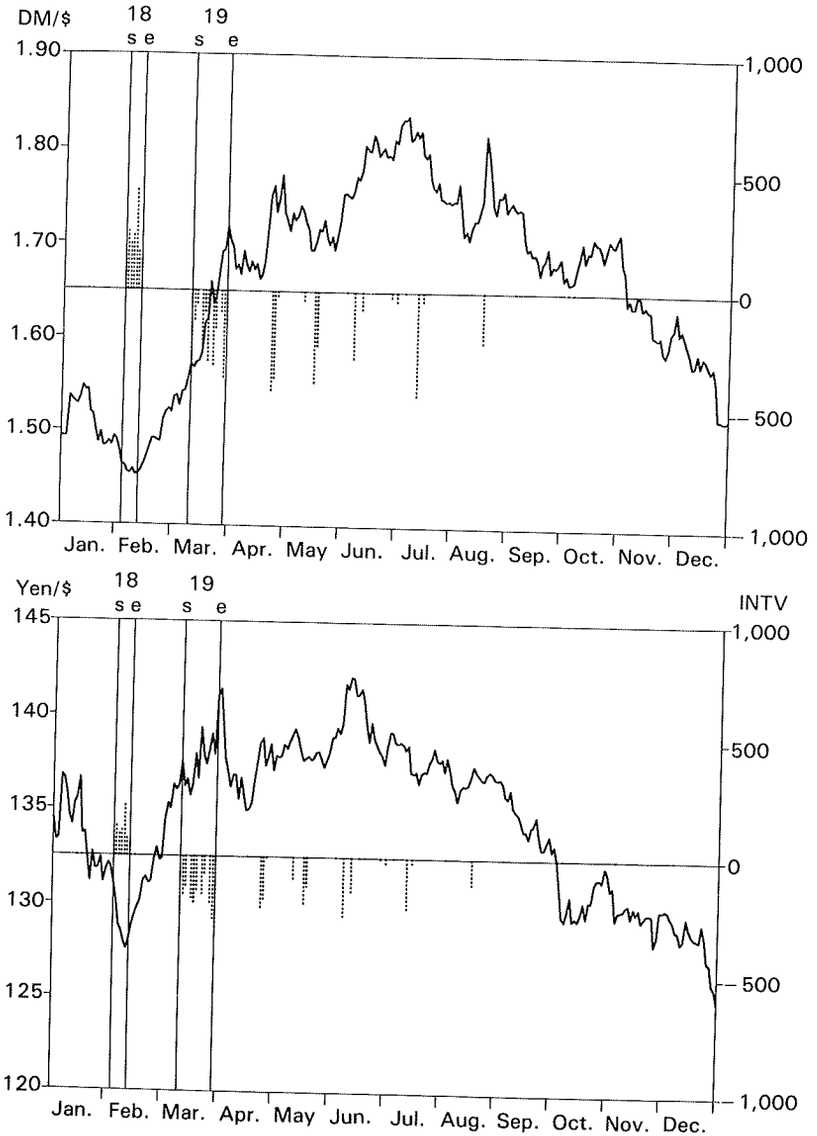

Figure 8.6G Exchange rate and daily interventions by G-3 central banks, 1991
Note: ($ purchases–DM or Yen purchases)/2.

Notes

The views expressed are those of the authors and do not involve the responsibility of the Banca d'Italia. We are particularly indebted to F. Saccomanni for prompting us into this endeavour and to A. Santorelli and F. Panfili for useful discussions on the technical aspects of foreign exchange intervention.

1 An extensive survey of the literature on foreign exchange intervention is contained in Edison (1990). See Giavazzi and Giovannini (1989), Gros and Thygesen (1992) for the role of intervention in the European Monetary System.
2 This is the procedure by which central banks exchange information on interventions four times a day. Our sample includes the central banks of the following countries: Belgium, Canada, Denmark, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.
3 In some countries, there are procedures that normally call for immediate offsetting operations; however, this does not mean that intervention is sterilized over a full market day or over longer periods. To assess whether this is the case, one would have to distinguish empirically between demand and supply shocks and then judge whether the decision to intervene coincided with a decision to change the supply of the monetary base.
4 On only four days did two of the three central banks intervene simultaneously at cross-purposes, and only for very small amounts. This is in sharp contrast with the much higher frequency of such events in earlier periods, for instance in 1979–80.
5 In principle, this criterion does not include anomalous cases in which, for instance, two banks alternate in the market at weekly intervals. In practice this pattern is never observed, as intervention is usually sequential with interruptions of at most one or two days in each episode.
6 A detailed analysis of each episode is included as an appendix to the chapter, available on request from the authors.
7 The only episode that cannot easily be labelled as 'leaning against the wind' is the one that occurred after the Plaza Accord (episode 2). For this episode, and therefore for the preceding one, we use an evaluation criterion based on the objectives that were agreed at the meetings.
8 After a major sale of foreign currency, central banks sometimes intervene immediately in the opposite direction in order to accumulate reserves. However, this does not appear to be the case for the G-3.
9 The term 'successful' may not be completely appropriate. In most cases the target was stabilization around current levels, not trend reversion; however, the actual outcome of almost all episodes was a reversal of the trend.
10 The variable in brackets is divided by two in order to preserve the actual size interventions; an exchange of $100 against the Deutsche mark would otherwise be counted as being worth $200.
11 In June and July of 1991 intervention was small, discontinuous, and uncoordinated; only on one day (12 July) did two of the G-3 central banks intervene simultaneously.

12 For any given very short-term interest rates, the effects of intervention on longer-term differentials are ambiguous. A sale of dollars by the Fed may be taken by the market as signalling the intention of the US authorities to loosen monetary policy in the future; if, however, it gives rise to expectations of a devaluation of the dollar, it will lead agents to require a higher return on dollar assets. See section 5.2 for further discussion on the role of interest rates in the intervention episodes.

13 What follows is consistent with the writings of Blanchard and Dornbusch (1984), Dornbusch (1984), Sachs (1985), Feldstein (1986), Obstfeld (1989), De Grauwe (1989), Frankel (1990), though many of these authors cannot be labelled as 'fundamentalists'.

14 Goldberg and Frydman (1991) show that the actual, appropriately redefined, rational expectation paths of the exchange rate and of the economy depend on the distribution of agents across the different models of the economy adopted at any given moment and how this distribution changes over time.

15 MacDonald and Taylor (1992) manage to do slightly better than a random walk using an error correction monetary model of the exchange rate. We too have done a little better than a random walk by including broken trends between each pair of subsequent episodes; however, this is a rather obvious result given that virtually all the major turning points coincided with the episodes.

16 For a discussion of some of the definitions of sustainability see Krugman (1985 and 1987) and Marris (1985).

17 Blanchard and Fischer (1989, p. 261) see sunspots as interesting and disturbing, but implausible. However, they focus on models in which there is no uncertainty except about the realization of the sunspot. The idea put forward here is much less disturbing: essentially, markets may be virtually indifferent between different initial values of the exchange rate in the face of pronounced uncertainty, in the sense that different values may be viewed as being consistent with reaching equilibrium in the long run. The economy will then tend to behave as if there was a continuum of stable equilibria.

18 Based on consumption PPP data prepared by the Commission of the European Community in 1991.

19 See, among others, Summers and Summers (1989), Mussa (1990), De Long *et al.* (1990), Frankel and Froot (1986), MacDonald and Young (1986), Allen and Taylor (1990), and Taylor and Allen (1992).

20 According to Obstfeld (1991), if intervention has only a signalling value, it should not be viewed as an independent instrument of policy 'since it must be followed by concrete policy actions for signals to remain credible'. This argument, however, applies to a world in which there is a well-defined relationship between the exchange rate and fundamentals. Mussa (1981) provides a reason as to why intervention may prove a more credible signal than policy announcements by the authorities. He argues that intervention exposes a central bank to additional foreign exchange risk and enhances its incentive to pursue its objectives by other means in the future. Klein and Rosengren (1991) show that intervention was used, effectively, after the Louvre Accord to clarify imprecise policy announcements.

21 For a clear statement of this proposition see, among others, Krugman (1988, p. 117) and Kenen *Floating exchange rates reconsidered: the influence of new ideas, priorities, and problems* included in Part III of this volume).

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