

# FOREIGN EXCHANGE TRADERS IN HONG KONG, TOKYO, AND SINGAPORE

## A SURVEY STUDY

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### ABSTRACT

This study presents some findings from a survey of interbank foreign exchange traders in Hong Kong, Tokyo, and Singapore regarding some issues in exchange rate economics. Exchange rates are perceived to react to the unexpected component of macroeconomic news within the first minute of announcements. On labeling their trading methods, the traders' responses distribute quite evenly among strategies based on technical and fundamental considerations. Central banks are accused of exacerbating volatility via intervention. While more than one-half of the traders suggest interventions restore equilibrium and are conducted at the right time, they are divided on whether interventions achieve their goal. Our survey results also indicate that the responses depend on the market in which the trader is located, seniority, trading capacity, market share, and headquarters location.

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## INTRODUCTION

This paper reports some results from a mail survey of interbank foreign exchange traders regarding issues in exchange rate economics. The survey was conducted in the three major Far East foreign exchange markets; namely, Hong Kong, Singapore, and Tokyo. According to the Bank for International Settlements (1996), these three Far East centers account for 22.73 percent of the total global foreign exchange trading volume.

The survey methodology has been adopted to study economic phenomena for a long time. For example, one of the early survey studies is Hall and Hitch (1939). Since the recent float, a few survey studies on foreign exchange markets have been conducted. In the 1980s the Group of Thirty (1980, 1985) commissioned two survey studies on the global foreign exchange market. Recently, the Bank for International Settlements conducts a foreign exchange market survey once every three years. The survey focuses on transaction types and patterns in the major foreign exchange centers around the world. Results of the latest triennial survey were reported in the Bank for International Settlements (1996).

However, the survey approach is not unequivocally accepted by the profession. Economists' skepticism of the usefulness of survey studies can be traced back to the famous "billiard player" analogy (Friedman and Savage 1948). However, as argued by Blinder (1991), results from a properly designed survey can provide valuable complementary facts that are not otherwise available to economists. For example, the survey results in Taylor and Allen (1992) provide some interesting information on the use of technical analysis in the London foreign exchange market.<sup>1</sup>

The response of exchange rates to news releases is an issue considered in our survey. The asset price approach predicts that exchange rates, like other financial prices, react to information that alters expectations on fundamentals. Thus, effects of macroeconomic announcements, especially the unexpected component, can provide useful insights on the effects of fundamentals on exchange rates. Our survey draws on the first-hand experience of the traders and solicits their views on the rate at which exchange rates react to the unexpected component of macroeconomic announcements.

Foreign exchange dealers in the major trading banks jointly determine the interbank foreign exchange rates. Their trading activity thus has profound implications for exchange rates. However, there is limited empirical evidence on the trading strategies pursued by interbank foreign exchange traders. One set of our survey questions is designed to gather information on trading behavior. Specifically, we provide the traders with a list of trading strategies and ask them to select one strategy from the list to label their trading methods.

Central bank intervention is a well-publicized event in the global foreign exchange market. Central banks intervene in the market when they decide exchange rates have substantially deviated from their equilibrium values, a situa-

tion typically attributed to speculative activity though monetary and economic policies can well be the explanation. In general, the desirability of official intervention depends on the motivation. Even Milton Friedman (1953) consents to official intervention if the objective is to smooth out temporary fluctuations and not to interfere with fundamental adjustments. Foreign exchange dealers are frontline players in the interbank market and directly observe the impact of central bank intervention. In this survey study the market practitioners are asked to assess the effects of intervention.

In this survey we have replies from traders with diverse backgrounds from three different foreign exchange centers. The sample offers an excellent opportunity to determine if traders have different views of the market and if the response patterns

**Table 1.** Information About Respondents and Their Organizations

1.a Respondent's Position			
	Hong Kong	Tokyo	Singapore
Treasurer/Manager	68	28	30
Chief/Senior Dealer	117	38	44
Dealer/Junior Dealer	37	9	7
Others	5	1	8
Total	227	76	89

  

1.b Daytime Position Limit (Million US\$)			
	Hong Kong	Tokyo	Singapore
Below 10	31.5%	25.7%	15.2%
10-25	36.0%	13.5%	26.6%
26-40	10.0%	12.2%	15.2%
41-55	4.5%	12.2%	16.5%
56-70	2.5%	8.1%	2.5%
over 70	12.0%	27.0%	19.0%
Value at Risk	3.5%	1.4%	5.1%

  

1.c Headquarters Location			
	Hong Kong	Tokyo	Singapore
North America	17.6%	13.2%	27.0%
Europe (include UK)	44.5%	26.3%	29.2%
Asia	33.5%	50.0%	32.6%
Others	4.4%	10.5%	11.2%

  

1.d Average Daily Turnover of the Organization (Million US\$)			
	Hong Kong	Tokyo	Singapore
Below 100	40.7%	36.8%	23.7%
100-500	27.3%	33.8%	32.9%
500-1000	9.3%	8.8%	22.4%
Over 1000	22.7%	20.6%	21.1%

**Note:** Panel 1.a reports the number of respondents under each of the listed job capacities. Other panels present the percentages of respondents who selected the listed choices. For some questions, the component frequencies of a category do not sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

depend on some characteristics of the respondents. Findings of heterogeneous perceptions and behavior among traders will lend strong support to the use of a heterogeneous agent model in the exchange rate literature.

The rest of the paper is organized as follows. The next section briefly describes the survey and some preliminary data about the respondents. The third section reports the respondents' views on the adjustment to the unexpected component of macroeconomic announcements, the best way to label their trading strategies, and effects of intervention. The fourth section investigates if the response patterns depend on market location, turnover volume, location of headquarters, seniority, and trading capacity. Some concluding remarks are offered in the final section.

## SURVEY DESIGN AND PRELIMINARY RESULTS

In preparing the questionnaire we incorporated advice, comments, and suggestions of a few prominent market practitioners. The survey was conducted between October 1995 and January 1996. In total, 1,961 questionnaires were sent to bank dealers in the Hong Kong, Tokyo, and Singapore interbank foreign exchange markets.<sup>2</sup> The mailing list was prepared from the Dealers Directory published by the Hambros Bank and information provided by the Forex associations in these three regions. We received 392 copies of the completed questionnaire. The response rates were 32.15 percent from Hong Kong, 14.42 percent from Tokyo, and 13.82 percent from Singapore. These response rates are quite reasonable for a mail survey (Alreck and Settle 1985, p. 45). Copies of the survey are available from the authors.

Information about the respondents and their organizations is summarized in Table 1. Judged by the responses reported in panel 1.a, most of the respondents are experienced traders in the foreign exchange business. Over 80 percent have the title of "chief/senior dealer" or "treasurer/manager."<sup>3</sup> The pattern of responses roughly matches the distribution of trader's seniority in the mailing list. We use a nonparametric test of homogeneity to evaluate the hypothesis that the three markets have the same proportion of respondents in each of the four listed positions.<sup>4</sup> The test gives a chi-square statistic of 6.0, which has a  $p$ -value equal to 0.40. This means the distributions of the respondents' seniority are not significantly different in these three foreign exchange centers.

The intraday position limit is the maximum open position a dealer is authorized to assume during the day. Since, in most cases, dealers square their positions at the end of a trading day, the intraday position limit can be used as a proxy for a dealer's trading capacity.<sup>5</sup> The position limits of our respondents exhibit a bimodal distribution (panel 1.b). Most respondents have a daytime position limit either below US\$40 million or above US\$70 million even though responses from the Tokyo market spread more evenly across different position limit classifications. The test of homogeneity yields a statistic of 30.5 ( $p$ -value = 0.00) which indicates

the patterns of position limits in these market locations are not the same. Relatively speaking, the Tokyo center has a higher percentage of dealers with a larger daily trading limit and the Hong Kong center has a higher proportion of respondents with a position limit less than US\$26 million. Note that only a few respondents use the notion of value at risk to describe their position limits.<sup>6</sup>

Panel 1.c shows that 44.5 percent of the respondents from Hong Kong are from financial institutions with headquarters in Europe and the United Kingdom. On the other hand, responses from Asia-based financial institutions comprise 50 percent of the Tokyo sample. The Singapore sample spreads quite evenly across the three major geographic classifications. The chi-square statistic of 16.4 ( $p$ -value = 0.00) confirms that the headquarters of trading banks in the three foreign exchange centers have a wide divergence of geographic compositions.<sup>7</sup>

Data on average daily turnover, which measures the activity and market share of a trading bank, are reported in panel 1.d. The patterns of average daily turnover are quite different in these

three foreign exchange centers. The Singapore center has a lower response frequency in the below-US\$100 million average daily turnover category and a higher rate in the US\$500-1000 million category. In fact, the test of homogeneity gives a chi-square statistic of 14.0 with a  $p$ -value of 0.03, indicating the patterns of replies from the three foreign exchange centers are statistically different from each other.

Overall, respondents from Hong Kong, Tokyo, and Singapore are homogeneous in terms of their seniority in the foreign exchange business but heterogeneous in terms of position limit, location of headquarters, and average daily turnover. In the subsequent analysis, we will examine whether the response pattern depends on these characteristics.

## SURVEY RESULTS

In this section we report the responses from each of the three foreign exchange centers. The way we grouped the responses allows us to detect the possible variation in response patterns across these centers. In the fourth section, a homogeneity test will be used to test if the response pattern depends on the respondents' characteristics.

### The Speed of Adjustment

In the literature, data on macroeconomic announcements are often used to assess the effect of unanticipated news on exchange rates and the relationship between exchange rates and their fundamentals. Mainly due to data availability, most early studies (Dornbusch 1980) use monthly data to investigate the reaction of exchange rates to macroeconomic news. Recent studies, on the other hand, rely heavily on high frequency data such as intraday and tick-by-tick observations to

**Table 2.** Adjustment to the Unexpected Component of Economic Announcements

	Hong Kong	Tokyo	Singapore
<i>Unemployment</i>			
< 10 sec.	49.8%	37.0%	51.2%
< 1 min.	30.4%	34.2%	35.4%
< 10 min.	13.4%	19.2%	11.0%
< 30 min.	4.1%	4.1%	2.4%
> 30 min.	2.3%	5.5%	0.0%
<i>Trade Deficit</i>			
< 10 sec.	45.8%	40.3%	43.4%
< 1 min.	33.3%	31.9%	39.8%
< 10 min.	14.8%	13.9%	13.3%
< 30 min.	4.2%	9.7%	3.6%
> 30 min.	1.9%	4.2%	0.0%
<i>Inflation</i>			
< 10 sec.	34.1%	20.8%	40.2%
< 1 min.	38.7%	26.4%	34.1%
< 10 min.	20.3%	31.9%	20.7%
< 30 min.	3.2%	12.5%	2.4%
> 30 min.	3.7%	8.3%	2.4%
<i>Gross Domestic Product</i>			
< 10 sec.	34.7%	23.3%	35.4%
< 1 min.	30.5%	26.0%	36.6%
< 10 min.	23.5%	34.2%	26.8%
< 30 min.	6.6%	11.0%	0.0%
> 30 min.	4.7%	5.5%	1.2%
<i>Interest Rate</i>			
< 10 sec.	49.5%	41.1%	49.4%
< 1 min.	29.2%	27.4%	26.5%
< 10 min.	10.6%	15.1%	15.7%
< 30 min.	5.1%	8.2%	6.0%
> 30 min.	5.6%	8.2%	2.4%
<i>Money Supply</i>			
< 10 sec.	24.4%	19.4%	32.5%
< 1 min.	33.6%	33.3%	33.7%
< 10 min.	20.3%	25.0%	26.5%
< 30 min.	11.1%	5.6%	6.0%
> 30 min.	10.6%	16.7%	1.2%

**Note:** The percentages of respondents in each category are reported. For some questions the component frequencies of a category do not always sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

characterize announcement effects (Hakkio and Pearce 1985; Ederington and Lee 1993; Andersen and Bollerslev 1998). A comparison of these studies reveals that the observed announcement effects depend on the choice of data frequency and the type of announcement under investigation. Further, the announcement effects rarely account for more than 10 percent of the data variability.

In this survey we focus on the rate at which the foreign exchange market reacts to the unanticipated element of a macroeconomic announcement. Table 2 summarizes the responses. Six types of macroeconomic news (unemployment, trade deficit, inflation, gross domestic product, interest rate, and money supply) are considered. In general, traders believe the price adjustment in reaction to unexpected news occurs very fast. For example, more than 40 percent of the respondents report the effects of unexpected news on unemployment, trade deficit, and interest rate are assimilated within the first 10 seconds of their announcements. The exchange rate seems to have the slowest response rate to the unexpected component of money supply news. Only 32 percent or less of the respondents in these markets report that the effects of money supply surprises are incorporated in exchange rates within 10 seconds of the announcements. For the unanticipated components in the inflation and gross domestic product announcements, there are 40 percent or less of the respondents who believe the effects will be gone in 10 seconds.

Overall, at least 80 percent of the respondents believe that it takes less than 10 minutes for exchange rates to reflect the impacts of the unexpected components of macroeconomic announcements. Our survey results are comparable to those reported in, for example, Ederington and Lee (1993), who find price adjustment to a major announcement typically occurs within the first minute. Anderson and Bollerslev (1998) observe the main impact of announcement effects on exchange rate volatility is gone within 10 to 20 minutes.

In preparing the questionnaire we did not distinguish between the first and second moment effects of announcements in order not to confuse respondents. Further we did not ask the respondents to rank the relative importance of the listed macroeconomic announcements. While the responses show different adjustment rates for different types of announcements, one cannot infer the actual magnitudes of the announcement effects. However, our results reaffirm the importance of using high frequency data to study effects of the unexpected component of macroeconomic announcements.

### Trading Strategy

Traditionally, academics are quite skeptical about the usefulness of technical trading. There is an ongoing debate on the effectiveness and profitability of technical analysis.<sup>8</sup> The exchange rate dynamics in the presence of technical trading is examined by, for example, Frankel and Froot (1990). Despite its widespread implications on exchange rate dynamics and market efficiency, there is only limited empirical evidence on the use of technical analysis in the interbank foreign exchange market. Taylor and Allen (1992) may be the only study that provides direct information on the popularity of technical analysis among traders in the London foreign exchange market.

**Table 3.** Spot Foreign Exchange Trading Method

	Hong Kong		Tokyo		Singapore	
	5 Years Ago		5 Years Ago		5 Years Ago	
	Now	Now	Now	Now	Now	Now
Technical Trading	23.6%	26.4%	22.5%	27.5%	20.1%	25.5%
Customer Order	24.6%	24.9%	26.4%	26.8%	28.1%	29.2%
Fundamentals	23.2%	23.0%	26.4%	21.7%	20.9%	20.8%
Jobbing	28.6%	25.7%	24.8%	23.9%	30.9%	24.5%

**Note:** The percentages of respondents in each category are reported. The component frequencies of a category do not always sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

Our survey offered the respondents a list of trading strategies, which includes both fundamental and nonfundamental approaches, and asked them to use the listed strategies to characterize their trading methods. Specifically, technical trading, trading based on customer orders, trading based on fundamentals, and jobbing are on the list.<sup>9</sup> Thus, in the presence of other competing trading methods, we can evaluate the relative importance of nonfundamental analysis in the interbank market. To see if there is a trend in trading behavior, the respondents are also asked to label their trading methods at two points of time, now and five years ago. The results are reported in Table 3.

The responses distribute quite evenly across the four trading strategy categories. The use of technical rules to facilitate spot foreign exchange trading accounts for about 25 percent of the replies. Over time there is a shift toward technical trading. In the five-year period, the proportion of choices selecting technical trading has increased by 2.8 percent (Hong Kong) to 5.4 percent (Singapore). However, the changes in these proportions are not statistically significant.

The percentage of traders who choose technical trading to label their trading method appear to be lower than that reported in Taylor and Allen (1992), who report that approximately 90 percent of dealers they surveyed in the London foreign exchange market use some form of technical analysis in formulating their short-term trading activity. However, it is noted that in our survey the traders are asked to select the method which best characterizes their trading strategies. It is possible that traders routinely take technical analysis into consideration. However, technical analysis is not the most important factor dictating their trading decisions. Similarly, the Group of Thirty (1985) reports 97 percent of bank respondents and 87 percent of securities houses believe the use of technical trading models has a significant impact on the foreign exchange market. However, only 12 percent of the respondents indicate that trading against the technical resistance and support levels is the best way to describe their trading behavior. Thus, technical analysis is not likely to be a dominating trading tool among interbank traders even though traders recognize its potential impacts on exchange rates.



Trading based on customer orders accounts for 25 percent or more of the responses. In the five-year period, the proportion of traders who characterize their spot trading as driven by customer orders does not show a significant change. The percentage allocated to the choice of customer orders seems high given the usual perception that customer business represents only a small fraction of the overall interbank transactions.<sup>10</sup> However, the result is consistent with Lyons (1997) who shows that customer orders are a central driver of trading strategies in the multi-dealer foreign exchange market. The large interbank transaction volume may reflect the position adjustments that follow some initial customer orders.

One puzzle in exchange rate economics is the limited success of using fundamentals to explain exchange rate movements, especially the short-run dynamics. In the foreign exchange market, most interbank traders close their positions before leaving their offices on a daily basis. Combining these two observations, we find the weights assigned to fundamental analysis, between 21 to 26 percent, are surprisingly high. In the five-year period the percentage for this category dropped by 4.7 percent in the Tokyo market but it barely changed in the other two centers.

In the Group of Thirty (1985) survey, 63 percent of the responses from banks and securities houses selected "jobbing" to describe their spot trading strategy. However, the popularity of jobbing seems to have declined over time. In this survey the proportion of responses that subscribes to the jobbing strategy is less than 30 percent and shows an average decrease of 3.2 percent in the five-year period.

#### Central Bank Intervention

Until the early 1980s the prevailing view in the literature was that intervention, especially sterilized intervention, had a limited impact on exchange rates.<sup>11</sup> Also,

**Table 4.** Effects of Central Bank Intervention

	Hong Kong	Tokyo	Singapore
<i>Volatility</i>			
Increase	72.2%	61.6%	62.2%
Decrease	27.8%	38.9%	37.8%
<i>Fundamental Value</i>			
Away	29.3%	45.1%	36.5%
Toward	70.7%	54.9%	63.5%
<i>Appropriate Timing</i>			
Yes	54.1%	52.9%	60.8%
No	45.9%	47.1%	39.2%
<i>Achieve the Goal</i>			
Yes	60.8%	31.9%	58.7%
No	39.2%	68.1%	41.3%

*Note:* The percentages of respondents in each category are reported. For some questions the component frequencies of a category do not sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

there is no consensus on the stabilization property of official intervention.<sup>12</sup> On the other hand, some recent studies suggest that even sterilized intervention can have a measurable impact on exchange rates through the portfolio balance effect and, more importantly, by signaling future monetary policy.<sup>13</sup> Our questionnaire asked the respondents to evaluate central bank intervention according to its effects on volatility, its ability to restore equilibrium, timing, and the likelihood to achieve the goal.

Table 4 presents the respondents' views on central bank intervention. Over 60 percent of the replies indicate that intervention adds to, rather than reduces, exchange rate volatility. The perception of volatility exacerbation is consistent with the empirical results on intervention and exchange rate volatility reported in some recent studies (Bonser-Neal and Tanner 1996; Dominguez 1998).

Despite volatility exacerbation, more than one-half of the respondents say official intervention helps restore equilibrium exchange rates. Among the three foreign exchange centers, Hong Kong has the highest percentage of respondents supporting the view that intervention tends to restore equilibrium values. At the same time, the Hong Kong center has the highest fraction of responses claiming intervention increases volatility. It is noted that, however, volatility increase and convergence to equilibrium are not necessarily two inconsistent responses.

Group of Thirty (1980) reports some bankers accused central banks of technical incompetence. Among other things, the bankers suggested some central banks were poor at reading the market and intervened at the wrong moment. Several bankers admitted that their foreign exchange profit growth had been at the expense of central banks. Our survey results are in accordance with those of the Group of Thirty. A good proportion of traders in our survey say that central banks are poor in reading the market. Between 39 percent (Singapore) to 47 percent (Tokyo) of the respondents say central bank intervention is usually conducted at the wrong time.

On the question of whether central bank intervention achieves the desired goal, respondents give a mixed evaluation. While over one-half of the replies from Hong Kong and Singapore agree that official intervention achieves its goal, 69 percent of the replies from Tokyo think it does not. It is noted that the Tokyo market has the most pessimistic view on intervention in terms of restoring equilibrium values, being conducted at the right moment, and achieving the goal.

The goal of central bank intervention is not specified in the survey. It is up to the respondents to interpret what the goal is. One possible goal is to stabilize the market. However, this interpretation does not match the results of the responses about the effects of intervention on market volatility. Indeed, the choices of intervention decreasing volatility and intervention achieving its goal appear to be independent as the nonparametric test for homogeneity gives a chi-square statistic of 0.002 ( $p$ -value = .95). Thus, volatility reduction is not likely to be the goal as perceived by traders. However, it is found that the choice of intervention achieving its goal is significantly related to that of intervention moving exchange rates

toward their fundamental values. This inference is supported by a homogeneity test statistic of 20.44 ( $p$ -value = 0.00). Thus, from the traders' perspective, the goal of intervention is to direct exchange rates to their fundamental values.

## CLASSIFICATION EFFECTS

From Table 2 through Table 4, we observe that traders from different centers tend to have dissimilar perceptions about the foreign exchange market.<sup>14</sup> In some

**Table 5.** Response Patterns and Respondents' Characteristics

	Market	Turnover	Rank	Headquarters	Trading Limit
2. <i>Response to Economic News</i>					
Unemployment	10.0 (.262)	17.8 (.121)	21.5 (.044)	7.58 (.475)	20.8 (.408)
Trade Balance	8.67 (.371)	10.7 (.551)	20.3 (.062)	6.15 (.630)	10.9 (.948)
Inflation	24.8 (.002)	16.3 (.176)	20.3 (.061)	9.32 (.317)	8.00 (.992)
Gross Domestic Product	16.5 (.035)	16.8 (.158)	12.2 (.428)	4.47 (.812)	26.2 (.158)
Interest Rate	6.03 (.644)	9.78 (.635)	23.2 (.026)	10.2 (.253)	32.1 (.042)
Money Supply	16.8 (.032)	13.6 (.327)	14.2 (.289)	5.45 (.709)	22.7 (.306)
3. <i>Trading Method</i>					
5 Years Ago	2.87 (.825)	7.17 (.620)	6.66 (.673)	4.85 (.563)	9.59 (.845)
Now	1.58 (.954)	9.96 (.354)	5.78 (.762)	6.48 (.372)	8.26 (.913)
4. <i>Central Bank Intervention</i>					
Volatility	4.39 (.111)	12.5 (.006)	1.86 (.601)	1.75 (.417)	3.30 (.654)
Fundamental Value	6.26 (.044)	1.67 (.642)	5.48 (.140)	11.1 (.004)	3.56 (.615)
Timing	1.28 (.527)	8.32 (.040)	6.10 (.107)	1.95 (.377)	4.55 (.474)
Effectiveness	19.5 (.000)	8.13 (.043)	1.05 (.790)	1.61 (.448)	3.50 (.623)

**Note:** Table 5 reports the homogeneity test results with the  $p$ -values given in parentheses underneath the chi-square statistics. The column headings are "Market" = responses sorted according to market location, "Turnover" = responses sorted according to turnover volume, "Rank" = responses sorted according to the position of respondents, "Headquarters" = responses sorted according to the location of headquarters, and "Trading Limit" = responses sorted according to the respondent's daytime trading limit. The responses to the survey questions under investigation are given in column one with an indicator corresponding to the responses reported in the previous tables. For example, under the indicator 3 are the choices available to the question on trading methods reported in Table 3.

cases, there are some obvious differences between responses from the three foreign exchange centers. In fact, as reported in the second section, the samples from Hong Kong, Singapore, and Tokyo are significantly different from each other in terms of respondents' trading position limit, location of headquarters, and average daily turnover. In this section we conduct a more thorough examination of the implications of respondents' attributes on the response patterns.

First, we use a nonparametric test of homogeneity to investigate if the response patterns from the three foreign exchange centers are significantly different from each other. Formally, the test of homogeneity is used to evaluate the hypothesis that, for each survey question, the three markets have the same proportion of replies in each of the possible responses. Then, we extend our analysis to test if the response pattern depends on seniority, turnover volume (a proxy for market share), headquarters location (a proxy for potential differences in management style), and daytime spot position limit (a proxy for the individual's trade capacity).<sup>15</sup> The homogeneity test statistics and the associated *p*-values are reported in Table 5.

When the survey responses are grouped according to the market location criterion (see the results reported in Table 2 through Table 4), the null hypothesis that the responses are homogeneous across the three foreign exchange centers is rejected in five out of 12 cases at the 5 percent level. Respondents in these three markets tend to disagree on the speed at which the exchange rate reacts to surprises in the inflation, gross domestic product, and money supply announcements. For these four types of macroeconomic news, Table 2 indicates that the responses from Japan are likely to be the source of rejection. Compared with the other two markets, the Japan market has the lowest percentage of respondents who believe the unexpected component of macroeconomic news will be reflected in exchange rates within the first minute of announcements.

The compositions of trading methods in the three Far East markets are very similar. The *p*-value for the homogeneity test statistic is larger than 80 percent. In fact, the compositions also appear quite stable over time (Table 3). When we tested if the composition changes over time, we obtained a chi-square statistic of 1.37 (*p*-value = .71) for Hong Kong, a statistic of 2.27 (*p*-value = .51) for Singapore, a statistic of 1.30 (*p*-value = .73) for Tokyo, and a statistic of 3.72 (*p*-value = .29) for the whole sample. That is, the proportions of traders adopting these trading strategies do not change significantly over the five-year period under consideration.

The homogeneity test indicates that the patterns of responses to the question of whether central bank intervention restores equilibrium and achieves the goal depends on the respondents' market location. The source of differences is likely due to the Tokyo center's pessimistic view on the effects of central bank intervention (Table 4).

When the responses are sorted according to turnover volume, seniority, organization base, and trading limit, the numbers of rejection cases are, respectively, three, two, one, and one. The observed rejection frequencies are larger than the 5

percent test size. This implies that the traders' perception about the foreign exchange market depends on their experiences as shaped by their working environment. However, the responses to the question on trading method are quite similar across different schemes to classify the respondents.

It is interesting to know why these characteristics affect the traders' views on some aspects of the foreign exchange market but not on others. Unfortunately, our survey results only reveal information on response patterns but not answers to the question of why the response patterns depend on traders' characteristics. Nonetheless, our findings confirm that traders, who determine prices in the interbank foreign exchange market, have diverse beliefs and reinforce the importance of using a heterogeneous agent model to describe the foreign exchange market.<sup>16</sup>

## CONCLUDING REMARKS

This study presents some findings from a survey of foreign exchange traders in three Far East foreign exchange centers, namely, Hong Kong, Tokyo, and Singapore. Since the traders participating in the survey are the ones who jointly determine exchange rates in the interbank market, their views on the market offer some alternative perspectives on exchange rate dynamics. The respondents have different beliefs on the exact rate at which the foreign exchange market adjusts to the unexpected components of different macroeconomic announcements. However, most of them report the price adjustment is completed within the first minute of the announcement. On the trading style, the responses are quite evenly distributed across four categories: technical trading, trading based on customer orders, trading based on fundamental analysis, and jobbing. In the presence of other competing trading methods, the use of technical trading is not as widespread as perceived. Further, the overall pattern of trading methods has not changed significantly in the last five years. It is evident that market traders have diverse views on the effects of central bank intervention. For instance, central bank intervention is generally perceived to be conducted at the wrong time and to exacerbate market volatility. However, the respondents also contend that intervention is likely to restore equilibrium and achieve its goal.

The survey results clearly indicate market participants have a wide divergence of opinions on the foreign exchange market. The response pattern depends on the market where the respondent is selected, seniority, trading capacity, market share, and headquarters location. In addition to the heterogeneous exchange rate forecasts and expectations documented in the literature, our results show that market participants adopt different trading strategies and have dissimilar perceptions on adjustment to news and intervention. Thus, the survey results emphasize the use of an exchange rate model that allows for heterogeneous agents with dissimilar beliefs. A potential future research topic is to investigate the source of heterogeneous perceptions and behavior and the subsequent implications on exchange rate dynamics.

## APPENDIX

**Table A1.** Adjustment to the Unexpected Component of Economic Announcements

<i>A1.a Responses Sorted According to Seniority</i>				
	<i>Treasurer/ Manager</i>	<i>Chief/Senior Dealer</i>	<i>Dealer/Junior Dealer</i>	
<i>Unemployment</i>				
< 10 sec.	36.8%	54.9%	47.1%	
< 1 min.	35.1%	28.2%	43.1%	
< 10 min.	18.4%	12.3%	5.9%	
< 30 min.	4.4%	3.6%	2.0%	
> 30 min.	5.3%	1.0%	2.0%	
<i>Trade Deficit</i>				
< 10 sec.	32.5%	50.0%	51.0%	
< 1 min.	39.5%	32.0%	33.3%	
< 10 min.	19.3%	11.3%	11.8%	
< 30 min.	4.4%	6.2%	2.0%	
> 30 min.	4.4%	0.5%	2.0%	
<i>Inflation</i>				
< 10 sec.	29.0%	37.1%	27.4%	
< 1 min.	32.5%	35.1%	47.1%	
< 10 min.	21.9%	21.7%	21.6%	
< 30 min.	7.0%	4.6%	2.0%	
> 30 min.	9.7%	1.6%	3.9%	
<i>Gross Domestic Product</i>				
< 10 sec.	25.4%	40.0%	34.0%	
< 1 min.	31.6%	29.2%	38.0%	
< 10 min.	30.7%	24.5%	20.0%	
< 30 min.	9.7%	4.2%	4.0%	
> 30 min.	2.6%	5.2%	4.0%	
<i>Interest Rate</i>				
< 10 sec.	34.2%	53.9%	56.9%	
< 1 min.	30.7%	27.7%	25.5%	
< 10 min.	17.5%	10.3%	9.8%	
< 30 min.	7.9%	3.6%	7.8%	
> 30 min.	9.7%	4.6%	2.0%	
<i>Money Supply</i>				
< 10 sec.	20.9%	29.4%	19.6%	
< 1 min.	33.0%	32.5%	41.2%	
< 10 min.	22.6%	23.2%	17.7%	
< 30 min.	8.7%	7.2%	15.7%	
> 30 min.	14.8%	7.7%	5.9%	
<i>A1.b Responses Sorted According to Turnover Volume (Million US\$)</i>				
	< 100	100-500	500-1000	> 1000
<i>Unemployment</i>				
< 10 sec.	44.4%	43.4%	43.6%	56.9%
< 1 min.	36.5%	34.3%	35.9%	29.2%
< 10 min.	8.7%	17.2%	18.0%	9.7%

< 30 min.	4.4%	5.1%	2.6%	2.8%
> 30 min.	6.1%	1.0%	2.6%	1.4%
<i>Trade Deficit</i>				
< 10 sec.	43.5%	41.2%	38.5%	50.7%
< 1 min.	30.4%	39.2%	35.9%	37.0%
< 10 min.	14.8%	13.4%	20.5%	9.6%
< 30 min.	7.8%	5.2%	2.6%	1.4%
> 30 min.	3.5%	1.0%	2.6%	1.4%
<i>Inflation</i>				
< 10 sec.	25.2%	28.6%	33.3%	37.5%
< 1 min.	39.1%	31.6%	41.0%	44.4%
< 10 min.	21.7%	28.6%	23.1%	15.3%
< 30 min.	7.0%	6.1%	2.6%	1.4%
> 30 min.	7.0%	5.1%	2.6%	1.4%
<i>Gross Domestic Product</i>				
< 10 sec.	30.4%	27.6%	38.5%	35.6%
< 1 min.	25.9%	32.6%	28.2%	36.6%
< 10 min.	25.9%	33.7%	28.2%	21.9%
< 30 min.	10.7%	4.1%	2.6%	4.1%
> 30 min.	7.1%	2.0%	5.1%	2.7%
<i>Interest Rate</i>				
< 10 sec.	52.6%	39.4%	43.6%	50.7%
< 1 min.	24.6%	36.4%	30.8%	27.4%
< 10 min.	10.5%	12.1%	20.5%	9.6%
< 30 min.	7.0%	6.1%	2.6%	5.5%
> 30 min.	5.3%	6.1%	2.6%	6.9%
<i>Money Supply</i>				
< 10 sec.	22.6%	23.5%	25.6%	30.1%
< 1 min.	27.8%	33.7%	38.5%	41.1%
< 10 min.	20.9%	24.5%	20.5%	19.2%
< 30 min.	13.0%	8.1%	7.7%	5.5%
> 30 min.	15.6%	10.2%	7.7%	4.1%

*A1.c Responses Sorted According to Headquarters Location*

	<i>North American</i>	<i>European</i>	<i>Asian</i>
<i>Unemployment</i>			
< 10 sec.	52.2%	51.8%	42.4%
< 1 min.	25.4%	33.3%	33.1%
< 10 min.	16.4%	10.6%	16.6%
< 30 min.	3.0%	3.6%	4.3%
> 30 min.	3.0%	0.7%	3.6%
<i>Trade Deficit</i>			
< 10 sec.	46.3%	44.3%	42.7%
< 1 min.	31.3%	38.6%	33.3%
< 10 min.	13.4%	13.6%	15.2%
< 30 min.	6.0%	3.6%	5.8%
> 30 min.	3.0%	0.7%	2.9%
<i>Inflation</i>			
< 10 sec.	31.8%	39.0%	27.5%
< 1 min.	37.9%	33.3%	35.5%

< 10 min.	18.2%	22.7%	24.6%
< 30 min.	6.1%	3.6%	6.5%
> 30 min.	6.1%	1.4%	5.8%
<i>Gross Domestic Product</i>			
< 10 sec.	29.8%	33.6%	32.4%
< 1 min.	35.8%	32.1%	29.5%
< 10 min.	22.4%	26.3%	27.3%
< 30 min.	4.5%	5.8%	5.8%
> 30 min.	7.5%	2.2%	5.0%
<i>Interest Rate</i>			
< 10 sec.	47.1%	45.4%	52.2%
< 1 min.	19.1%	34.0%	26.1%
< 10 min.	20.6%	9.2%	12.3%
< 30 min.	5.9%	5.7%	5.1%
> 30 min.	7.3%	5.7%	4.3%
<i>Money Supply</i>			
< 10 sec.	20.9%	28.4%	23.9%
< 1 min.	38.8%	29.8%	34.8%
< 10 min.	17.9%	26.2%	21.0%
< 30 min.	10.4%	7.8%	9.4%
> 30 min.	11.9%	7.8%	10.9%

*A1.d Responses Sorted According to Daytime Trading Limit (million US\$)*

	< 10	10-25	26-40	41-55	56-70	> 70
<i>Unemployment</i>						
< 10 sec.	50.0%	45.4%	45.9%	53.3%	41.7%	50.9%
< 1 min.	29.4%	38.4%	45.9%	30.0%	33.3%	21.1%
< 10 min.	14.1%	9.1%	8.1%	10.0%	8.3%	22.8%
< 30 min.	4.3%	3.0%	2.7%	6.7%	8.3%	1.7%
> 30 min.	2.8%	4.0%	2.7%	3.3%	8.3%	3.5%
<i>Trade Deficit</i>						
< 10 sec.	45.2%	41.4%	40.5%	51.7%	45.4%	47.4%
< 1 min.	32.3%	38.4%	40.5%	31.0%	27.3%	31.6%
< 10 min.	14.0%	12.1%	18.9%	13.8%	9.1%	14.0%
< 30 min.	6.4%	6.1%	2.7%	3.4%	9.1%	3.5%
> 30 min.	2.1%	2.0%	2.7%	3.4%	9.1%	3.5%
<i>Inflation</i>						
< 10 sec.	32.3%	31.6%	32.4%	31.0%	16.7%	31.6%
< 1 min.	34.4%	34.7%	43.2%	44.8%	41.7%	31.6%
< 10 min.	23.7%	23.5%	13.5%	20.7%	25.0%	26.3%
< 30 min.	6.4%	4.1%	5.4%	3.4%	8.3%	5.3%
> 30 min.	3.2%	6.1%	5.4%	3.4%	8.3%	5.3%
<i>Gross Domestic Product</i>						
< 10 sec.	33.0%	32.6%	22.2%	23.3%	16.7%	38.6%
< 1 min.	24.2%	36.7%	41.7%	43.3%	16.7%	24.5%
< 10 min.	25.3%	23.5%	25.0%	33.3%	58.3%	28.1%
< 30 min.	9.9%	4.1%	8.3%	3.3%	8.3%	5.3%
> 30 min.	7.7%	3.1%	2.8%	3.3%	8.3%	3.5%
<i>Interest Rate</i>						
< 10 sec.	55.0%	47.0%	35.1%	46.7%	16.7%	54.4%
< 1 min.	22.0%	33.0%	43.2%	30.0%	41.7%	19.3%



< 10 min.	15.4%	8.0%	8.1%	13.3%	8.3%	15.8%
< 30 min.	3.3%	8.0%	2.7%	10.0%	8.3%	3.5%
> 30 min.	4.4%	4.0%	10.8%	3.3%	25.0%	7.0%
<i>Money Supply</i>						
< 10 sec.	17.2%	27.3%	18.9%	31.0%	8.3%	29.8%
< 1 min.	33.3%	34.3%	35.1%	31.0%	25.0%	36.8%
< 10 min.	21.5%	22.2%	27.0%	31.0%	25.0%	19.3%
< 30 min.	12.9%	9.1%	5.4%	3.5%	8.3%	8.8%
> 30 min.	15.1%	7.1%	13.5%	3.5%	33.3%	5.3%

**Note:** Responses sorted according to seniority, turnover volume (million US\$), headquarters location, and daytime trading limit (million US\$) are reported in Panels A1a, A1b, A1c, and A1d, respectively. The percentages of respondents in each category are given. For some questions the component frequencies of a category do not always sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

**Table A2. Spot Foreign Exchange Trading Method**

A2.a Responses Sorted According to Seniority

	Treasurer/ Manager		Chief/Senior Dealer		Dealer Junior Dealer	
	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW
Technical Trading	20.1%	24.3%	22.8%	27.1%	29.8%	27.0%
Customer Order	29.0%	30.0%	23.9%	25.1%	21.4%	22.6%
Fundamental	25.0%	24.3%	23.0%	21.2%	22.6%	21.7%
Jobbing	25.9%	21.4%	30.3%	26.6%	26.2%	28.7%

A2.b Responses Sorted According to Turnover Volume (Million US\$)

	< 100		100-500		500-1000		> 1000	
	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW
Technical Trading	27.0%	29.0%	20.3%	30.1%	18.4%	18.0%	22.8%	24.2%
Customer Order	22.7%	24.4%	28.0%	23.9%	25.3%	30.3%	26.2%	28.2%
Fundamental	26.0%	24.4%	22.0%	22.5%	21.8%	19.1%	22.8%	21.3%
Jobbing	24.3%	22.2%	29.7%	23.5%	34.5%	32.6%	28.3%	26.4%

A2.c Responses Sorted According to Headquarters Location

	North America		Europe		Asia	
	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW
Technical Trading	26.0%	22.0%	23.4%	25.7%	20.7%	29.6%
Customer Order	21.9%	30.7%	24.9%	23.7%	28.3%	25.9%
Fundamental	21.2%	22.7%	22.2%	22.0%	25.7%	22.1%
Jobbing	30.8%	24.7%	29.5%	28.6%	25.3%	22.5%

A2.d Responses Sorted According to Daytime Trading Limit (million US\$)

	< 10		10-25		26-40		41-55		56-70	
	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW	5 Years Ago	NOW
Technical Trading	27.0%	29.0%	20.3%	30.1%	18.4%	18.0%	22.8%	24.2%	18.4%	18.0%
Customer Order	22.7%	24.4%	28.0%	23.9%	25.3%	30.3%	26.2%	28.2%	25.3%	30.3%
Fundamental	26.0%	24.4%	22.0%	22.5%	21.8%	19.1%	22.8%	21.3%	21.8%	19.1%
Jobbing	24.3%	22.2%	29.7%	23.5%	34.5%	32.6%	28.3%	26.4%	34.5%	32.6%

**Notes:** Responses sorted according to seniority, turnover volume (million US\$), headquarters location, and daytime trading limit (million US\$) are reported in panels A2a, A2b, A2c, and A2d, respectively. The percentages of respondents in each category are given. For some questions the component frequencies of a category do not always sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

**Table A3.** Effects of Central Bank Intervention

<i>A3.a Responses Sorted According to Seniority</i>				
	<i>Treasurer /Manager</i>	<i>Chief/Senior Dealer</i>	<i>Dealer/Junior Dealer</i>	
<i>Volatility</i>				
Increase	64.4%	69.4%	70.2%	
Decrease	35.6%	30.6%	29.8%	
<i>Fundamental Value</i>				
Away	26.7%	38.6%	30.0%	
Toward	73.3%	61.4%	70.0%	
<i>Appropriate Timing</i>				
Yes	56.8%	51.9%	58.8%	
No	43.2%	48.1%	41.2%	
<i>Achieve the Goal</i>				
Yes	54.0%	55.7%	49.0%	
No	46.0%	44.3%	51.0%	
<i>A3.b Responses Sorted According to Turnover Volume (Million US\$)</i>				
	<i>&lt; 100</i>	<i>100-500</i>	<i>500-1000</i>	<i>&gt; 1000</i>
<i>Volatility</i>				
Increase	67.3%	80.4%	58.5%	59.5%
Decrease	32.7%	32.7%	41.5%	40.5%
<i>Fundamental Value</i>				
Away	39.0%	31.5%	30.6%	34.3%
Toward	61.0%	68.5%	69.4%	65.7%
<i>Appropriate Timing</i>				
Yes	50.5%	47.4%	60.0%	67.6%
No	49.5%	52.6%	40.0%	32.4%
<i>Achieve the Goal</i>				
Yes	53.2%	45.8%	71.0%	58.9%
No	46.8%	54.2%	29.0%	41.1%
<i>A3.c Responses Sorted According to Headquarters Location</i>				
	<i>North American</i>	<i>European</i>	<i>Asian</i>	
<i>Volatility</i>				
Increase	67.1%	71.0%	63.8%	
Decrease	32.9%	29.0%	36.2%	
<i>Fundamental Value</i>				
Away	33.3%	44.4%	25.0%	
Toward	66.7%	55.6%	75.0%	
<i>Appropriate Timing</i>				
Yes	53.0%	52.6%	60.0%	
No	47.0%	47.5%	40.0%	
<i>Achieve the Goal</i>				
Yes	60%	54.1%	50.8%	
No	40%	45.9%	49.2%	

A3.d Responses Sorted According to Daytime Trading Limit (million US\$)						
	< 10	10-25	26-40	41-55	56-70	> 70
<i>Volatility</i>						
Increase	69.3%	71.4%	71.8%	56.7%	71.4%	65.0%
Decrease	30.7%	28.6%	28.2%	43.3%	28.6%	35.0%
<i>Fundamental Value</i>						
Away	30.2%	37.2%	38.5%	44.4%	35.7%	27.8%
Toward	69.8%	62.8%	61.5%	55.6%	64.3%	72.2%
<i>Appropriate Timing</i>						
Yes	51.1%	56.7%	48.8%	44.8%	53.8%	64.3%
No	48.9%	43.3%	51.2%	55.2%	46.2%	35.7%
<i>Achieve the Goal</i>						
Yes	60.0%	53.1%	52.5%	43.3%	61.5%	50.0%
No	40.0%	46.9%	47.5%	56.7%	38.5%	50.0%

**Notes:** Responses sorted according to seniority, turnover volume (million US\$), headquarters location, and daytime trading limit (million US\$) are reported in panels A3a, A3b, A3c, and A3d, respectively. The percentages of respondents in each category are given. For some questions the component frequencies of a category do not always sum to one due to rounding. In some cases there are multiple responses or incomplete replies.

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## NOTES

1. Other studies based on the survey technique include Blinder (1991, price stickiness), Cheung and Wong (1999, Fx market), Frey and colleagues (1984, both micro- and macroeconomic issues), Kearl and colleagues (1979, both micro- and macroeconomic issues), and Shiller, Fumiko, and Tsutsui (1991, stock market crash). There is a related literature on using survey data on exchange rate expectations to study exchange rate dynamics. See, for example, Frankel and Froot (1987) and Chinn and Frankel (1994). It is also noted that some commonly used macroeconomic data (for example, unemployment rate) are constructed from surveys.

2. The numbers of questionnaires sent to Hong Kong, Tokyo, and Singapore are, respectively, 718, 595, and 648. In total, 84 questionnaires were not delivered because the addressee was no longer

with the institution. We are grateful that Yoshiaki Ai (Japan Forex Association) and Eddie Tan (Singapore Forex Association) sent out questionnaires for us to some addressees in Tokyo and Singapore.

3. The job titles given under the "Others" category include managing director, FX sales, money market dealer, head of HK\$ trading in fixed income and derivatives, general manager, trading manager, regional coordinator, and manager of business development.

4. The homogeneity test used in this study is a nonparametric procedure. Given the nature of survey data, it is preferable to use a nonparametric procedure that does not rely on distributional and functional assumptions. For a textbook discussion of the homogeneity test, see, for example, DeGroot (1975).

5. The intraday position limit can be lifted temporarily with verbal approval by the immediate supervisor or the head of the forex department. In some large trading banks, senior dealers do not have an explicit intraday position limit, and they are expected to report to their immediate supervisors if they take a large open position. Overnight position limit, which is typically smaller than the intraday position, is the maximum open position a dealer can carry overnight.

6. Based on a volatility estimate, value at risk measures the price risk of a portfolio, that is the potential loss in the portfolio value due to changes in asset prices. Given the concern about risk in trading derivatives, the use of value at risk to assess market risk has gained considerable popularity in recent years and is recommended by, for example, the Basle Committee on Banking Supervision.

7. Respondents who selected the "Others" category are working in institutions with headquarters in Bermuda, South Africa, and the Middle East.

8. Some recent studies on technical analysis include Cheung and Wong (1997), Kho (1996), and Sweeney (1986).

9. Jobbing refers to the trading style in which a trader continually buys and sells in an attempt to make many, albeit small, profits.

10. Goodhart (1988), for example, suggests interbank deals are 10 or 20 times of those for non-bank customers. Also, see Bank for International Settlements (1996) and Group of Thirty (1985).

11. See, for example, the Jurgensen Report (1983).

12. For instance, Taylor (1982) indicates that official intervention is destabilizing. A contrary view to Taylor (1982) is put forward by Mayer and Taguchi (1983) who claim the profit criterion adopted by Taylor in general is not a good indicator of the stabilizing effect. Based on several other alternative criteria, these authors find evidence on the stabilizing effect of official intervention.

13. A recent review on central bank intervention is Edison (1993). See, for example, Dominguez and Frankel (1993) and Kaminsky and Lewis (1996) for the signaling effect argument.

14. The Bank for International Settlements (1996) shows that the composition of trading activity can be very different across countries.

15. Response frequencies based on different classification schemes are given in the appendix.

16. Heterogeneity in the foreign exchange market is also documented in, for example, Ito (1990) who reports exchange rate expectations are heterogeneous between different groups of participants including exporters, importers, and bankers. Recently, Peiers (1997) shows that Deutsche Bank acts as a price leader prior to Bundesbank intervention announcements.

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