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**MACROECONOMIC NEWS ANNOUNCEMENTS AND  
THE YEN/\$US INTRADAY EXCHANGE RATE**

**Brent Hughes**

**A Thesis  
In  
The Faculty  
of  
Commerce and Administration**

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## **ABSTRACT**

### **MACROECONOMIC NEWS ANNOUNCEMENTS AND THE YEN/\$US INTRADAY EXCHANGE RATE**

**Brent Hughes**

This study provides new evidence on the effects of macroeconomic news announcements and their impact on the yen/US\$ exchange rate. Trading days are divided into 4 groups: (1) major US announcement days, (2) minor US announcement days, (3) Japanese announcement days, and (4) Non-announcement days. These groups are examined to determine the effects they have upon the volatility of intraday (five-minute) returns of yen futures contracts. Both Japanese and US announcements are also examined in order to determine which specific announcements have the greatest affect upon the exchange rate.

Both US and Japanese announcements are found to have significant impacts on the volatility of intraday returns of yen futures contracts. Major US announcements were found to have the greatest affect upon the exchange rate, with Japanese announcements having the second largest affect. The increased volatility, due to the release of the announcements continues to affect volatility throughout the day, however the major impact disappears quite rapidly.

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## **I. INTRODUCTION**

Daily experience seems to support the view that individual asset prices are influenced by a wide variety of unanticipated events and that some events have a more pervasive affect on asset prices than do others. According to the efficient markets hypothesis, security prices should only respond to the unexpected part of any announcements, that part which is truly news, since the expected part of the announcement should already be embedded in asset prices. In addition, this hypothesis maintains that the full response of asset prices to news will occur essentially immediately. This paper employs data on market participants' expectations of certain economic announcements to investigate whether the evidence supports the efficient markets view.

Two major aspects of the market response to new information have been explored in past literature ( Ederington and Lee 1995). First, how long does it take for the information to be fully reflected in market prices in the sense that price volatility returns to normal levels? Second, how quickly and efficiently does the market incorporate the new information? If prices adjust slowly, traders with quick access to the market may be able to earn excess trading profits based on the initial market response. Furthermore, trading profits are only possible if the direction of future price changes is predictable. Thus, volatility may remain high if subsequent price adjustments are large but unpredictable.

As the world's recent experience with the Asian crisis has shown, it is important to have an understanding of how foreign economies and markets interact with the domestic market. Among the recent studies examining the effect of macroeconomic news on market prices, the response of foreign exchange rates has received considerable attention. It is important to note that exchange rates are the relative price of two assets (currencies), therefore the rate can respond to domestic and/or foreign news. Furthermore, the foreign exchange market is open almost continually somewhere in the world. Therefore, when analyzing the effects of news on exchange rates, it is essential to look at other country's news as well as U.S. news. Previous studies have largely focused only on the impact of U.S. news announcements.

This study attempts to contribute to the current literature by looking at the effects that both U.S. and Japanese macroeconomic news announcements have upon the yen/U.S. exchange rate through the use of intraday data. The features of this study provide important insight on the linkage between the U.S. and Japanese economies. By identifying what kind of news influences the exchange rate more, and also by identifying what kind of news in each market moves the exchange rate, numerous insights can be gained on which factors have contributed to the strong value of the U.S. dollar and the collapse of the Japanese Yen throughout this period.

This study proceeds as follows. In the next section, a brief review of the pertinent literature is provided. Section 3 describes the data and announcements used in the

study, while Section 4 discusses their anticipated effects on the exchange rate. Section 5 estimates the impact of the announcements using 5-minute intervals for currency prices. The final section summarizes the main conclusions.

## **II. LITERATURE REVIEW**

### **2.1 Macroeconomic News Announcements and Equity Markets**

One data source that has been used to investigate the release of macroeconomic news announcements is equity markets. The relationship between macroeconomic variables and equity markets has been the subject of many research efforts<sup>1</sup>. The results from these studies are mixed. Numerous studies, including Wasserfallen (1989), Mitchell and Mulherin (1994), and Fitzpatrick (1994) find that the macroeconomic news announcements has no significant effect on stock prices. The results from these studies discourage a market timing investment approach due to its inability to achieve superior stock market results. Furthermore, Cutler, Poterba, and Summers (1989) find that unexpected macroeconomic developments only accounted for approximately 35% of stock return variability. Therefore, other factors such as political developments that affect future policy expectations and international events are also very important in asset pricing. The central question in interpreting their

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<sup>1</sup> See Castanias (1979), Schwert (1981), Pearce and Roley (1985), Chen, Roll and Ross (1986), French and Roll (1986), Jain (1988), Cutler, Poterba, and Summers (1989), Wasserfallen (1989), Fitzpatrick (1994), Mitchell and Mulherin (1994), Becker, Finnerty, and Friedman (1995).

evidence is whether the unexplained return announcements are due to omitted macroeconomic variables or other factors.

Announcements about economic variables may also affect trading volume if the market participants rebalance their portfolios based on the new information. If market participants disagree about the effects of surprises in announcements there should be increased trading activity in the market soon after the announcements. In contrast, if traders are in consensus about the effects of new information, trading activity may be abnormal even when prices change. Thus, examining the trading activity provides useful information about the actions taken by the market participants based on macroeconomic news that stock returns alone can not. Jain (1988) examines hourly trading volume to investigate the response of the market participants to various macroeconomic news announcements. The results indicate that trading volume is not associated with surprises in the macroeconomic announcements. Mitchell and Mulherin (1994) reach a similar conclusion. These results are consistent with the hypothesis that market participants interpret the surprises in macroeconomic news announcements in an analogous manner and do not engage in additional trading.

However, many past studies have also found macroeconomic variables to have very significant effects on equity markets. Castanias (1979) was the first to report that the variance of stock prices rises around the days of most economic news events, which he interprets as a reflection of new information appearing. However, expected and unexpected announcements are not differentiated because he uses dummy

variables for the days of the announcements and ignores market expectations. Pearce and Roley (1985) expand the research by using daily stock returns, and find that money supply announcements have a significantly negative effect on stock prices. Jain (1988) extends their study by using hourly returns data to obtain a more precise estimate, and finds both money supply and CPI announcements to have significant effects. Other studies, which find significant effects, include Schwert (1981), Chen, Roll, and Ross (1986), and Becker, Finnerty, and Friedman (1995). Thus, the possible trading profits available from further understanding the relationship between macroeconomic news announcements and asset pricing makes this an important area for further research.

## **2.2 Foreign Exchange Markets and Macroeconomic News Announcements**

Another data source that many studies are now using to investigate the response of asset prices to macroeconomic news is the foreign currency markets<sup>2</sup>. Hardouvelis (1988) first emphasized the necessity of isolating the impact of the news announcements to gain a precise measure of its effect, yet he utilized daily price changes on foreign currency as a measure of the effect. Recently, exchange rate studies using transactions data have appeared in the literature<sup>3</sup>. However, as explained by Tanner (1997) the worldwide volume of the spot market makes working

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<sup>2</sup> See Frankel (1981), Edwards (1983), Doukas (1985), Hoffman and Schlagenhauf (1985), Hakkio and Pearce (1985), and Ito and Roley (1987), Hardouvelis (1988), Ederington and Lee (1993, 1995), and Tanner (1997).

<sup>3</sup> See Goodhart et al. (1993), Ederington and Lee (1993, 1995, 1996), and Tanner (1997).

with such a data set so burdensome that these studies have worked with only about three months of data at a time.

Use of intraday spot data allows two significant improvements (Tanner 1997). First, the market's actual response to news announcements can be more closely isolated, avoiding unrelated noise that may occur later in the day. Second, intraday spot data can reveal the market's reaction speed to the new information. Efficient markets fully process new information instantaneously, market reaction well beyond the announcement period may be evidence of market inefficiency. Several papers have attempted to address this same issue. A study by Hakkio and Pearce (1985) used intraday data to show how currency prices respond to information. The authors used price quotes collected at 9:00am, noon and 4:40pm to examine the announcement effects of macroeconomic news, plus the anticipation and persistence effect of these announcements. Persistence effects were found to be largely insignificant. Ederington and Lee (1993, 1995) used higher frequency intraday data in a more recent sample period. Their study examined five-minute intervals of return volatility in the deutschemark futures market. They found that volatility increased at the time of several U.S. macroeconomic announcements, and they gauged the market's speed of adjustment by measuring how long volatility remained higher than normal. The authors found that, in general, most of the impact occurred in the first minute after the announcement, and that return volatility returned to normal within 45 minutes after the announcement. However, Tanner (1997), using spot rates, found surprisingly different results in a sample period very similar to that of Ederington and

Lee (1993). He found that the dollar / deutschemark exchange rate is significantly affected by announcements of the merchandise trade balance and the consumer price index. The impact of the trade balance is significant only in the first half-hour following the announcement but the consumer price index news is not fully impounded in the exchange rate for at least three and one-half hours. The difference found in the two studies in regards to the prolonged persistence effects of announcements could be due to the use of different data sources, futures and spot rates. Informed traders turn to the futures market prior to dealing with spot rates. As noted by Kawaller, Koch, and Koch (1993), futures markets adjust to new information more quickly than spot markets.

### **2.3 Foreign Macroeconomic News Announcements**

As is recognized in the previously mentioned literature on the response of asset prices to economic announcements, it is desirable to take the shortest interval possible around potential news since other shocks may dilute the estimated effect over time. In addition, as Edwards (1982, 1983, 1984) points out, exchange rates should respond to not only U.S. news but also foreign news. This leads to the question of how to measure exchange rate responses to foreign news. Since an exchange rate is the relative price of two assets (i.e. currencies), changes in the rates could be in response to domestic and/or foreign news (Ito and Roley 1987). Therefore, an analysis of the effects of news on exchange rates needs to be carried out with respect to the other



country's news as well as U.S. news. However, if exchange rate responses to domestic and foreign news are to be separated, intraday data becomes essential in order to separate the reactions to both domestic and foreign news.

In one of the first studies in this area, Doukas (1985) analyzes the relation between both U.S. and Canadian money supply announcements and the current US\$/C\$ exchange rate. He finds that the exchange rate is more sensitive to U.S. than Canadian money supply announcements. He also identifies a significant positive correlation between U.S. monetary innovations and changes in the current US\$/C\$ exchange rate.

Ito and Roley (1987) study the effects of U.S. and Japanese money supply, industrial production, and wholesale price announcements by examining the opening and closing quotes of the yen/dollar exchange rate in the Tokyo market and the 9 a.m., noon, and 4:30 p.m. quotes in the New York market for each business day from January 1980 through September 1985. They conclude that the New York market was typically more volatile, suggesting that the most significant news is generated in the U.S.; and that among the economic announcements considered, U.S. money announcement surprises had the most consistent effects. Positive surprises in the money supply are found to result in dollar appreciation.

Further evidence has also been provided, in regards to the intraday interdependence structure between U.S. and Japanese markets. Employing opening

and closing index data, Kato (1990), Becker Finnerty, and Gupta (1990), and Hamao, Masulis, and Ng (1990) report that the U.S. equity market has a strong influence on the Japanese equity market, although the opposite does not hold. However, by using hourly returns, Becker, Finnerty, and Tucker (1992) provide evidence that suggests that the documented significant correlation between current Japanese open-to-close returns is attributable to a sticky Japanese opening index value. This would cause returns that are generally independent of the lagged returns of the U.S. market, regardless of their magnitude. However, a recent study by Karolyi and Stulz (1996), utilizing a constructed index of inter-listed Japanese stocks trading in New York as American Depository Receipts (ADRs), demonstrates that the S&P 500 returns in the previous day explain from 7 to 25% of the fluctuations in the Nikkei Index open to close returns. In contrast, the Japanese market had only a small impact on U.S. equities, accounting for only 1 percent of the changes in U.S. open to close returns.

Finally, Becker, Finnerty, and Friedman (1995) examine the source of equity market linkages between the U.S. and U.K. by focusing on intraday price movements of stock index futures contracts. Using macroeconomic survey expectation data for both countries, they find that the U.S. and U.K. markets generally respond alike to U.S. news, with inflation and merchandise trade figures particularly important to both countries. This evidence demonstrates the importance of public information in explaining international equity market linkages. In addition, while U.S. information is important to both countries, S&P 500 returns do not appear to be significantly related to U.K. macroeconomic disclosures. The aforementioned studies provide

support for the view that the documented international market linkages are attributable to reactions of foreign traders to public information originating from the US.

The rapid and significant reaction of other markets to U.S. market movements can be attributed to two causes (Becker, Finnerty, and Friedman 1995). The first view, which is consistent with efficient markets theory, is that the heightened awareness of U.S. equity market performance by international participants is attributable to the preeminence of the U.S. in the world marketplace. Since the U.S. is the dominant producer of goods and services in the world economy, the U.S. is also the most important producer of information. In addition it is also thought that U.S. traders will possess a more provincial view and ignore information from other countries. Thus, common reactions to U.S. news will result in an international correlation structure in which the U.S. leads the world.

The second explanation of this phenomenon is a systematic tendency on the part of foreign traders to overreact to the movements of the U.S. market. According to this view, international participants ignore fundamental international economic information and simply focus on price movements in other countries, particularly the U.S. However, Becker, Finnerty, and Friedman (1995) show that the U.K. market responds immediately to U.S. macroeconomic news surprises rather than waiting for the U.S. market's reaction to the U.S. news, which supports the previously mentioned hypothesis.

As mentioned in the literature, it is extremely important when examining macroeconomic announcements to use finely partitioned data, consistent with efficient markets hypothesis. There is also merit to studies of the exchange rate between two countries and the reaction to news announcements from both countries. No study to date has done both, using futures markets data. To the extent that information traders utilize futures markets, due to its advantages (low transactions cost, ease of execution, etc.) it seems worthwhile to address the issues using futures market data.

### **III. DATA AND ANNOUNCEMENTS**

#### **3.1 Yen/US\$ Foreign Exchange Data**

The data set, which consists of tick-by-tick transaction prices for the yen/US\$ exchange rate, for each business day (422 trading days) from January 1996 through August 1997. Futures market prices are examined, as futures markets are where information traders disseminate information first. The nearby contract, which is the most liquid contract, is used to stay consistent with (Ederington and Lee 1993). The Japanese yen futures data were obtained from the Chicago Mercantile Exchange (CME) and are formatted according to Central Standard time. Exchange personnel who observe the pits from a platform above the exchange floor and post the most recent price record these transaction prices to the nearest second. Since their

objective is to provide market participants with the current price on a real time basis, the observers record every price change but not subsequent trades at the same price. During this two year period, the Japanese yen futures market opened at 7:20 and closed at 14:00<sup>4</sup>. The prices used are for the nearest contract except during an expiration month.

Using this data set, the responses of the exchange rate to U.S. and Japanese economic news can be differentiated to a greater degree. Due to the 14-hour (13-hour during daylight saving time) time difference between Tokyo and New York, the business hours of the two markets do not overlap. However, most Japanese announcements are released during trading time on the US markets. Thus, the exchange rate during these trading hours should reflect not only U.S. news but also Japanese news. Harvey and Huang (1991) find higher U.S.-Japanese exchange rate volatility during U.S. trading hours, possibly accounting for the increased information arriving in the market. Our data set allows us to examine, for the first time the effects of both Japanese and U.S. economic announcements on exchange rates on an intraday basis.

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<sup>4</sup> Central Standard Time

### 3.2 US Announcements

This study begins by examining the market's response to the announcement of the 18 U.S. Macroeconomic variables, which were analyzed by Ederington and Lee (1993, 1995, 1997) and are briefly described in Appendix 1. The eighteen monthly announcements whose upcoming release is regularly covered in "The Week Ahead" section of Business Week.<sup>5</sup>, are described in Appendix 1. Only monthly announcements are examined. The figures for these announcements were collected from the Bloomberg database. Market analyst's expected figures for these announcements were also obtained from the Bloomberg database. All eighteen announcements are government releases.

As noted in the Appendix, nine of the releases are released at 7:30 a.m., two at 8:15 a.m., six at 9:00 a.m., and one at 1:00 p.m. (all Central Standard Time). Ederington and Lee (1993, 1995) found that some announcements had a much greater impact on prices than others. A brief explanation of the six U.S. macroeconomic indicators which have virtually become the "standard macroeconomic announcements" in exchange rate studies<sup>6</sup> is given below: money supply, the trade deficit, the unemployment rate, the consumer price index, the producer price index, and industrial production.

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<sup>5</sup> A few other upcoming monthly announcements are reported in this column but not on a consistent basis.

<sup>6</sup> See Hakkio and Pearce (1985) Ito and Roley (1987) or Tanner (1997).

i) Money Supply – this variable represents the announced weekly percentage change in M1. The figure is formed from a survey of Federal Reserve member banks' balance sheets. The announcement is made every Thursday at 4:30 pm. However, This study only incorporates monthly announcements, and therefore the M1 variable's closest substitute is the monthly federal budget. The federal budget represents the monthly budget that is released by the Department of the Treasury. However, the Japanese money supply (M2 +CD) announcement is included in the study.

ii & iii) CPI and PPI - Monthly percentage changes in the consumer and producer price index are released at 8:30am near the middle of each month. The PPI is announced a few days before the CPI; because they both are measures of inflation, the PPI announcement may bring more new information to the market than the CPI announcement. However, both indices have their limitations as measures of inflation (Tanner 1997). The CPI measures only the price inflation of an urban household's typical shopping list; the PPI also includes investment goods, but does not cover the cost of services and imported goods. Both also suffer from a six to seven week delay between measurement and announcement.

iv) Trade deficit variable - is the Merchandise Trade Deficit, which is also released at 8:30am around the middle of the month. It is a seasonally adjusted monthly figure representing the level of the deficit incurred in the month ending six to seven weeks previously.

v) Unemployment rate - is typically announced the first Friday of every month at 8:30am. The rate represents the number of unemployed people as a percentage of the labor force in the previous month.

vi) Industrial production index - is also released mid-month at 8:30am. The figures are seasonally adjusted and represent the previous month's change in quantity of output in manufacturing, mining, and utilities.

### **3.3 Japanese Announcements**

The Japanese macroeconomic announcements used in this study were also obtained from the Bloomberg database and are listed in Appendix 2. In order for an announcement to be included, market analyst expectations of the announcements also had to exist in Bloomberg. Complete analyst expectations and announcement times were available for twelve announcements. As noted in the Appendix, five of the releases are released at 7:50 a.m., two at 8:30 a.m., one at 12:30 p.m., and four at 1:00 p.m. (all Central Standard time). Since two announcements, GDP and retail sales, are released after the US market closes they were excluded from the study.



#### **IV. EXPECTED COEFFICIENT SIGNS**

Simple monetary models of exchange rates suggest that news of higher-than-expected money growth will cause the domestic currency price to fall if the change in money growth is perceived to be permanent. However, if the Fed is committed to its M1 growth targets, a positive surprise may be only a temporary increase in money supply, but may signal a permanent increase in money demand (Tanner 1997). In this case, real interest rates would rise, attracting capital inflows and raising the price of the dollar. The response to the Federal Reserve's weekly money announcements is investigated by Cornell (1982, 1983), Frankel and Hardouvelis (1985), Engel and Frankel (1984), Hardouvelis (1984), and Roley (1986), among others. Most of the evidence is consistent with the so-called policy-anticipations (or Keynesian) hypothesis in that a positive money announcement surprise causes dollar appreciation. Under this hypothesis, the observed positive response of U.S. interest rates to positive money announcement surprises represents a real interest-rate response, leading to an appreciation of the dollar in foreign exchange markets (Urich and Wachtel 1981). The real rate rises due to the expectation of future tightening by the Federal Reserve as a reaction to the unanticipated increase in money. However, Pearce and Roley (1985) examined the daily response of stock prices to money supply announcements and found a significantly negative effect for the 1977-1982 sample period.

Announcements of consumer or producer price indices should convey news about inflation to the market. The effect of inflation surprises is debatable. Purchasing power parity suggests that a rise in domestic inflation will cause a rise in the domestic

price of foreign currency. Sticky price equilibrium models predict that higher-than-expected permanent inflation will appreciate the value of the domestic currency in the short run, with money supply held constant. An increase in price level creates an excess demand for money. The real interest rate rises, attracting capital inflows, which drive the price of the home currency higher. This “disequilibrium” is reversed in the long run. Tandon and Simaan (1985) find a negative correlation between the value of the dollar and domestic inflation surprises, whereas Hakkio and Pearce (1985) found that inflation surprises had no significant effect on exchange rates.

Unfavorable news concerning the trade balance should depreciate the domestic currency. A high trade deficit surprise means a higher supply of the domestic currency, resulting in a reduced price. Hogan et al. (1991) suggest that trade deficit surprises may affect exchange rates in other ways. First, if the Federal Reserve has trade balance targets, an unusually high deficit may signal future Fed intervention to depreciate the dollar and improve the trade balance. Second, they also suggest that there may be a “politically-sensitive level” of the trade deficit. If this level is exceeded, the government may impose import restrictions, which would eventually drive up the US price level and cause the dollar to depreciate. Madura and Tucker (1992) document a significantly positive correlation between US trade deficit surprises and the dollar prices of five foreign currencies.

News about unemployment and industrial production could signal changes in national income. Keynesian theories predict that higher national income increases

imports and depreciates the domestic currency. Rising unemployment or declining industrial production could indicate an economic slowdown and subsequent domestic currency appreciation. According to the monetary model, an increase in income will cause an increase in demand for the domestic currency and a currency appreciation. Thus, domestic currency value should be negatively correlated with unemployment news and positively correlated with production news. Harris and Zabka (1995) find that an unanticipated rise in US unemployment causes the dollar to appreciate.

The impact of all of these announcements may be dampened by several factors. First, there is always a lag time between measurement and announcement (Tanner 1997). These announcements thus refer to past changes, which may have already affected the exchange rate. Second, the market does not necessarily interpret the news as signals of future changes. That is, if the market interprets an announcement surprise as a temporary fluctuation, the surprise may have little or no effect on the exchange rate.

The Japanese announcements are expected to have similar effects as the US announcements. However, due to the US dominance in the world market place, it is expected that the Japanese announcements affects on the exchange rate will be significantly less than those of the US announcements.

## V. METHODOLOGY AND RESULTS

### 5.1 Intraday Volatility

To examine intraday volatility, log returns,  $\ln(P_t/P_{t-1})$  are calculated from prices on the nearby contract for each five-minute period over the trading day. Building on Leng's (1996) results, this study separates the whole sample into four subsamples: (1) the A-sample (US major announcements), (2) the B-sample (US minor announcements), (3) the C-sample (Japanese announcements), and (4) the N-sample, including all trading days except those when any of the above macroeconomic statistics were announced. The sample sizes for each of these groups is given in Appendix 3. Standard deviations of these log returns calculated across all trading days in each of the samples are shown in figure 1 (pg. 37). In this figure, the time on the horizontal axis indicates the end of the interval in central standard time, e.g., 7:55 for 7:50 to 7:55 returns.

Panel A, in Figure 1 compares the exchange rate volatility during trading days in which a major US macroeconomic announcement occurs versus' days during which no announcements are released. The figure shows that prices appear to be much more volatile between 7:30 and 7:35 on days when major US announcements occur compared to non-announcement days. This is particularly interesting because all major US macroeconomic announcements are released at 7:30. Thus, the large volatility spike at 7:35 is assumed to be caused by the market receiving new

information from the news releases on these days. These results are in accordance with other studies (Ederington and Lee 1993, Leng 1996). Volatility remains quite low throughout the rest of the trading periods, including from market open (7:20) up to the time just before the major announcements are released (7:30).

Panel B, in Figure 1 compares trading days with US macroeconomic announcements deemed to be of minor importance from other studies (Ederington and Lee 1993,1994 , Leng 1996), versus trading days with no announcements. Exchange rate volatility is only slightly more pronounced throughout days with minor US announcements occurring than on non-announcement days. Therefore, these minor US announcements appear to bring far less pertinent information to the market than the previously mentioned major US announcements.

Panel C, in Figure 1 compares trading days during which Japanese announcements are released with trading days during which no announcements are released. During days when Japanese macroeconomic announcements are released there are pronounced volatility spikes throughout the trading day; however none of these as pronounced as the volatility spike occurring at 7:35 on days during which the major US announcements are released. The Japanese announcements are released throughout the day , often at no particular time, possibly accounting for the numerous volatility spikes.

To closer examine the variances of the 4 groups, the Brown-Forsythe-modified-Levene (B-F-L) test statistic (F1) for the null hypothesis that the variance of returns is constant throughout the trading day, is calculated in Table I. The null hypothesis is rejected at the 1 percent level for all four groups. However, the null is overwhelming rejected for the days when major US announcements are released, and then is followed by the days when Japanese announcements are released. The null hypothesis is still significant at the .01 percent level for minor US announcement days and non-announcement days, however the F statistic is much lower, and trading appears to be relatively flat as seen in Figure 1.

## **5.2 Which Announcements Move the Market?**

In this section, the response of the yen/US\$ exchange rate to specific announcements of important economic news is examined. Japanese announcements are analyzed in parallel with U.S. announcements. Since the exchange rate could be influenced by either economy, parallel effects from Japanese news announcements might be expected. However, due to the difference in monetary policy rules, regulations, institutions, and economic structures, announcement effects may not be symmetric between the two countries (Ito and Roley 1987). Two separate models are used to examine the significance of the announcements; one model incorporates dummy variables while the other focuses on the unexpected surprise component of

the news announcements. To isolate the impacts of the announcements, Yen futures contracts were sampled at 5 minute intervals.

### 5.2.1 Market Survey Model and Specifications

To examine the effects of major US macroeconomic news announcements on the yen/US\$ exchange rate, I have adapted the specification of Tanner (1997):

$$\begin{aligned} \Delta \text{Log } E_t = & \alpha + \beta_1 \text{CPI}_t + \beta_2 \text{DUR}_t + \beta_3 \text{UNEM}_t + \beta_4 \text{GNP}_t + \beta_6 \text{MTB}_t \\ & + \beta_7 \text{MTB}_t + \epsilon_t \end{aligned} \quad (1)$$

where  $\Delta \text{Log } E_t$  represents the percentage change in the futures price between the 5-minute intervals measured on day  $t$ . Each independent variable (which is listed in Appendix 1) represents the unexpected news, which would affect the exchange rate on day  $t$ . The value of each independent variable takes on the value of the surprise component of the announcement, or zero if no announcement has occurred<sup>7</sup>. The unexpected component is defined as the percentage difference between the market's expectation of the announcement and the actual announcement.

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<sup>7</sup> For instance, a positive coefficient on the US money supply variable would indicate that the dollar depreciates relative to the mark in response to higher-than-expected US money growth, and appreciates with lower-than-expected US money growth

Under the null hypothesis of market efficiency, and if the market incorporates news rapidly, the coefficients on the surprise components of the announcements, should equal zero in segments following that of the announcement. Alternatively, if one segment of the market either over- or under-reacts to news, subsequent segments may exhibit significant responses.

US announcements which are deemed of minor importance through previous studies (Ederington and Lee 1993, Leng 1996, and Tanner 1997) are analyzed through equation (2):

$$\begin{aligned} \Delta \text{Log } E_t = & \alpha + B_1 \text{IP}_t + B_2 \text{CAP}_t + B_3 \text{BI}_t + B_4 \text{CON}_t + B_5 \text{FI}_t + B_6 \text{NAPM}_t \\ & + B_7 \text{NHS}_t + B_8 \text{PI}_t + B_9 \text{Bud}_t + \epsilon_t, \end{aligned} \quad (2)$$

The model used to examine the intra-daily impact of Japanese macroeconomic announcements on exchange rates is similar to equations (1) and (2), but uses variables in accordance with Japanese announcements:

$$\begin{aligned} \Delta \text{Log } E_t = & \alpha + \beta_1 \text{CA}_t + \beta_2 \text{MTB}_t + \beta_3 \text{TAN}_t + \beta_4 \text{MO}_t + \beta_5 \text{DIFF}_t + \beta_6 \text{HS}_t \\ & + B_7 \text{LSRET}_t + B_8 \text{GDP}_t + B_9 \text{WPI}_t + B_{10} \text{MS}_t + \epsilon_t, \end{aligned} \quad (3)$$

The independent variables used in equation (3) are listed in Appendix 2.



### 5.2.2 Dummy Variable Model and Specifications

Ederington and Lee's (1993) model, used to determine which announcements have the greatest impact on the market, unlike the previous model does not incorporate a survey forecast to separate the announced figure into anticipated and surprise components. Instead, their model defines a series of dummy variables  $D_{kt}$  where  $D_{kt} = 1$  if announcement  $k$  is made on day  $t$  and  $D_{kt} = 0$  otherwise. The dependent variable is the absolute value of the difference between the actual return  $R_{jt}$  for the five-minute interval  $j$  on day  $t$  and the mean return  $R_j$  for interval  $j$  over all 422 trading days. Ederington and Lee (1993) propose that the previously mentioned market survey model manages to capture the impact of announcements on the level of rates, however it does not delineate the effect on market volatility and does not allow for the comparison of the relative importance of various announcements. Ederington and Lee's (1993) regression format is shown below:

$$|R_{jt} - R_j| = \alpha_{oj} + \sum_{k=1}^K \alpha_{kj} D_{kt} + e_{jt} \quad (4)$$

Separate regressions for each five-minute interval  $j$  are estimated over 422 trading days. If log returns are normally distributed with constant mean but time-varying variance,  $E |R_{jt} - R_j| = (\pi/2)^{0.5} \alpha_{oj}$  where  $\alpha_{oj}$  is the standard deviation of returns in interval  $j$  on day  $t$ . Consequently,  $(\pi/2)^{0.5} \alpha_{oj} = 1.2533 \alpha_{oj}$  provides an estimate of the standard deviation of returns in interval  $j$  on non-announcement days (Schwert 1989). If the announcement results in a surprise of either good or bad news,  $\alpha_{kj}$  should be

positive if announcement  $k$  impacts the market. The estimated standard deviation of returns in interval  $j$  on days when  $k$  is announced is given by  $1.2533 (\alpha_{oj} + \alpha_{kj})$ . If an announcement is ignored by the market,  $\alpha_{kj}$  should be approximately zero.

In order to obtain meaningful estimates  $\alpha_{kj}$  of the impact of an announcement on the standard deviation of returns, it is necessary that the announcement occur at a consistent time  $j$  and not always coincide with another announcement. In the minor US announcement group, the industrial production report is released at the same time and day as the capacity utilization report. The capacity utilization report is therefore excluded from the sample, however, it must be noted that any effects shown from the industrial production announcement may also be contributed partially from the capacity utilization announcement. The NAPM survey was also released alongside the construction spending report and was also removed from the sample. Finally, in the Japanese announcements group, the Tankan survey was not released at any specific time and was excluded from the sample. Other Japanese announcements were not always released at a perfectly consistent time, however as long as the announcement was released at the same time more than 50 percent of the time it was included in the sample, minus the days it was released at other time periods.

### *5.2.3 Estimation Results*

Results for the regressions, testing the impact of specific announcements on yen futures markets are shown in Tables II,III,IV,V,VI and VII. Tables II – IV contain

the results from the market survey model, while tables V – VII contain the results from Ederington and Lee’s dummy variable model.

Among the major US announcements, the unemployment report, and the merchandise trade deficit are both significant at the 1 percent level when tested using Ederington and Lee’s (1993) dummy variable model. The producer price index was also found to be significant, however, only at the 10 percent level. These announcements help explain the volatility spike during the 7:30 – 7:35 time period on days when major US announcements are released. On days when the employment report is released, the estimated standard deviation of yen futures returns is  $1.2533 ( .5238 + .355 ) (10^{-3}) = 1.152$  compared to only  $1.2533 (.355) (10^{-3}) = 0.495$  on non-announcement days. Ederington and Lee (1993) and Tanner (1997) also found the merchandise trade deficit and employment report significant at the 1 percent level when explaining dollar-deutsche mark returns. However, Ederington and Lee (1993) also found GDP, and retail sales significant at the 1 percent level. The results from the market survey model supported these findings with the exception that the market survey regression did not find the producer price index to be significant in this market. The results from the market survey model show that larger U.S. trade deficit surprises cause the yen to appreciate relative to the dollar as theory predicts. This result is consistent with results obtained by Madura and Tucker (1992) and Tanner (1997). Larger than expected unemployment numbers resulted in the yen depreciating against the U.S. dollar. This finding is also consistent with theory. No

minor US announcements were found to be significant regardless of which regression model is used.

Japanese announcements are analyzed in Tables III, and VI. The wholesale price index variable is found to be significant at the 1 percent level, and the money supply variable significant at the 5 percent level, when the dummy variable model is applied. However, when the market survey model is applied, only the wholesale price index report is found to be significant. Results from the market survey model indicate that news of a larger-than-expected Japanese wholesale price index causes the yen to appreciate against the U.S. dollar. These results also conform to theory, as unexpected surprises from the wholesale price index should result in similar exchange rate responses as those implied by the CPI and PPI. The results from Ederington and Lee's (1993) dummy variable model can be used to calculate the increased return volatility for days when the wholesale price index is announced. On days when the wholesale price index report is released, the estimated standard deviation of yen futures returns is  $1.2533 ( .581 + .315 ) (10^{-3}) = 1.123$  compared to only  $1.2533 (.315) (10^{-3}) = 0.395$  on non-announcement days. However, results from the market survey model conflict with Ito and Roley (1997) who did not detect a significant response of the yen/\$US dollar exchange rate in regards to Japanese money supply announcements. However, Ito and Roley's data consist of spot prices instead of future prices, and they use much larger time intervals over which the announcements are analyzed. In this study, the yen appreciates with unexpected increases in the money supply level, possibly indicating an increase in money demand.

### **5.3 Volatility, and the Speed of Adjustment**

#### *5.3.1 Volatility Persistence*

The next issue explored is the speed of which the market is able to adjust to the arrival of this new information. If the market is efficient, the market should incorporate this information as soon as it can be disseminated by currency traders. Therefore, it is expected that the standard deviation of returns will increase with the arrival of the news announcements and return to normal once the full implications of the information for market prices are worked out.

In order to further examine volatility persistence, successive five-minute return variances are calculated for the four groups: (1) major US announcement days, (2) minor US announcement days, (3) Japanese Announcement days, and (4) Days without any macroeconomic news announcements. Five-minute standard deviations are reported successively from 7:30 to 13:30. The ratio of each of the first three groups standard deviations and the non-announcement days standard deviations is also reported along with the Brown-Forsythe-Levene (B-F-L) tests for homoskedasticity.

Table VIII contains the observations of the above methods for testing for volatility persistence. The first noticeable observation is that the standard deviation for major US announcement days during the 7:30-7:35 is almost twice as large as the

standard deviations on non-announcement days. The standard deviation ratio remains at this magnitude until the 7:45-7:50 interval where it decreases to 1.317. The B-F-L F ratio also is significant at the 1 percent level during this period. The B-F-L F ratio is also significant for the Japanese announcement, and minor US announcement groups over this period, although the F ratio is sharply reduced. No Japanese or minor US announcements are announced at this time, therefore the increased volatility can be contributed to the cross-over of major US announcements that occur on these same days or possibly increased early morning volatility which is observed in equity markets (Lockwood and Linn 1990).

Since the Japanese money supply, and wholesale price index ( the significant Japanese announcements) are released at 7:50, increased volatility is expected at this time. The B-F-L test statistic for the five-minute interval following these announcements is found to be significant. There is also evidence over the time period spanning from 8:05 to 8:15 of continuing effects from these announcements with B-F-L ratio remaining significant. The standard deviation ratio varies from around 1 to 1.5 throughout the rest of the day's intervals, showing signs of volatility persistence that last until the market closes.

After the initial increase in volatility during the minor US announcement days, the standard deviation remains relatively low, with the standard deviation ratio between the minor announcement days and the non-announcement days remaining at approximately one, with no significant B-F-L F statistics.

Further evidence of the volatility adjustment is presented in table IX. This table shows the dummy variable regression results from the 6 periods following the announcements, which were found to be significant in section 2 of this paper. These intervals cover a total time period of 30 minutes. Although, the Japanese money supply variable was not found to be significant in the initial interval following the announcement by way of the Ederington and Lee (1993) regression method, it is included in the table due to being found to be significant through the market survey method.

All four announcements, which were found to be significant at least at the 5 percent level during the initial five-minute interval after the announcement, also show significant effects in following intervals. The merchandise trade deficit announcement remains significant throughout the entire 30-minute time frame. Although, not all of the coefficients remain significant for all the announcements throughout this time period, the coefficients remain positive for most of the announcements. However, after thirty minutes the coefficients have sharply dropped in size, and as is seen in Table VIII, volatility appears to drop off significantly after 15 minutes of trading. Furthermore, the length of time the coefficients remain positive could be due to the length of time it takes traders to fully digest the true impact of the report, in which case the market remains efficient.

## **SUMMARY AND CONCLUSION**

This paper examined yen/US\$ exchange rate by concurrently examining both US and Japanese macroeconomic announcements during the operating hours of the Chicago Mercantile Exchange. Yen futures contracts were used to capture the immediate effects of the announcements, as futures market's prices respond to information before spot markets, due to the participation of informed traders in these markets. In the 1996-1997 sample period, the yen/US\$ exchange rate was affected by both US and Japanese announcements. However, the specific announcements that affected the exchange rate varied for the two countries. The two announcements that had the largest effect on the exchange rate were the U.S. employment report and merchandise trade deficit. In turn, the Japanese equivalent of these announcements had no significant affect upon the market. The Japanese announcements that were found to have significant affects upon the market were the money supply variable and the wholesale price index. The varying effects of the two country's announcements could be attributed to the possible significant differences in material contained in each countries reports or possibly to the importance currency traders place on each country's reports.

Separating the trading day sample into four subgroups based on whether the day contained a major US announcement, minor US announcement, Japanese announcement, or no announcement from either country also revealed important information regarding macroeconomic announcements. Returns throughout the trading days of each of the



groups were found to be highly volatile, with major US announcement days having the highest rate of volatility followed by days when Japanese announcements were released. When these announcement days are compared with non-announcement days, volatility of returns is found to rise significantly on the announcement days at the time when the announcements were released. The increased variance in returns is reduced sharply after the first fifteen minutes of trading, but remains higher than usual throughout the rest of the trading day

These findings stress the importance that macroeconomic announcements have upon the exchange rate. Although major US announcements have the most profound effects, the evidence is nevertheless suggestive that both the US and Japanese economic policies and the behavior of their economies are at least partly responsible for the behavior of the yen/\$US exchange rate over this period.

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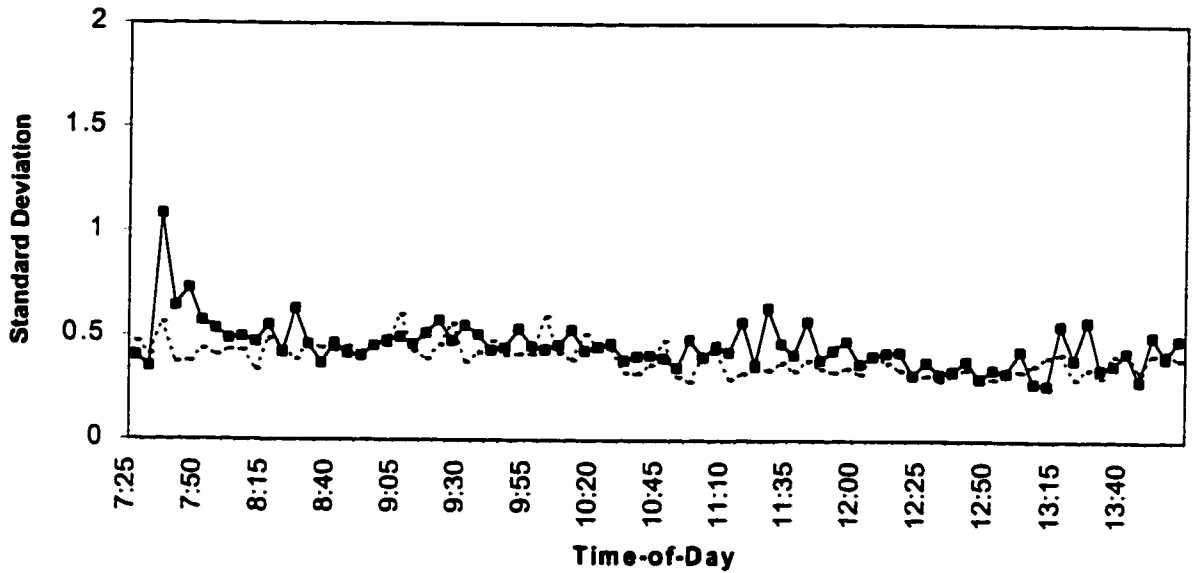
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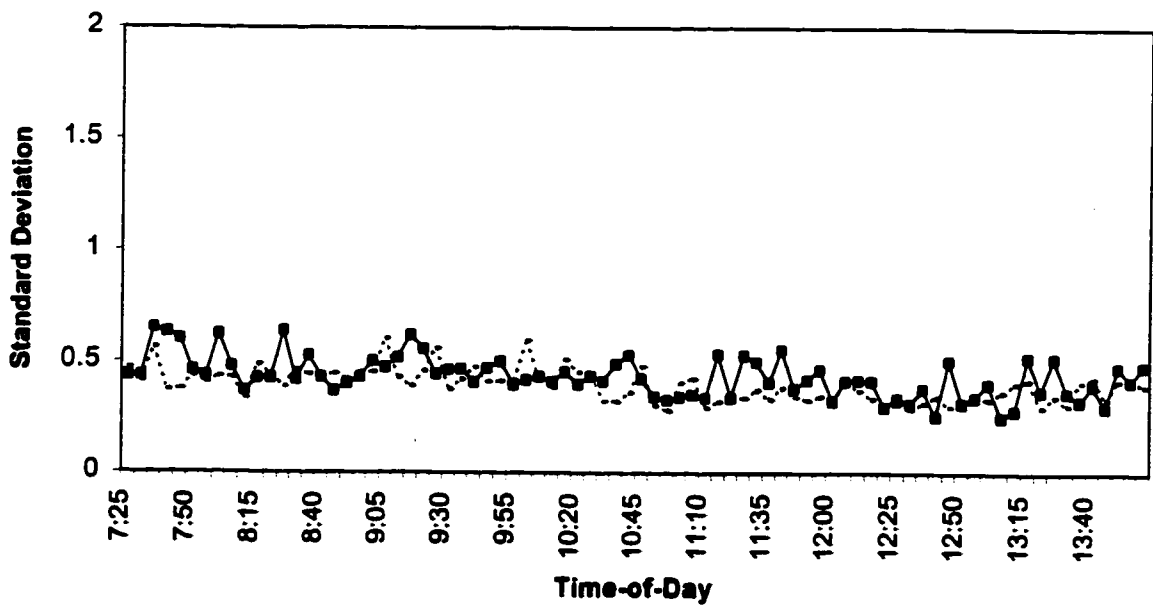
**FIGURE 1**

**Five-Minute Ln Returns of Announcement Days versus Non-announcement Days**

**Panel A: Major US Announcement Days vs Non-Announcement Days**

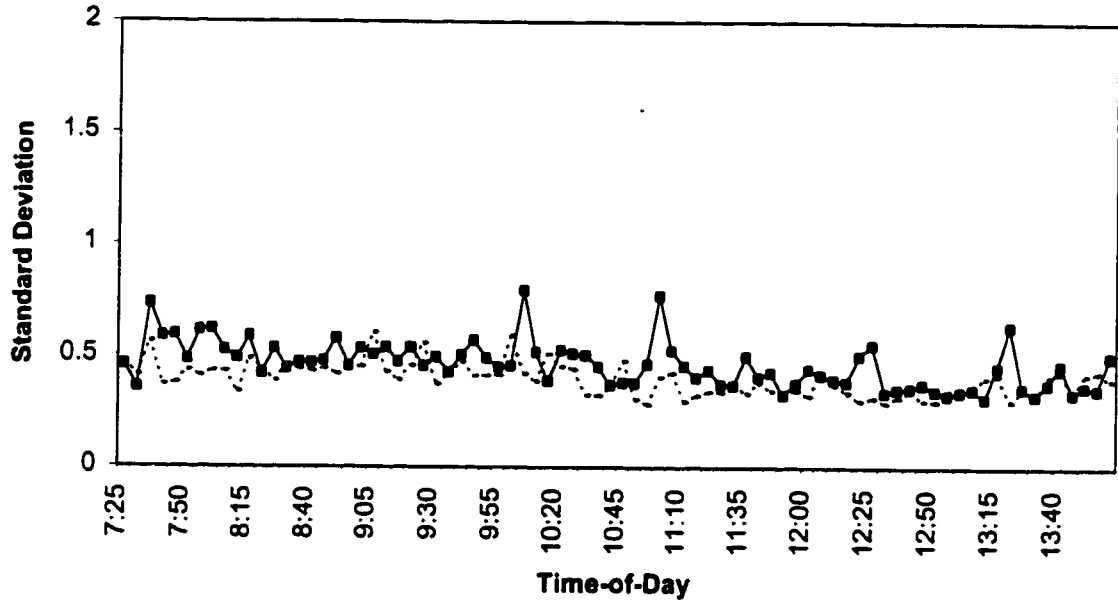


**Panel B: Minor US Announcement Days vs Non-Announcement Days**



**FIGURE 1 - Continued**

**Panel C: Japanese Announcement Days vs Non-Announcement Days**



**Figure 1. Intraday return volatilities on announcement and non-announcement days.** Standard deviations of five-minute returns are reported for trading days with major US announcements, minor US announcements, and Japanese Announcements (solid lines) versus days with none of these announcements (dashed lines). Daily observations from January 1, 1996 through August 31, 1997 are utilized. The reported standard deviations are  $10^3$  times the calculated values and the times shown are interval ending times (CST).

**Table I**

**Test of Homoskedasticity of the Return Variates**

Brown-Forsythe-modified Levene test statistics are reported; F1 is the test statistic for equality of the variances across the 80 intraday five-minute intervals. The Brown-Forsythe-modified Levene test statistic is

$$F = \frac{\sum_{j=1}^J n_j (D_j - D_{..})^2}{\sum_{j=1}^J \sum_{t=1}^{n_j} (D_{jt} - D_j)^2} \frac{(N - J)}{(J - 1)}$$

where  $D_{jt} = |r_{jt} - M_j|$ ;  $r_{jt}$  is the return for day  $t$ , interval  $j$ ;  $M_j$  is the sample median return for interval  $j$  computed over the  $n_j$  days included in the test;  $D_j = \sum_{t=1}^{n_j} (D_{jt}/n_j)$  is the mean absolute deviation (from the median) for interval  $j$ ; and  $D_{..} = \sum_{j=1}^J (D_j/N)$  is the grand mean, and  $N = \sum_{j=1}^J n_j$ . The statistic is distributed  $F_{J-1, N-J}$  under the null hypothesis. One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	Major US A - Days	Minor US A - Days	Japanese A - Days	Non-Announcement Days
F <sub>1</sub>	6.299***	2.692***	3.121***	2.025***



**Table II**

**The Impact of Major US Announcements on the Immediate Five-Minute  
Interval Return Volatility for Yen Futures Contracts**

**\*Survey Forecast Model\***

Coefficients  $\alpha_{ij}$  of the regression  $\Delta \text{Log } E_t = \alpha + B_1 \text{CPI}_t + B_2 \text{DGO}_t + B_3 \text{EMP}_t + B_4 \text{GDP}_t + B_5 \text{MTD}_t + B_6 \text{PPI}_t + B_7 \text{RS}_t + \varepsilon_t$ , are reported.  $\Delta \text{Log } E_t$  is the log return over the five minute interval  $j$ . The regression is estimated for the interval of 7:30-7:35. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	<u>7:30 - 7:35</u>
	Regression Coefficient (T-Value)
Intercept	0.009 (.288)
Consumer Price Index	-3.808*** (-5.838)
Durable Goods Orders	3.481 (.410)
Employment	-.250*** (-2.656)
Gross Domestic Product	3.426 (1.297)
Merchandise Trade Deficit	0.067 (6.771)***
Producer Price Index	1.915 (.356)
Retail Sales	2.200 (.479)
$R^2$	0.421

**Table III**

**The Impact of Minor US Announcements on the Immediate Five-Minute Interval Return Volatility for Yen Futures Contracts**

**\*Survey Forecast Model\***

Coefficients  $\alpha_{ij}$  of the regression  $\Delta \text{Log } E_t = \alpha + B_1 IP_t + B_2 CAP_t + B_3 BI_t + B_4 CON_t + B_5 FI_t + B_6 NHS_t + B_7 PI_t + B_8 Bud_t + \varepsilon_t$ , are reported.  $\Delta \text{Log } E_t$  is the log return over the five minute interval j. The regression is estimated for the variables with announcements being released in that immediated interval for j intervals of 7:30-7:35, 8:15-8:20, 9:00-9:05, 13:00-13:05 over 442 trading days. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	<u>7:30-7:35</u>	<u>8:15-8:20</u>	<u>9:00-9:05</u>	<u>13:00-13:05</u>
	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Intercept	-0.002 (-.047)	0.031 (1.586)	-0.001 (-.055)	-0.005 (-.282)
<u>7:30 A.M. Announcements</u>				
Housing Starts	1.073 (.316)	-	-	-
Leading Indicators	-9.310 (-.983)	-	-	-
Personal Income	-2.551 (-.319)	-	-	-
<u>8:15 Announcements</u>				
Industrial Production	-	0.720 (1.32)	-	-
<u>9:00 A.M. Announcements</u>				
Business Inventories	-	-	0.427 (.537)	-
Construction Spending	-	-	8.629 (1.128)	-
New Home Sales	-	-	-0.069 (-.365)	-
Wholesale Price Index	-	-	2.940 (1.55)	-
<u>1:00 P.M. Announcements</u>				
Federal Budget	-	-	-	0.0054 (.484)
R <sup>2</sup>	0.053	0.010	0.010	0.001

**Table IV**

**The Impact of Japanese Announcements on the Immediate Five-Minute Interval Return Volatility for Yen Futures Contracts**

**\*Survey Forecast Model\***

Coefficients  $\alpha_{kj}$  of the regression  $\Delta \text{Log Et} = \alpha + B1\text{CA}_t + B2\text{MTB}_t + B3\text{MO}_t + B4\text{CON}_t + B5\text{DIFF}_t + B6\text{HS}_t + B7\text{WPI}_t + B8\text{CPI}_t + B9\text{EMPLY}_t + B_{10}\text{MS}_t + B_{11}\text{HSPEND}_t + \epsilon_t$ , are reported.  $\Delta \text{Log Et}$  is the log return over the five minute interval  $j$ . The regression is estimated for  $j$  intervals of 7:50-7:55, 8:30-8:35, 12:30-12:35, and 13:00-13:05 over 422 trading days.. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	<u>7:50-7:55</u>	<u>8:30-8:35</u>	<u>12:30-12:35</u>	<u>13:00-13:05</u>
	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Intercept	-0.016 (-.662)	-0.007 (-.324)	0.005 (.286)	-0.003 (-.178)
<u>7:50 A.M. Announcements</u>				
Current Account	0.0001 (.557)	-	-	-
Merchandise Trade Balance	0.0001 (.507)	-	-	-
Money Supply	0.173** (2.380)	-	-	-
Wholesale Price Index	0.028 (.566)	-	-	-
<u>8:30 A.M. Announcements</u>				
CPI	-	0.679 (1.047)	-	-
Employment	-	0.254 (.564)	-	-
<u>12:30 P.M. Announcements</u>				
Industrial Production	-	-	-0.558 (-.065)	-
<u>1:00 P.M. Announcements</u>				
Diffusion Index	-	-	-	1.52 (1.613)
Household Spending	-	-	-	1.220 (.318)
Housing Starts	-	-	-	0.029 (.364)
Machinery Orders	-	-	-	-1.128 (-.198)
R <sup>2</sup>	0.016	0.003	0.000	0.011

**Table V**

**The Impact of Major US Announcements on the Immediate Five-Minute Interval Return Volatility for Yen Futures Contracts**

**\*Dummy Variables Model\***

Coefficients  $\alpha_{kj}$  of the regression  $|R_{jt} - R_j| = \alpha_{0j} + \sum_{k=1}^K \alpha_{kj} D_{kt} + e_{jt}$  are reported.  $R_{jt} = \ln(P_{jt}/P_{j-1,t})$  is the log return over the five minute interval  $j$  where  $P_{jt}$  is the price at the end of interval  $j$  on day  $t$ .  $D_{kt} = 1$  is announcement  $k$  is released on day  $t$ . The regression is estimated for interval  $j$  of 8:30-8:35. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	8:30 - 8:35 Regression Coefficient (T-Value)
Intercept	0.355*** (13.313)
Consumer Price Index	0.067 (0.582)
Durable Goods Orders	0.118 (0.980)
Employment	0.5238*** (4.848)
Gross Domestic Product	-0.015 (-0.136)
Merchandise Trade Deficit	1.340*** (11.474)
Producer Price Index	0.214* (1.380)
Retail Sales	0.016 (1.38)
R <sup>2</sup>	0.271

Table VI

**The Impact of Minor US Announcements on the Immediate Five-Minute Interval Return Volatility for Yen Futures Contracts**

**\*Dummy Variables Model**

Coefficients  $\alpha_{kj}$  of the regression  $|R_{jt} - R_j| = \alpha_{0j} + \sum_{k=1}^K \alpha_{kj} D_{kt} + \epsilon_{jt}$  are reported.  $R_{jt} = \ln(P_{jt}/P_{j,t-1})$  is the log return over the five minute interval  $j$  where  $P_{jt}$  is the price at the end of interval  $j$  on day  $t$ .  $D_{kt} = 1$  if announcement  $k$  is released on day  $t$ . The regression is estimated for  $j$  intervals of 7:30-7:35, 8:15-8:20, 9:00-9:05, and 13:00-13:05. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	<u>7:30-7:35</u>	<u>8:15-8:20</u>	<u>9:00-9:05</u>	<u>13:00-13:05</u>
	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Intercept	0.476*** (16.872)	0.284*** (19.353)	0.352*** (17.301)	0.229*** (19.047)
<u>7:30 A.M. Announcements</u>				
Housing Starts	-0.157 (-1.239)	-	-	-
Leading Indicators	-0.253 (-1.478)	-	-	-
Personal Income	-0.079 (-0.549)	-	-	-
<u>8:15 Announcements</u>				
Industrial Production	-	0.064 (.948)	-	-
<u>9:00 A.M. Announcements</u>				
Business Inventories	-	-	0.080 (.842)	-
Construction Spending	-	-	-0.011 (-1.16)	-
New Home Sales	-	-	-0.008 (-.088)	-
Wholesale Price Index	-	-	-0.026 (-.270)	-
<u>1:00 P.M. Announcements</u>				
Federal Budget	-	-	-	-0.0284 (-.499)
R <sup>2</sup>	0.094	0.046	0.072	0.025

Table VII

**The Impact of Japanese Announcements on the Immediate Five-Minute Interval Return Volatility for Yen Futures Contracts**

**\*Dummy Variables Model\***

Coefficients  $\alpha_{kj}$  of the regression  $|R_{jt} - R_j| = \alpha_{0j} + \sum_{k=1}^K \alpha_{kj} D_{kt} + \epsilon_{jt}$  are reported.  $R_{jt} = \ln(P_{jt}/P_{j,t-1})$  is the log return over the five minute interval  $j$  where  $P_{jt}$  is the price at the end of interval  $j$  on day  $t$ .  $D_{kt} = 1$  if announcement  $k$  is released on day  $t$ . The regression is estimated for  $j$  intervals of 7:50-7:55, 8:30-8:35, 12:30-12:35, and 13:00-13:05. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

	<u>7:50-7:55</u>	<u>8:30-8:35</u>	<u>12:30-12:35</u>	<u>13:00-13:05</u>
	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Intercept	0.315*** (17.733)	.303*** (20.007)	.219*** (17.396)	0.229 (19.047)
<u>7:50 A.M. Announcements</u>				
Current Account	0.079 (.936)	-	-	-
Merchandise Trade Balance	0.094 (1.031)	-	-	-
Money Supply	0.158 (1.314)	-	-	-
Wholesale Price Index	0.581*** (4.657)	-	-	-
<u>8:30 A.M. Announcements</u>				
CPI	-	0.147 (1.096)	-	-
Employment	-	0.265 (2.088)	-	-
<u>12:30 P.M. Announcements</u>				
Industrial Production	-	-	-0.030 (-.406)	-
<u>1:00 P.M. Announcements</u>				
Diffusion Index	-	-	-	-0.004 (-.069)
Household Spending	-	-	-	-0.069 (-1.071)
Housing Starts	-	-	-	-0.002 (-.030)
Machinery Orders	-	-	-	0.438 (.765)
R <sup>2</sup>	0.248	0.030	0.001	0.005

**Table VIII**

**Volatility Persistence Following Announcements**

Five-minute return standard deviations are reported and compared for major US announcement days, minor US announcement days, and Japanese announcement days against non-announcement days. The data period is 01/03/96 through 08/29/97.

	7:30-7:35	7:35-7:40	7:40-7:45	7:45-7:50	7:50-7:55	7:55-8:00	8:00-8:05	8:05-8:10	8:10-8:15	8:15-8:20	8:20-8:25
Panel A: Major US Announcements											
Major US announcement day	1.082	0.642	0.728	0.572	0.535	0.486	0.496	0.470	0.552	0.420	0.630
Nonannouncement day	0.561	0.369	0.377	0.434	0.407	0.431	0.429	0.336	0.487	0.440	0.386
Standard deviation ratio	1.927	1.741	1.928	1.317	1.314	1.127	1.156	1.397	1.135	0.954	1.632
B-F-L F ratio	18.955***	15.887***	17.846***	3.3395*	2.731*	1.319	2.530	8.590***	1.434	0.011	2.077
Panel B: Minor US Announcements											
Minor US Announcements	0.650	0.630	0.600	0.459	0.436	0.621	0.478	0.368	0.425	0.425	0.636
Nonannouncement day	0.561	0.369	0.377	0.434	0.407	0.431	0.429	0.336	0.487	0.440	0.386
Standard deviation ratio	1.158	1.709	1.590	1.057	1.071	1.440	1.115	1.093	0.874	0.965	1.647
B-F-L F ratio	0.801	5.062**	5.327**	0.427	0.019	0.070	0.136	0.707	0.251	0.351	1.128
Panel C: Japanese Announcements											
Japanese Announcements	0.733	0.588	0.594	0.483	0.614	0.619	0.525	0.490	0.567	0.420	0.534
Nonannouncement day	0.561	0.369	0.377	0.434	0.407	0.431	0.429	0.336	0.487	0.440	0.386
Standard deviation ratio	1.305	1.594	1.573	1.111	1.507	1.435	1.225	1.456	1.206	0.955	1.383
B-F-L F ratio	3.893**	6.534**	10.175***	0.343	4.795**	0.060	0.849	6.107**	2.825*	0.095	1.489

**Table VIII - Continued**

Volatility Persistence Following Ann	8:25-8:30	8:30-8:35	8:35-8:40	8:40-8:45	8:45-8:50	8:50-8:55	8:55-9:00	9:00-9:05	9:05-9:10	9:10-9:15	9:15-9:20
Panel A: Major US Announcements											
Major US announcement day	0.460	0.367	0.464	0.414	0.403	0.452	0.477	0.493	0.457	0.512	0.574
Nonannouncement day	0.460	0.440	0.431	0.444	0.416	0.450	0.451	0.602	0.428	0.389	0.456
Standard deviation ratio	1.000	0.834	1.076	0.931	0.965	1.004	1.058	0.820	1.067	1.316	1.259
B-F-L F ratio	0.488	0.495	0.052	0.384	0.040	0.254	0.012	0.006	0.391	1.740	3.114*
Panel B: Minor US Announcements											
Minor US Announcements	0.418	0.526	0.428	0.366	0.401	0.428	0.500	0.471	0.515	0.618	0.554
Nonannouncement day	0.460	0.440	0.431	0.444	0.416	0.450	0.451	0.602	0.428	0.389	0.456
Standard deviation ratio	0.909	1.195	0.994	0.825	0.959	0.954	1.110	0.782	1.202	1.587	1.216
B-F-L F ratio	0.034	1.528	0.314	0.339	0.437	0.035	0.125	0.595	0.857	0.988	1.517
Panel C: Japanese Announcements											
Japanese Announcements	0.443	0.471	0.467	0.478	0.578	0.453	0.535	0.504	0.538	0.472	0.537
Nonannouncement day	0.460	0.440	0.431	0.444	0.416	0.450	0.451	0.602	0.428	0.389	0.456
Standard deviation ratio	0.982	1.071	1.085	1.076	1.384	1.008	1.187	0.838	1.255	1.213	1.178
B-F-L F ratio	0.003	0.017	0.177	1.579	0.416	0.002	0.097	0.000	1.339	1.183	0.900



**Table VIII - Continued**

Volatility Persistence Following Ann	9:20-9:25	9:25-9:30	9:30-9:35	9:35-9:40	9:40-9:45	9:45-9:50	9:50-9:55	9:55-10:00	10:00-10:05	10:05-10:10	10:10-10:15
Panel A: Major US Announcements											
Major US announcement day	0.477	0.552	0.506	0.431	0.443	0.533	0.449	0.434	0.455	0.528	0.428
Nonannouncement day	0.557	0.373	0.419	0.473	0.408	0.411	0.413	0.592	0.419	0.383	0.508
Standard deviation ratio	0.856	1.479	1.208	0.810	1.085	1.286	1.089	0.734	1.086	1.377	0.843
B-F-L F ratio	0.566	4.813**	2.436	0.282	0.668	3.573*	0.762	0.857	0.636	1.859	1.753
Panel B: Minor US Announcements											
Minor US Announcements	0.442	0.481	0.465	0.405	0.469	0.500	0.393	0.416	0.431	0.407	0.452
Nonannouncement day	0.557	0.373	0.419	0.473	0.408	0.411	0.413	0.592	0.419	0.383	0.508
Standard deviation ratio	0.793	1.236	1.112	0.855	1.147	1.216	0.953	0.703	1.029	1.061	0.889
B-F-L F ratio	1.360	1.837	0.352	2.080	1.392	2.942*	0.002	1.207	0.018	0.723	0.856
Panel C: Japanese Announcements											
Japanese Announcements	0.454	0.494	0.424	0.503	0.570	0.491	0.447	0.455	0.792	0.516	0.386
Nonannouncement day	0.557	0.373	0.419	0.473	0.408	0.411	0.413	0.592	0.419	0.383	0.508
Standard deviation ratio	0.814	1.325	1.013	1.064	1.395	1.184	1.082	0.768	1.889	1.348	0.759
B-F-L F ratio	0.790	5.817**	0.025	0.301	2.138	2.487	0.454	0.449	0.771	2.625	3.635*

**Table VIII - Continued**

Volatility Persistence Following An	10:15-10:20	10:20-10:25	10:25-10:30	10:30-10:35	10:35-10:40	10:40-10:45	10:45-10:50	10:50-10:55	10:55-11:00	11:00-11:05	11:05-11:10
	Panel A: Major US Announcements										
Major US announcement day	0.446	0.464	0.382	0.403	0.407	0.394	0.347	0.484	0.398	0.451	0.422
Nonannouncement day	0.451	0.440	0.324	0.320	0.361	0.477	0.304	0.280	0.404	0.424	0.284
Standard deviation ratio	0.990	1.055	1.179	1.261	1.129	0.824	1.141	1.728	0.986	1.064	1.436
B-F-L F ratio	0.110	0.065	0.035	4.552**	0.186	0.150	3.617*	2.807	0.142	0.134	4.4459**
	Panel B: Minor US Announcements										
Minor US Announcements	0.397	0.432	0.411	0.488	0.528	0.423	0.342	0.327	0.341	0.351	0.337
Nonannouncement day	0.451	0.440	0.324	0.320	0.361	0.477	0.304	0.280	0.404	0.424	0.284
Standard deviation ratio	0.881	0.982	1.270	1.527	1.465	0.885	1.126	1.167	0.845	0.828	1.146
B-F-L F ratio	1.286	0.069	1.015	2.088	1.067	1.001	3.917**	1.569	2.855*	1.561	1.114
	Panel C: Japanese Announcements										
Japanese Announcements	0.525	0.509	0.502	0.449	0.368	0.378	0.377	0.461	0.769	0.523	0.455
Nonannouncement day	0.451	0.440	0.324	0.320	0.361	0.477	0.304	0.280	0.404	0.424	0.284
Standard deviation ratio	1.166	1.156	1.551	1.404	1.022	0.792	1.240	1.646	1.905	1.235	1.548
B-F-L F ratio	0.045	0.714	1.058	7.286***	0.036	0.309	2.726*	3.100	0.659	0.914	4.203**

**Table VIII - Continued**

Volatility Persistence Following Ann	11:10-11:15	11:15-11:20	11:20-11:25	11:25-11:30	11:30-11:35	11:35-11:40	11:40-11:45	11:45-11:50	11:50-11:55	11:55-12:00	12:00-12:05
Panel A: Major US Announcements											
Major US announcement day	0.567	0.362	0.636	0.463	0.408	0.572	0.365	0.430	0.475	0.365	0.404
Nonannouncement day	0.321	0.340	0.336	0.373	0.331	0.383	0.343	0.327	0.346	0.319	0.411
Standard deviation ratio	1.769	1.065	1.891	1.243	1.233	1.485	1.121	1.317	1.378	1.145	0.981
B-F-L F ratio	2.492	0.132	5.032	1.342	0.820	1.966	0.019	1.115	1.476	0.016	0.114
Panel B: Minor US Announcements											
Minor US Announcements	0.533	0.337	0.527	0.497	0.405	0.551	0.378	0.417	0.463	0.321	0.412
Nonannouncement day	0.321	0.340	0.336	0.373	0.331	0.383	0.343	0.327	0.346	0.318	0.411
Standard deviation ratio	1.660	0.992	1.568	1.333	1.224	1.439	1.101	1.278	1.340	1.009	1.001
B-F-L F ratio	0.667	0.275	1.736	0.866	1.598	0.917	0.106	0.109	1.832	0.002	0.001
Panel C: Japanese Announcements											
Japanese Announcements	0.400	0.435	0.370	0.367	0.488	0.403	0.424	0.324	0.374	0.440	0.412
Nonannouncement day	0.321	0.340	0.336	0.373	0.331	0.383	0.343	0.327	0.346	0.319	0.411
Standard deviation ratio	1.247	1.281	1.099	0.966	1.504	1.054	1.235	0.991	1.081	1.363	1.000
B-F-L F ratio	1.143	1.599	0.356	0.003	2.152	0.000	2.546	0.390	0.877	4.054	0.157

**Table VIII - Continued**

Volatility Persistence Following An	12:05-12:10	12:10-12:15	12:15-12:20	12:20-12:25	12:25-12:30	12:30-12:35	12:35-12:40	12:40-12:45	12:45-12:50	12:50-12:55	12:55-13:00
Panel A: Major US Announcements											
Major US announcement day	0.418	0.422	0.312	0.374	0.318	0.332	0.381	0.286	0.340	0.325	0.430
Nonannouncement day	0.372	0.336	0.298	0.312	0.288	0.315	0.344	0.300	0.296	0.344	0.331
Standard deviation ratio	1.124	1.255	1.048	1.201	1.104	1.056	1.108	0.986	1.148	0.943	1.288
B-F-L F ratio	0.163	2.984*	0.824	1.374	0.019	0.492	0.104	0.002	0.947	0.561	0.019
Panel B: Minor US Announcements											
Minor US Announcements	0.418	0.413	0.295	0.335	0.311	0.378	0.255	0.503	0.314	0.340	0.400
Nonannouncement day	0.372	0.336	0.298	0.312	0.288	0.315	0.344	0.300	0.286	0.344	0.331
Standard deviation ratio	1.119	1.228	0.981	1.075	1.077	1.202	0.743	1.678	1.081	0.987	1.207
B-F-L F ratio	0.012	0.980	0.009	0.010	0.159	1.204	7.075***	1.155	0.674	0.037	0.013
Panel C: Japanese Announcements											
Japanese Announcements	0.393	0.382	0.500	0.548	0.333	0.349	0.358	0.373	0.343	0.323	0.340
Nonannouncement day	0.372	0.336	0.298	0.312	0.288	0.315	0.344	0.300	0.296	0.344	0.331
Standard deviation ratio	1.056	1.136	1.681	1.763	1.154	1.109	1.034	1.242	1.158	0.839	1.025
B-F-L F ratio	0.066	1.058	1.473	1.719	2.050	2.097	0.357	1.679	0.348	0.465	0.086

**Table VIII - Continued**

Volatility Persistence Following Announce	13:00-13:05	13:05-13:10	13:10-13:15	13:15-13:20	13:20-13:25	13:25-13:30
Panel A: Major US Announcements						
Major US announcement day	0.275	0.268	0.553	0.390	0.573	0.344
Nonannouncement day	0.362	0.402	0.417	0.288	0.344	0.307
Standard deviation ratio	0.760	0.665	1.327	1.309	1.663	1.120
B-F-L F ratio	3.307*	1.446	0.017	0.188	0.806	1.677
Panel B: Minor US Announcements						
Minor US Announcements	0.251	0.283	0.519	0.367	0.515	0.363
Nonannouncement day	0.362	0.402	0.417	0.288	0.344	0.307
Standard deviation ratio	0.682	0.704	1.246	1.232	1.496	1.183
B-F-L F ratio	7.139***	2.586	0.172	0.148	0.208	0.659
Panel C: Japanese Announcements						
Japanese Announcements	0.350	0.310	0.451	0.632	0.358	0.323
Nonannouncement day	0.362	0.402	0.417	0.288	0.344	0.307
Standard deviation ratio	0.966	0.772	1.081	2.124	1.039	1.053
B-F-L F ratio	0.489	1.003	0.475	2.078	0.044	0.939

**Table IX**

**The Speed of the Volatility Adjustment in Response to Significant Announcements**

**\*Dummy Variables Model\***

Coefficients  $\alpha_{kj}$  of the regression  $|R_{jt} - R_j| = \alpha_{0j} + \sum_{k=1}^K \alpha_{kj} D_{kt} + e_{jt}$  are reported.  $R_{jt} = \ln(P_{jt}/P_{j,t-1})$  is the log return over the five minute interval  $j$  where  $P_{jt}$  is the price at the end of interval  $j$  on day  $t$ .  $D_{kt} = 1$  is announcement  $k$  is released on day  $t$ . The regression is estimated for the following six intervals after the initial announcement. Only announcements found to be significant at the 0.1 percent level in the first five-minute interval following the announcement are shown. The reported coefficients are the actual coefficients times  $10^3$ . One, two, and three asterisks indicate significance at the 0.1, 0.5, and 0.01 percent levels, respectively.

Major (Significant) US Announcements						
	<u>7:30-7:35</u>	<u>7:35-7:40</u>	<u>7:40-7:45</u>	<u>7:45-7:50</u>	<u>7:50-7:55</u>	<u>7:55-8:00</u>
	Regression	Regression	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Employment	0.524*** (4.848)	0.257*** (2.939)	0.388*** (4.191)	0.288*** (3.700)	0.149* (1.851)	0.005 (.548)
Merchandise Trade	1.340*** (11.474)	0.256*** (2.709)	0.179* (1.788)	0.222*** (2.641)	0.273** (3.116)	0.211** (2.142)
Producer Price Index	0.214* (1.380)	0.085 (.982)	0.086 (.908)	-0.055 (-.691)	-0.092 (-1.100)	-0.042 (-.443)
Japanese (Significant) Announcements						
	<u>7:50-7:55</u>	<u>7:55-8:00</u>	<u>8:00-8:05</u>	<u>8:05-8:10</u>	<u>8:10-8:15</u>	<u>8:15-8:20</u>
	Regression	Regression	Regression	Regression	Regression	Regression
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	(T-Value)	(T-Value)	(T-Value)	(T-Value)	(T-Value)	(T-Value)
Money Supply	0.158 (1.314)	.505*** (3.740)	2.927** (2.555)	0.087 (.876)	0.189 (.159)	-0.055 (-.538)
Wholesale Price Index	.581*** (4.657)	-0.033 (-.282)	.355*** (2.971)	-0.076 (-.741)	-0.080 (-.572)	0.009 (.932)

**Appendix 1**  
**U.S. Macroeconomic Announcements**

Eastern Time	Central S. Time	Var.	Title of Report	Reporting Agency
<b><u>Major Announcements</u></b>				
8:30 am	7:30 am	CPI	Consumer Price Index	Bureau of Labor Stats
8:30 am	7:30 am	DGO	Durable Goods Orders	Bureau of the Census
8:30 am	7:30 am	EMP	Unemployment Report	Bureau of Labor Stats
8:30 am	7:30 am	GDP	Gross Domestic Product	Bureau of Econ Analy.
8:30 am	7:30 am	MTD	Merchandise Trade Deficit	Bureau of the Census
8:30 am	7:30 am	PPI	Producer Price Index	Bureau of Labor Stats
8:30 am	7:30 am	RS	Advance Retail Sales	Bureau of the Census
<b><u>Minor Announcements</u></b>				
8:30 am	7:30 am	HS	Housing Starts	Bureau of the Census
8:30 am	7:30 am	LI	Leading Indicators	Bureau of Econ Analy.
9:15 am	8:15 am	IP	Industrial Production	Federal Reserve Board
9:15 am	8:15 am	CU	Capacity Utilization	Federal Reserve Board
10:00 am	9:00 am	BI	Business Inventories	Bureau of the Census
10:00 am	9:00 am	CS	Construction Spending	Bureau of the Census
10:00 am	9:00 am	WI	Wholesale Inventories	Bureau of the Census
10:00 am	9:00 am	NAPM	NAPM Survey	Nat. Ass. of Purch. Mgrs.
10:00 am	9:00 am	NHS	New Home Sales	Bureau of the Census
10:00 am	9:00 am	PI	Personal Income	Bureau of Econ Analy.
2:00 pm	1:00 pm	BUD	Federal Budget	Dep. of the Treasury

**Appendix 2**  
**Japanese Macroeconomic Announcements**

Eastern Time	Central US Time	Variable	Title of Report
8:50	7:50	CA	Current Account
8:50	7:50	MTB	Merchandise Trade Balance
8:50	7:50	TAN	Tankan Survey
8:50	7:50	WPI	Wholesale Price Index
8:50	7:50	MS	Money Supply (M2 +CD)
9:30	8:30	CPI	Consumer Price Index
9:30	8:30	JAR	Job-to-Applicant Ratio
9:30	8:30	EMPLY	Unemployment Rate
13:30	12:30	IP	Industrial Production
14:00	13:00	HSPEND	Household Spending
14:00	13:00	HS	Housing Starts
14:00	13:00	MO	Machinery Orders (MON)
14:00	13:00	DI	Diffusion Index (Leading)



### Appendix 3

#### TRADING DAYS (SAMPLE SIZES)

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<u>Group</u>	<u>Sample Size</u>
Total Days	442 Days
US Major Announcements	115 Days
US Minor Announcements	148 Days
Japanese Announcements	142 Days
Non-Announcement Days	118 Days

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