

NBER WORKING PAPER SERIES

THE INTRA-DAILY EXCHANGE RATE
DYNAMICS AND MONETARY POLICIES
AFTER THE G5 AGREEMENT

Takatoshi Ito

Working Paper No. 2048

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 1986

The author is grateful to Geoffrey Carliner, Richard Clarida, Christine Cumming, Jeffrey Frankel and Robert Mundell for their helpful comments on earlier versions of this paper. He also benefited from comments and discussions in the United States-Japan Consultative Group on International Monetary Affairs, in Oiso, Japan, in July 1986; Summer Institute, National Bureau of Economic Research, in August 1986; and Japan Economic Seminar at Columbia University, in September 1986. The research reported here is part of the NBER's research programs in Financial Markets and Monetary Economics and International Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

The Intra-Daily Exchange Rate Dynamics and Monetary
Policies After the G5 Agreement

ABSTRACT

This paper investigates determinants of yen appreciation from the G5 agreement of September 1985 to the end of May, 1986. During that period, four waves of appreciation separated by calm periods are identified. For each wave and calm period, the changes in the yen/dollar exchange rate are decomposed in those taken place in the Tokyo, Europe and New York markets. In addition, correlations among the yen, mark, and pound for each market for each wave are studied.

The surprisingly strong effect of the G5 agreement on the exchange rate was due to the signaled U.S. policy change. The role of direct intervention by the Bank of Japan was rather limited at that point. The Bank of Japan, adopted the "high interest policy" in October 1985. By narrowing the interest rate gap between Japan and the United States, the Bank of Japan successfully led to another round of appreciation.

A major cause of the third wave of yen appreciation starting January 24, 1986 was the decline in oil prices. After the third wave was over, the Bank of Japan started intervening the market in support of the dollar -- a reversal of direction. However, the effort was not successful to stop another round of yen appreciation. The fourth wave of appreciation in the middle of April was due to a mix of prospects of reducing the U.S. federal deficits and a further decline in oil prices.

These findings are consistent with a view that the exchange rates respond mainly to news of fundamentals and that the exchange rates are not manageable by coordinated interventions alone.

Takatoshi Ito
NBER
1050 Massachusetts Avenue
Cambridge, MA 02138

1. INTRODUCTION

This paper examines exchange rate dynamics after the much-hailed Group of Five (G5) Meeting of September 22, 1985, held in New York. Just before the G5 meeting, many policy makers as well as economists would have agreed that the U.S. dollar was overvalued. The only remaining question was how to bring about the dollar depreciation and how quickly it should be done.

A dramatic announcement at the end of G5 meeting, coupled with direct intervention and other measures taken by central banks, brought down the value of U.S. dollar very quickly. In the six months after the G5 meeting, the trade-weighted dollar depreciated more than 15%: the dollar depreciated more than 25% against the yen, about 20% against the German Mark, and 10% against the British pound. Figure 1 shows the daily yen/\$ exchange rate dynamics from September 19, 1985 to May 30, 1986. By December 1986 it appeared that coordinated interventions seemed to have worked very well, although there was no agreement to why it was so successful.

Some consider that the episode shows how effectively the government can manage the exchange rate by interventions and other (monetary) policies. Others, however, believe that the rapid depreciation of the dollar was essentially driven by market forces, pointing out that the dollar had been gradually slipping for seven months prior to the G5 big push. They contend that the government intervention was effective only because it was "leaning with the wind." But even if we suppose that government actions made a big difference, there still are questions. During the first three months after the G5 meeting, was it the Japanese side (the Ministry of Finance and Bank of Japan) which should be given

responsibility, since the yen appreciated the most? Or, was it the United States team (the Treasury and the Fed) which made the difference this time?

After the first three months of quick dollar depreciations, Japan became more and more hesitant to support further yen appreciation. As the yen appreciated to 175 yen/\$ in the middle of March, the Bank of Japan started intervening again, but this time by selling dollars in order to prevent further yen appreciation. In Japan, this operation was nicknamed "reverse interventions." However, the Tokyo summit in May did not yield any agreement on an international monetary reform or a target zone for the exchange rates. It seems that international coordination on the exchange rate management is once again in disarray. Major countries seem unable to agree on whether or not the dollar should further depreciate (yen should further appreciate).

First of all, let us review Figure 1, the yen/\$ exchange rate dynamics from September 1985 to May 1986. We clearly see that the exchange rate changes came in "waves." In a given wave, the yen appreciates by 10 or more yen in a matter of one week or two, then the exchange rate stays relatively calm for two weeks to two months until the next wave. This kind of alternating pattern of volatility is a common feature of exchange rate movements. (See Mussa (1979).)

Since the foreign exchange market is a well-organized, highly efficient asset market, relevant information is processed and reflected upon exchange rates within minutes. Moreover, unlike the country-specific stock market or bond market, the foreign exchange market is practically open 24 hours Monday through Friday, somewhere in the world. A wave of

appreciation should coincide with the arrival of a major news about the determinants (fundamentals) of the exchange rate. By matching economic and political news with a wave of appreciation, we will be able to identify sources of exchange rate changes. However, for this purpose, daily exchange rate data are not "fine" enough. The exchange rate responds to news in a matter of minutes. For example, if relevant news, say Baker's testimony before a Congressional committee, originates in the United States, the exchange rate should change during the New York market sessions. By the time the New York market closes, the exchange rate is fully adjusted to news that became available during the day.

Time differences make it possible to identify the origin of news by looking at changes in respective markets. Since New York is 14 hours (13 hours during daylight saving time) behind Tokyo, business hours of the two countries do not overlap. Thus, it is safe to assume that exchange rate changes in the New York market primarily reflect U.S. news, while changes in the Tokyo market are primarily caused by the Japanese political and economic news. In sum, by looking at intra-daily movements of the exchange rate in different countries, good inferences on determinants of the exchange rate can be made.¹¹

When the Tokyo market opens two and half (three and half, during the summer) hours after the New York closing, the Tokyo opening exchange rate reflects all the news up to that point. Any exchange rate changes during the Tokyo market reflect relevant news that becomes available during the Tokyo market hours. For example, if the Bank of Japan's policy change is responsible for the exchange rate movement, then the exchange rate changes in the Tokyo market where the Japanese monetary policy is revealed.

Economists, who do not know exactly what are relevant fundamentals

(determinants), can look at the exchange rate changes in various markets within the day, and match them with the arrival of news, in order to obtain an important insight on the exchange rate dynamics.

In this paper, the daily exchange rate change is decomposed into the changes in the Tokyo market, the European market, and the New York market.

Figure 2 depicts how major markets in the world overlap each other. We divide changes in the exchange rate during a 24-hour period, day (t), into three representative market with the following definitions:

Definitions of "Changes in the market" ^{1/2}
=====

$$\text{Tokyo (t)} = [\text{Tokyo closing (t)}] - [\text{New York closing (t-1)}]$$

$$\text{Europe (t)} = [\text{New York opening (t)}] - [\text{Tokyo closing (t)}]$$

$$\text{New York (t)} = [\text{New York closing (t)}] - [\text{New York opening (t)}]$$

The above definitions are not as precise as one could hope for. First, because of the overlap of the afternoon hours of the European market and the early morning hours of the New York market, anything that happens in the London market after 3 pm is attributed to U.S. news, while anything that occurs in the New York market before 9 am is attributed to European news. In particular, some U.S. economic indicator announcements, including the producer price and industrial production indices occur at 8:30 am, before the New York foreign exchange market opens. Second, occasional political developments take place after the foreign exchange market closes in that country. President Reagan or Prime Minister Nakasone may conduct a press conference or make a TV appearance after market hours. Hence the correspondence between the timing of news announcements and market hours is not always perfect. However, as a first

approximation, this market decomposition of the exchange rate movements gives us an initial important sign of the origins of exchange rate disturbances. If there are notable exceptions, I will mention in the text. An investigation of market-specific changes will provide us with a foundation for exploring determination of the exchange rates.

In addition, we will look at correlations between the Japanese yen, the German mark and the British pound. Since various types of economic news might affect the three currencies differently, correlations between them would provide an additional evidence of what was a major disturbances in the foreign exchange markets. For example, if the yen appreciates because of the U.S. policy changes, then yen movements would be closely correlated with German mark and British pound movements. However, if oil is the major source of disturbances, the correlation between yen and pound would be negative, because the pound, the currency of a major oil producer should depreciate while yen, the currency of a major oil importer should appreciate.

The next section analyzes exchange rate movements, in particular causes behind four waves of yen appreciations from the G5 meeting of September 1985 to the end of May 1986. We will find that each appreciation wave is explained as the exchange rate responses to changes, or signals of upcoming changes, in "fundamentals." Implications of these findings will be discussed in the concluding remarks.

2. Four Waves of Yen Appreciations after G5

As shown in Figure 1, the eight-month period after the G5 meeting can be divided into four waves of yen appreciations with quiet periods separating the waves. Figure 1 also reports the important economic and political developments since the G5 meeting.

Table 1 shows the decomposition of changes in the yen/\$ exchange rate into the Tokyo, European and New York markets for each wave and for the periods in between. Table 2 shows correlation coefficients among the three currencies in each market for each subperiod.

A. The G5 weekend

The G5 emergency meeting was hastily put together on the weekend of September 21. At the time of closing in the New York market on September 20, Friday, it was known that the meeting would take place but there was no suspicion that anything big would come out of it. The yen/\$ rate was 239 yen/\$ at the New York closing on the Friday.

The G5 agreement, also known as the Plaza agreement, that the participants will take coordinated actions to depreciate the U.S. dollar was announced during the weekend. When the first market, New Zealand's Wellington market, opened on September 23, Monday, the yen appreciated by 5 yen to 234 yen/\$.¹³ The Tokyo market, which would have opened next, was closed for a national holiday. The London market put 232 yen/\$, and appreciation continued during the New York market session, opening at 231 and closing at 225.5 yen/\$. By the time the Tokyo market opened on September 24, yen had already appreciated by more than 10 yen. The Tokyo market opened at 229.7 and closed at 230.1, while the Bank of Japan reportedly sold 1.3 billion dollars. It was only after the big jump had

already taken place that the Bank of Japan started a heavy intervention, and the intervention did not seem to cause yen appreciation. (It, however, is possible to say that it prevented a sharp rebound.) Thus, the Bank of Japan's role in the yen appreciation should be minimal at this stage. It is safe to say that the initial jump was caused by the G5 announcement itself.

What was new in the announcement then? In answering this question, it is useful to investigate what happened one week following the announcement.

B. First Wave: September 23 to September 30, 1985

Reading statistics of the first wave (September 23- September 30) in Table 1 (row I), we notice that 85% (=12.675/14.95) of the yen appreciation during the week took place in the New York market. During the week, central banks of the G5 countries sold U.S. dollars, as agreed upon in the G5 meeting. It is reported that the amount of intervention accumulated in this week by the Bank of Japan surpassed that of the Federal Reserve Bank of New York. However, the fact that the yen appreciation was concentrated in the New York market rather than the Tokyo market suggests that the most important factor for the appreciation was not the Bank of Japan's intervention but news in the New York market. (There is no evidence I could detect for an intervention by Bank of Japan in the New York market in these weeks.)

In Table 2 (row I), we see that correlations among the yen, mark and pound in the New York market during the week of first wave are uniformly very high. This also suggests that the dollar was the major source of disturbances and the rest of the currencies moved together against the

dollar.

This is consistent with a view that a most important aspect of the G5 meeting was the change in the U.S. position from benign neglect to international coordination. During the Regan-Sprinkel regime, the Treasury Department took a position that the dollar was strong because of the strong U.S. economy. They denied a link between the U.S. fiscal deficit and high interest rates or a link between high U.S. interest rates and the strong dollar. Under the Baker regime, a need for greater international coordination was expressed and manifested itself in to the G5 agreement. It was a "surprise" (news) for the market that the Fed intervened in cooperation with other central banks, although the amount of Fed intervention was less than the Bank of Japan's at this point.

The market must have been more and more conviced of the U.S. policy change in the New York market everyday.

C. Second Wave:

During the first three weeks of October, the yen was stabilized at the 214 - 218 range. In fact, from TABLE 1, (the Q row between waves I and II) we know that the yen slightly depreciated, with all the depreciation taking place in Tokyo, while it appreciated in the other markets.

At this point, many market participants were expecting that the dollar might become strong again. Especially when the Seoul Meeting of Finance ministers at the occasion of the IMF meeting (weekend of October 5) did not produce any follow-up to the G5, some market participants expressed an opinion that the dollar had hit bottom. However, the Japanese authorities decided that the amount of appreciation was not enough and feared that the dollar might creep up to its previous level.

The Bank of Japan announced a major policy change on October 24, Thursday. Governor Sumita in a regular press conference announced that the Bank would adopt a high short-term interest rate policy. The presumption was that narrowing the interest rate gap between the U.S. and Japan would create another round of yen appreciation.

The market, however, did not respond immediately. During the day of Sumita's announcement, the exchange rate hardly changed in the Tokyo market or in the New York market: the Tokyo market opening was 215.85 and its closing was 215.65; then the New York market opening was 216.90 and its closing was 216.37. On October 25, the Tokyo market opened at 216.55. Yen appreciation took off from there. As the short-term interest rate soared in the morning trading, the yen appreciated sharply. The Tokyo closing rate of the day was 214.90.

It is quite interesting from the scholarly point of view that the market missed the "cue" and did not act for more than 18 hours after Sumita's announcement. This shows that either the Bank of Japan's announcement was not credible or market participants were not rational enough.

Yen appreciation continued for two weeks, as more and more market participants became convinced about the new monetary policy. During this wave, most of the yen appreciation occurred in the Tokyo market -- in contrast to the first wave. TABLE 1 (row II) shows that 72% ($=7.7/10.745$) of the appreciation took place in Tokyo. This suggests that new information became available in the Tokyo market. As the short-term interest rate rises in Tokyo, yen became appreciated in the Tokyo market.

The Tokyo market in the second wave in TABLE 2 shows that the correlation between the yen and the mark was low and so was the correlation between the yen and the pound. In contrast, the mark-pound correlation

was higher, implying that the relative values between mark and pound stayed constant. The correlation table is an evidence that a major disturbance occurred with regard to yen against the other currencies in the second wave of yen appreciation.

These facts suggest a scenario that the second wave was caused by the Bank of Japan's monetary policy alone.

D. The regime of 200 yen/\$

After the second wave of yen appreciation, the yen hovered just above 200 for more than two and half months. Was it so calm because of a lack of major news?

It seemed that there was as much potential news as in any other periods. The high interest rate policy, which caused the second wave, was gradually eased and formally abandoned on December 17. (The three-month Tegata interest rate peaked on November 19, the one-month Tegata rate peaked on December 13.) The discount rate cut by the Bank of Japan, which did not take place until January 30, was rumored as early as December 20. These developments might have put pressure on the yen to depreciate, especially after the middle of December.

The OPEC countries announced after the December 8 meeting that it had decided to defend their market shares even if it meant lower oil prices. The German mark appreciated about 7.3% from November 7 to January 24, while the British pound depreciated about 1.3 % during the same period. The pound depreciation seemed to have been caused by the decline in crude oil prices. As Japan is a major oil importer, it would not have been surprising if yen had appreciated during the same period. In other words, it looked rather "artificial" that the yen/\$ value is fixed, while German

mark and British pound against dollar moved around. (In TABLE 2, the same point can also be seen as very low correlations between the yen and the mark, and between the yen and the pound in the Tokyo market for the period between November 8 to January 23.)

There are two possible explanations for the apparent stability of the yen/\$ exchange rate from the beginning of November to the end of January. The first hypothesis is that as the high interest rate policy was gradually lifted, the yen received pressure to depreciate, while the oil price decline worked in the opposite direction. The two conflicting pressures may have happened to have an equal magnitude.

The second hypothesis is that the Japanese monetary authorities made an attempt to stabilize the yen at around 200. The decision might have been made in early November. The interest rate policy was adjusted so that the exchange rate level could be sustained. That is why the interest rate continued to climb until late November and then turned around and slid steadily until late January, while the exchange rate was essentially constant. There must have been a constant pressure on the yen to appreciate since the OPEC meeting of December 8, which was only mitigated by the interest rate decline. (One-month Tegata rate was 8.1875% on December 17 and 7.000% on January 23.) However, by January 24, the Japanese monetary authorities must have been decided that it would be difficult to maintain the 200 yen/\$ rate (without a drastic cut in the interest rate).

I think that the latter explanation, i.e., the policy target explanation, is more plausible. There were two episodes which reinforce this view. First, during the Japanese New Years holidays (the Tokyo market closes from the January 1 to January 3), the yen sneaked to appreciate in

the New York market. On January 2, the yen closed at 198.55 in the New York market, breaking the 200 target level. Then news came from Japan. Governor Sumita of the Bank of Japan gave a New Years press interview that the yen should be kept around at 200. As soon as the news is relayed to the New York market on January 3, the yen level went back above the 200 level.

Second, what happened on January 24 is another proof for a hypothesis that the Japanese authorities tried to keep a target for the yen/dollar exchange rate. Finance Minister Takeshita was in Washington D.C. on his way home from the London G5 meeting of January 18 and 19. At a press conference in the United States, he reportedly said that he would allow the yen to go below the 200 level. The Tokyo market was informed of Takeshita's remark by a news wire at around 3pm, thirty minutes to the closing of the market. The yen jumped from 201 to 198 in the matter of 20 minutes, then profit taking brought it back to 199.50 at the closing (3:30pm). Finance Minister Takeshita came home that evening, long after the Tokyo market was closed, and gave another news conference in Tokyo. He said "if the exchange rate becomes in the 190s as a natural result of the market movement, it should not be artificially brought back (to more than 200). Though it varies depending on sectors, the 190s would be acceptable by the industries." (Literal translation from Nihon Keizai Shinbun, January 25, 1986.) This news conference in Tokyo was in turn reported in the European and New York markets which were still open.⁴⁴ The yen jumped to 198 in the London market and then 196.60 by the closing of the New York market.

E. Third Wave (January 24 - February 19)

A steep yen appreciation of 21 yen (10%) followed within four weeks

after the Takeshita announcement. A long-expected discount rate cut by the Bank of Japan effective on January 30 (which was announced on January 29) did not stop the strength of the appreciation.

A major cause of the yen appreciation in this wave was the rapid oil price decline. A minor role was played by the decline in the U.S. long-term interest rate which reflected a U.S. fiscal policy switch. I have two kinds of evidence for this view.

First, Table 1 (row III) reveals that yen appreciation in this period took place almost equally in the three markets. What is interesting is that the contribution of the European market in this wave is very large compared to the other periods. Recall that the first wave of appreciation was attributed to the U.S. policy shift in favor of international coordination and the second wave was to Japanese monetary policy. What is new about the third wave is that the yen is appreciated in the European market, too. Why would the yen, which is a third-country currency, appreciate in the European market? The answer becomes evident if one recognizes that significant developments on oil prices occur after the Tokyo market closes and before the New York market opens. Major news on oil include decisions on oil production and pricing by the OPEC countries, and the important spot market prices in Netherlands and London.

Second, Table 2 (row III) reveals the correlation between the yen and the pound became very low in this period. Great Britain as a major exporter of oil, suffers from oil price declines so that its currency tends to decline in value. While Japan, as the largest oil importer, benefits so its currency tends to appreciate. Therefore, the low correlation between the two currencies makes us suspect that oil prices were a

big factor, but not the only factor. (If oil is the only cause, then the correlation between yen and pound should be negative and close to -1.) Hence, we need to closely investigate the relation between the oil prices, yen and pound. TABLE 3 compares oil prices (London, spot, blend crude), the yen/dollar rate (New York opening) and the dollar/pound rate (New York opening) from January 24 to April 18.

The yen continuously appreciated, while oil prices steadily declined. Although the pound appreciated over the period in question, its movement was not consistent. It seems that there was a mix of pound depreciation news (oil price decline) and appreciation news (something else). In this period, what might make the dollar depreciate (the pound to appreciate)?

One possible source of pound appreciation (dollar depreciation) pressure was a gradual change in the market's perception of the chance of reducing the U.S. government budget deficit. The huge budget deficits in the past several years are often blamed for creating U.S. high interest rates and, in turn, a strong dollar. In the first four months of 1986, perceptions about future deficits seem to have changed drastically.^{\5\} In order to document this, the U.S. long-term (10-year government bond) interest rate is shown in the last column of TABLE 3. It is evident that the decline in the long term interest rate was drastic from January to April. By the beginning of April, Japanese security firms, which had been purchasing U.S. long-term bonds, were reported to have cut back dramatically on security investments.^{\6\}

F. "Reverse Intervention" by the Bank of Japan

As the third wave brought the yen into the 180's, the Japanese monetary authorities became resistant to further yen appreciation. The Bank of Japan started mentioning the possibility of intervention in

support of the dollar (sell yen and buy dollars), a total reversal of the direction. Thus it is dubbed as a "reverse intervention" (Gyaku Kainyu) in Japan. (The earliest headline about its possibility appeared on February 4, when the yen was about to go under 190.) The actual reverse intervention did not come until March 18 when yen hit below the 175 yen/\$ level.

During the interval between the third and fourth wave, there was a notable development. On March 6 and 7, France, Germany, Japan, and the United States cut their discount rates by 0.5%. This was the first "coordinated" discount rate cut, which would theoretically achieve aggregate demand expansions, with a neutral impact on international capital flows (by keeping the interest rate differential intact).⁷ However, right after the coordinated interest rate cut, the yen appreciated suddenly, which led to the reverse intervention of March 18 by the Bank of Japan. The yen appreciated from 179 (on the day of the discount rate cut announcement) to 174.90 eleven days later, which was turned around quickly and returned to the 180 level in a week. In that sense, a coordinated interest rate cut was successful in keeping the exchange rate stable, although with a quick fall and rise immediately following the rate cut.

G. Fourth Wave (April 16 - April 28)

The fourth wave started when the (second) internationally-coordinated discount rate cut became a certainty.⁸ From April 16 to April 28, the yen appreciated by more than 10 yen, breaking the all-time high on April 21 in Tokyo. The monetary authorities in Japan did not want to cause further appreciation of yen. Short-term interest rates went down quickly and reverse intervention continued.

Table 1 (row IV) indicates that most appreciation took place in Tokyo and New York. Looking at Table 2 (row IV), we see that correlations between the three currencies were quite high. Not only the yen, but the pound and mark appreciated at the same time. In fact, at the peak of appreciation, April 28, the German central bank joined the Bank of Japan in intervening the market in order to support the dollar.

This evidence points to United States monetary policy as a main cause of the fourth wave of yen appreciation. The fact that the United States was a leading advocate of the discount cut this time reinforces this view. The market participants must have figured out that despite the appearance of a "coordinated" discount rate cut, it is more likely to have a larger impact on U.S. (long-term) interest rates than on rates in other countries.

What about other factors? Since the decline of oil prices had stopped by the middle of April, oil is not the main factor. This is confirmed by relatively high correlations between the pound and yen (at least in Tokyo), and the pound and mark. There may have been some political speculation about a major international monetary reform to be discussed at the coming Tokyo summit. However, it would be hard to quantify what dealers expected about the monetary reform and how the outcome (no explicit agreement on a monetary reform) affected the foreign exchange market.

H. The Tokyo Summit and its aftermath

The Tokyo Summit, held from May 4 to 6, yielded little progress on the front of international monetary coordination. Japan reportedly sought coordinated intervention to prevent the yen from further appreciation,

which was rejected by the United States. Instead, a multilateral surveillance of macroeconomic indicators was proposed by the United States. The final agreement states that (i) G5 will be expanded to G7 to include Canada and Italy; (ii) Finance ministers and central bankers of the G7 countries will conduct "multilateral surveillance to make their best efforts to reach an understanding on appropriate remedial measures whenever there are significant deviations from an intended course and recommend that remedial efforts focus first and foremost on underlying policy fundamentals, while reaffirming the 1983 Williamsburg commitment to intervene in exchange markets when to do so would be helpful."

In Tokyo, this agreement was perceived as a measure not particularly helpful in relieving the pressure on the yen to appreciate. The agreement gave the impression that Japan's wish to stop further yen appreciation was unwelcomed by others, and that Japan had become "isolated." In particular, the Bank of Japan, which was almost alone in intervening in support of the dollar (selling yen), became more vulnerable to speculative attacks. The yen appreciated by about 10 yen (or 5.9%), to 160 in one week following the summit. However, the yen quickly turned around and depreciated to its level before the summit (i.e., after the fourth wave). Some people attribute the turnaround to the Treasury Secretary Baker's testimony in Congress on May 13 to the effect that he thought the yen had appreciated enough.

This short spell of quick appreciation and depreciation following the summit might have been a rare occasion of a speculative bubble forming and popping. First, there was no major economic news. Oil prices were stable, and major currencies were moving together (see TABLE 2, the last row.) Second, although the correlations with the yen were high, the

amount of appreciation in the mark and pound in the week after the summit was much smaller than the yen: 1.8% for the mark and pound. Third, the depreciation was as quick as the appreciation and the yen came back to where it was. If it was a bubble, it would not be surprising that the bubble was burst by the Treasury Secretary Baker's testimony.

The summit agreement could be seen as a step toward international coordination of macroeconomic policies. Of course, how much can be achieved by "surveillance" remains to be seen. It is ironic that Japan and Germany, which in the past few years have sought macroeconomic coordination (i.e., lowering the U.S. interest rates) wanted to set an exchange target zone and coordinated intervention; and the United States, which had been unsympathetic toward policy coordination in the past summit meetings, turned around and proposed coordination. If one recognizes that intervention without fundamental policy changes is destined to fail, it is difficult to understand why Japan wanted coordinated intervention.

Even more ironic in March was that the coordinated discount rate cut was not put forward by Japan but by the United States. It was the United States that almost attempted an unilateral discount rate cut (thanks to a power struggle), while Japan which theoretically would prefer an unilateral interest rate cut to prevent further yen appreciation, did not initiate an interest cut or go for a larger cut. Instead, Japan pursued unsuccessful intervention.

3. Concluding Remarks: Lessons from the G5 experiences

The success of quick depreciation of the U.S. dollar during the week following the G5 agreement gave to some observers the impression that if coordinated interventions are made, it is possible to manage the exchange rate.^{\9\} However, as argued in this paper, intervention itself has played only a minor role in a period immediately following the G5 meeting. The U.S. policy changes signaled by Fed interventions were more important in changing market participants' perceptions about the fundamentals in the future. Interventions do not seem to cause a large change in the exchange rate levels, unless they are also signals of policy switch or a change in domestic policies. Especially the so-called "reverse intervention" by the Bank of Japan intended to stop "too much" yen appreciation after March 1986 was not successful, because it was not accompanied by the change in unilateral discount rate change or in stimulating the Japanese domestic economy. However, this conclusion does not rule out the possibility of "smoothing out" fluctuations by interventions.

Time to time, the exchange rate appears to respond to what Chairman Volker or the Finance Minister Takeshita says. There were three good examples cited in section 2 of this paper. These episodes might give an impression that a mere talk could "manage" or mismanage the foreign exchange market.^{\10\} As discussed in Section 2, Governor Sumita's press interview and Finance Minister Takeshita's remark were effective only because Japanese authorities consciously pursued a policy of targeting the 200 yen/dollar, the former confirming the policy and the latter signaling its abandonment. In fact, by late January when Takeshita's remark was made, it was about the time for the yen to appreciate because of falling oil prices and relatively high Japanese interest

rates. Treasury secretary Baker's remark might have coincidentally been a place when the market was looking for an excuse to burst a bubble.

It turns out that the above three examples are exceptions. Other political remarks, such as one from President Reagan and the Minister of International Trade and Industry in Japan play much lesser roles. Although those remarks had been frequently reported and the market is said to be "sentitive" to them, close investigations would reveal that they did not change the exchange rate by more than one yen at a time and did not have a lasting effect.

Detailed investigations in this paper using intra-daily data reveal that the large changes in the yen/dollar exchange rate levels after the G5 agreement were not "managed" by the U.S. and Japanese monetary authorities. This paper found that four waves of yen appreciation were, respectively, cause by the U.S. policy switch, the high interest rate policy by the Bank of Japan, the decline in oil prices, and a mix of prospects of U.S. fiscal deficit reduction and a further decline in oil prices. In other words, the exchange rates respond to news on what we consider "fundamentals" and not to mere interventions of the monetary authorities.

Footnotes

1. The news analysis has been applied to the exchange rate movement in Engel and Frankel (1984) and Frankel (1984; ch.7). The news analysis with the intra-daily exchange rate data was first done by Ito and Roley (1986), which analyzed the movement from 1980 up to the G5 meeting in September 1985. This paper is a direct sequel of Ito and Roley (1986).
2. It is possible to define changes in the "Pacific" market (from the closing of the New York to the opening of the Tokyo market) and changes in the strict Tokyo market (from the opening to the closing of the Tokyo market) separately, in place of the Tokyo market as defined here. However, Ito and Roley (1986) convincingly showed that there is very little news happening to cause exchange rate changes in the "Pacific" market. Practically the New York closing is used as the Tokyo opening. Aggregating the "Pacific" and strict Tokyo market does not do any harm to our analysis.
3. In fact, the Bahrain market, which is open on Sundays, was the first market after the G5 agreement. It was reported that American banks started selling the dollars in the Bahrain market on Sunday, September 22, but no quotes were reported.
4. This same quote was translated as "Nations industry could live with the dollar valued at 190 yen" (Wall Street Journal, January 27, 1986.) Note that the Japanese version states the broadly-defined 190s, with a connotation that it does not go too far below 200, while the English version states 190 as the level. The development in the Europe and New York later in the same day was closer to the English version. The point,

however, was that it signaled the switch of the policy.

5. Although the Gramm-Rudman Act was found "unconstitutional" in a Federal Court on February 7, the Congress made efforts to trim federal deficits in the budgeting process. The market must have become more and more convinced during the spring of 1986 that efforts for reducing federal deficits would be more intensified in the near future whether or not the Gramm-Rudman Act is constitutional. However, I could not pinpoint specific events which would prove this conjecture.

6. Nihon Keizai Shinbun carried a story on April 25 about how Japanese investments became "diversified" into European securities. However, a security company source indicated that the "diversification" started in the beginning of April.

7. Later we learned that there was a split of opinions (and a power struggle) within the Federal Reserve Board of Governors. An anti-Volker faction was said to have outvoted Chairman Volker on February 24 in an attempt to cut the discount rate (without international coordination). However, one member changed position and delayed the rate cut until March

7. (See for example the Wall Street Journal, Editorial, on March 20 for details.) On March 21, the leader of anti-Volker group, Vice Chairman Preston Martin resigned. Since even with coordination, the dollar depreciated heavily after the rate cut, it was a wise decision, at least as afterthought, to delay it, from the viewpoint of the exchange rate stabilization.

8. The discount rates in Japan, the United States and Great Britain were

cut by 0.5% on Monday, April 21. The rumor had been around for a few weeks. But information about the decision became known (leaked?) to the market on April 16 or 17. The decision was formally made and announced on April 18 in the United States and in Great Britain and on April 19 in Japan.

9. The Japanese monetary authorities might have believed in the power of the coordinated interventions, since they reportedly sought after a pledge from other countries to coordinated interventions in the Tokyo summit.

10. The foreign exchange market which is sensitive to what cabinet members and central bankers say has been dubbed in Japan as a "political market" (Seiji souba). A column was written about a "political market" in Nihon Keizai Shinbun on as early as February 2. When monetary authorities are talking about the target level of the exchange rate without real interventions, it is dubbed as "all-talk interventions" (Kuchisaki kainyu) in Japan.

REFERENCES

Engel, C. and J. Frankel., "Why Interest Rates React to Money Announcements: An Explanation from the Foreign Exchange Market," *Journal of Monetary Economics*, Vol. 13, January 1984, pp. 31-39.

Frankel, J. "The Yen/Dollar Agreement: Liberalizing Japanese Capital Markets," *Institute for International Economics*, 1984.

Ito, T. and V. Vance Roley, "News From the U.S. and Japan: Which Moves the Yen/Dollar Exchange Rates?", *National Bureau of Economic Research*, working paper no. 1853, March 1986.

Mussa, Michael L. "Empirical regularities in the behavior of exchange rates and theories of the foreign exchange market, in Policies for employment prices and exchange rates, ed. K.Brunner and A. H. Meltzer. Carnegie-Rochester Conference Series, vol. 11, 1979.

Data Appendix

The definition of data used in the paper is summarized as follows:

TKO (t) = the openning (9am) yen/\$ in Tokyo at date t.

TKC (t) = the closing (3:30pm) yen/\$ in Tokyo at date t.

NYO (t) = the openning (9am) yen/\$ in New York at date t.

NYC (t) = the closing (4:30pm, or later if market is active)
yen/\$ in New York at date t.

In Tokyo, the interbank foreign exchange market is restricted to start at 9am and end at 3:30 with a lunch break from 12 noon to 1:30 pm. The screen goes blank right at the end of morning session and afternoon session. Thus, the openning and closing rates are well defined in Tokyo. In New York, the market hours are not well-defined, but the openning and closing time are defined from convention. The Tokyo rates are the transactions rate, while the New York rates are the simple average of bid and ask rates. The data in Tokyo are daily collected from Nihon Keizai Shinbun. The data in New York are given by the Federal Researve Bank of New York.

TABLE 1
Decomposition of the Yen/\$ Changes

Regime	Dates	Total change	Accumulated Yen Changes		
			Tokyo	Europe	New York
G5	Sep. 20 - Sep. 23	-7.75	(Tokyo closed)		-7.75
I	Sep. 23 - Sep. 30	-14.95	-0.85	-1.425	-12.675
Q	Oct. 1 - Oct. 24	0.12	4.225	-1.525	-2.005
II	Oct. 25 - Nov. 7	-10.745	-7.70	-1.80	0.055
Q	Nov. 8 - Dec. 17	-3.675	-0.12	-0.305	-4.30
Q	Dec. 18 - Jan. 23	-0.30	-0.41	-0.78	-0.825
III	Jan. 24 - Feb. 19	-21.10	-7.775	-6.84	-7.415
Q	Feb. 20 - Apr. 15	-2.40	0.64	-4.125	1.21
IV	Apr. 16 - Apr. 28	-10.90	-5.00	-1.415	-4.485
Q	Apr. 29 - Jun 13	-2.00	-1.185	1.28	0.935

Note: (i) Total change is defined as the change from the N.Y. closing of the last day of the preceding regime to the last day of the current regime with two exceptions. Exceptions: G5 regime is the change from the N.Y. closing on September 20, Friday, to the N.Y. opening of September 23, Monday. Note that the Tokyo market was closed on September 23, due to a banking holiday. The total change in the first regime is defined as the chnage from the opening of N.Y. market on September 23 to the N.Y. close of September 30.

(ii) The daily change in the Tokyo market is defined as the yen/\$ change from the N.Y. close of the preceding business day to the Tokyo close of the day. The daily change in the European market is defined as the yen/\$ change from the Tokyo close to the New York opening of the day. The daily change in the New York market is defined as the yen/\$ change from the New York opening to the New York close of the day.

The accumulated changes in a regime is the sum of the daily changes in the respective regime. Due to country-specific banking holidays, the four market changes do not add up to the total change of the regime.

(iii) The regime names, I, II, III, and IV stand for waves of yen appreciation, and Q for a relatively calm spell.

TABLE 2

Contemporaneous Correlation of Exchange Rate Intra-day Changes
Yen, DM, UK,

		Tokyo		Europe		New York	
		Yen	DM	Yen	DM	Yen	DM
I 9/23 - 9/30	DM	.84		.93		.72	
	UK	.36	.55	-.51	-.33	.74	.97
Q 10/1-10/24	DM	.75		.61		.96	
	UK	.65	.80	.27	.65	.56	.63
II 10/25-11/7	DM	.52		.69		.92	
	UK	.20	.70	.63	.72	.85	.94
Q 11/8-12/17	DM	.42		.59		.76	
	UK	.41	.32	.48	.57	.70	.83
Q 12/18-1/23	DM	.44		.63		.93	
	UK	.34	.69	.34	.27	.74	.87
III 1/24-2/19	DM	.81		.71		.78	
	UK	.28	.07	.06	.32	.31	.43
Q 2/20-4/15	DM	.40		.76		.50	
	UK	.29	.33	.52	.53	.40	.50
IV 4/16-4/28	DM	.75		.77		.80	
	UK	.79	.82	.39	.78	.44	.71
Q 4/29-6/13	DM	.81		.81		.89	
	UK	.49	.74	.72	.90	.79	.87

Notes: Appreciation waves are defined in Table 1. Changes in Yen/\$, DM/\$ and UK/\$ in the specific market everyday are measured in the same manner as Table 1. Then the correlation matrix is calculated.

TABLE 3
Weekly Changes in Oil Prices and Currencies

	oil prices	yen/\$	\$/pound	US long-term interest rate
1985: September 20	27.53	241.05	1.3640	10.32
1986: January 24	18.60	196.675	1.39525	9.17
January 31	18.40	192.855	1.41375	9.06
February 7	17.25	190.95	1.40325	9.07
February 14	17.10	182.35	1.4165	8.69
February 21	16.35	183.725	1.44185	8.46
February 28	16.55	179.775	1.46645	8.14
March 7	15.35	179.325	1.4585	7.96
March 14	13.35	176.25	1.46725	7.72
March 21	13.50	176.00	1.5020	7.79
March 28	11.55	179.50	1.47875	7.47
April 4	12.00	180.05	1.45545	7.44
April 11	12.75	178.05	1.4765	7.29
April 18	11.50	174.32	1.5145	7.08

Note: (i) The oil price is the London blend spot price, \$/barrel.

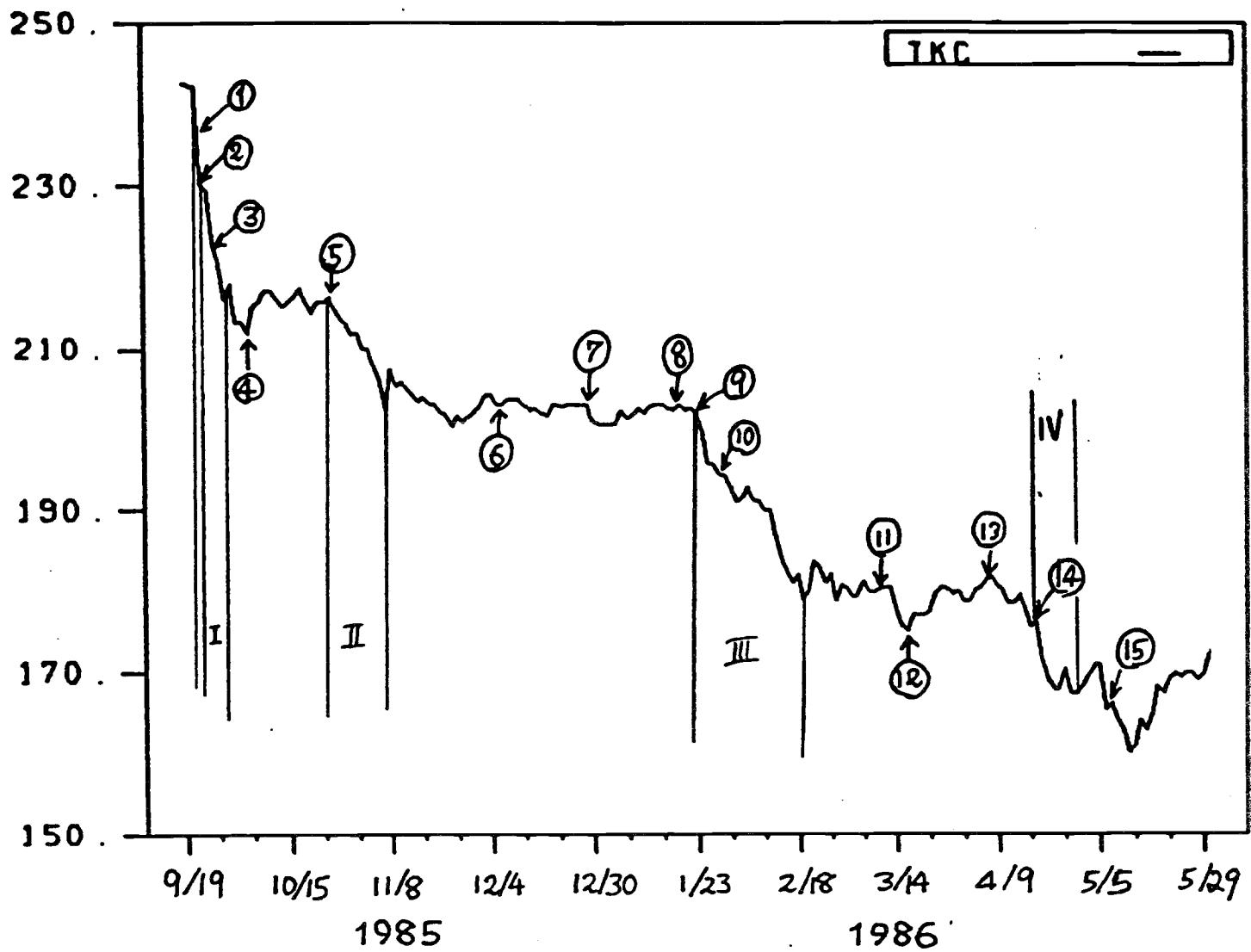
(ii) The yen/\$ rate and the \$/pound are both the average of the bid and offer rates at the opening of the New York market.

(iii) The U.S. long-term interest is for the 10-year government bond.

Source: Nihon Keizai Shinbun (Daily), various issues.

FIGURE 8

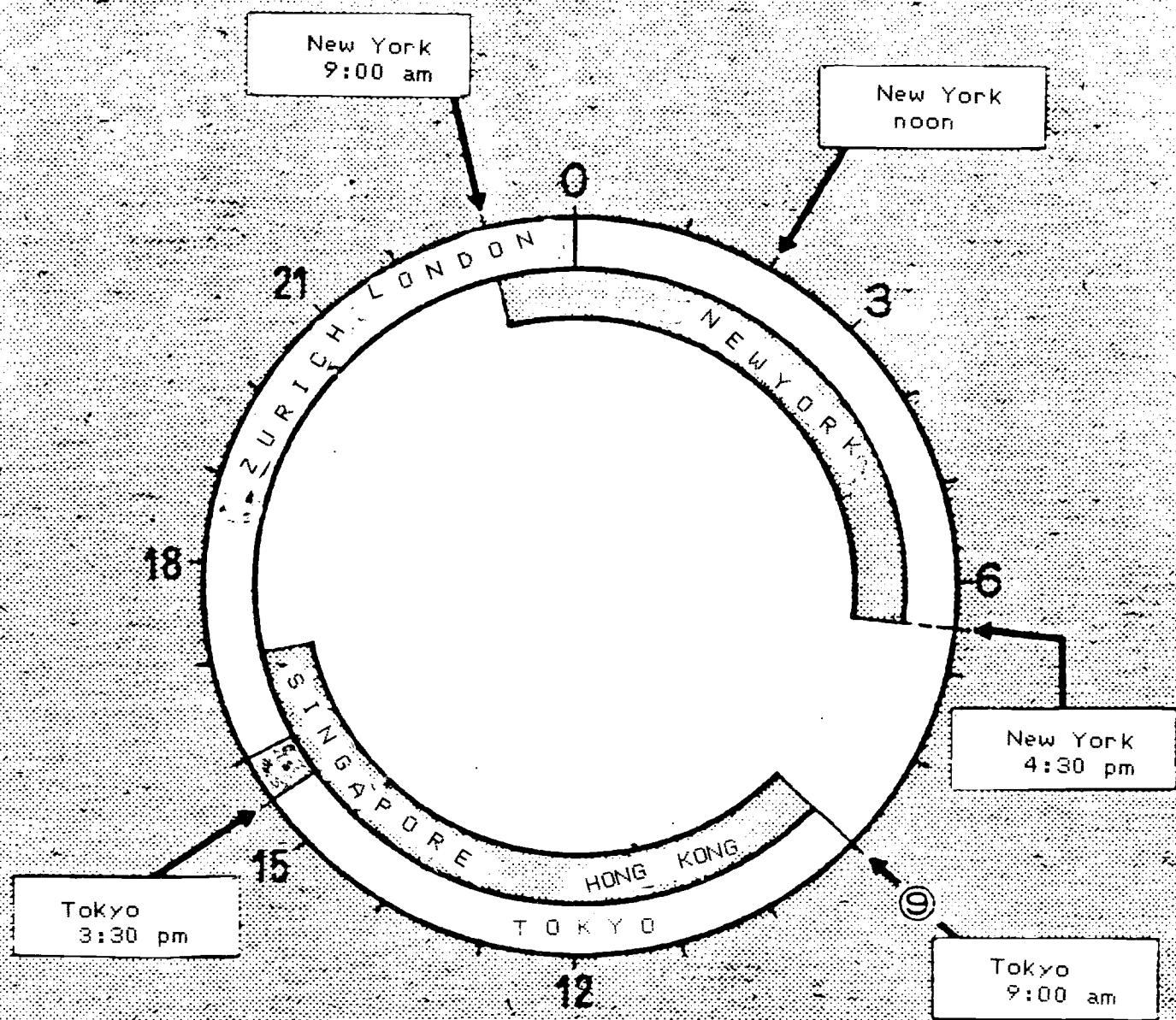
YEN/\$ (TK) AFTER G5



1. 9/22 G5
9/23 Tokyo market closed due to banking holiday
New York, opening at 231.30; closing 225.55.
New York Fed intervened, selling \$250 million.
2. 9/24 Tokyo, opening at 229.70; closing at 230.10.
Bank of Japan intervened, selling \$1.3 billion.
3. 9/26-30 Central banks of G5 heavily intervened: sell dollars.
4. 10/5 IMF meeting in Seoul.
5. 10/24 Bank of Japan, initiating "high interest policy".
6. 12/8 OPEC agreed to keep market shares; oil price decrease.
7. 12/17 Bank of Japan, quit "high interest policy."
8. 1/18 G5 in London. No agreement on interest rate cut.
9. 1/24 Finance Minister's interview on Yen rate.
10. 1/29 Bank of Japan, Discount rate cut #1 (announcement).
11. 3/7 Bank of Japan, Discount rate cut #2 (announcement).
Coordinated interest rate cut with Germany and U.S.
12. 3/18 Bank of Japan, intervened in N.Y.: Buy dollars.
13. 4/6 EMS realignment
14. 4/18 Bank of Japan, discount rate cut #3 (announcement).
Coordinated interest rate cut with Germany and U.S.
15. 5/4-6 Tokyo summit

FIGURE 2

Major Market Hours in 24-hour Clock (Tokyo time)



Note: Daylight saving time is observed from the end of April to the end of October in New York. During that time, the New York market hours should be shifted by one hour counter-clockwise.