Do Market Participants Listen to Verbal Intervention?*

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Abstract

Although verbal intervention appears to impact contemporaneous returns, evidence of a significant relationship with end-customer order flow is weak. This suggests that frequent, and by implication often uninformative, official communication undermines the effectiveness of verbal intervention as a meaningful policy tool. But there is evidence that the effectiveness of verbal intervention is enhanced when deployed in tandem with physical intervention. These findings assist in improving the design and implementation of official communication policies.

Keywords: foreign exchange intervention, exchange rates, communication; order flow; market microstructure

JEL Classification:

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1 Introduction

In this paper, we investigate the impact of verbal official intervention on the foreign exchange market. In so doing, we consider evidence of price effects that stem from this form of intervention and its quantity impact upon end-customer order flow. We also consider the efficacy of verbal intervention in isolation of, and in tandem with, actual intervention.

The academic literature on official foreign exchange intervention, both sterilized and unsterilized, is vast, and yet inconclusive in terms of the significance and sign of the impact of intervention upon exchange rate levels or volatility. Earlier studies of foreign exchange intervention often concluded against any significant impact upon exchange rate levels, but with some evidence of a consequent rise in the volatility of returns (Baillie, Humpage and Osterberg, 2000). As Sarno and Taylor (2001) discuss, more recent studies with access to reliable data on both intervention and market expectations have often reported both a significant impact of sterilized intervention on exchange rate levels (Dominguez and Frankel, 1993; Girardin and Lyons, 2006) and an increase in volatility at both intra-day (Chang and Taylor, 1998; Dominguez, 2006) and daily frequencies (Fratzscher, 2006; Dominguez, 2006). Although apparently perverse given the outcome expected by a majority of central bankers (Neely, 2006), the finding that intra-day volatility increases on days when actual intervention occurs is consistent with a core hypothesis of the market microstructure literature: heterogeneous private market participants first have to learn of news—in this case intervention—before they can interpret and then disseminate its implications to prices (Lyons, 2001; Dominguez, 2006).

The literature exploring the impact of verbal intervention on exchange rates is more recent, reflecting the new emphasis placed upon this strategy by a number of policy authorities around the world as an additional tool to achieve monetary policy goals. In turn, this increased emphasis partly reflects the rise in policy credibility experienced by authorities in many countries in recent years. And yet, the verbal intervention literature is arguably as inconclusive as the literature on actual intervention. For instance, Fratzscher (2006) finds evidence in favor of a significant impact upon exchange rate volatility—in this case, a dampening effect—and levels that last up to two to three days, whereas Jansen and de Haan (2005) using 5-minute indicative euro-dollar tick data conclude that the impact of verbal intervention is at best small and short-lived.

Recognition of the role of market participants in the price-setting mechanism has been a key recent development in the literature on intervention, as well as ex-

change rate determination more generally. It suggests a natural extension to the existing intervention literature—one that we pursue here, differentiating our approach in particular from other verbal intervention studies—whereby the primary focus of empirical analysis moves away from a reduced-form analysis of the price impact of actual and verbal intervention, and towards an examination of the quantity impact of communication on private sector market participants' behavior.

The largest obstacle in pursuit of significant, and persistent, direct intervention effects is the volume of relevant economic, financial and political news that impacts exchange rates, even on very short horizons. But failure to demonstrate such an impact because of noise associated with the impact of other relevant variables, for which one cannot control adequately, does not represent an appropriate rejection of the associated null hypothesis. Furthermore, as Girardin and Lyons (2006) argue, policymakers have long asserted that the contemporaneous impact of intervention on prices, for instance as dealers adjust bid-ask spreads in the immediate aftermath of official activity, is rather less important than its quantity impact on private market participant behavior. An examination of market participant behavior in response to intervention activity would therefore seem to be a more efficient way to measure the impact of these policy tools on the foreign exchange market.

Until recently, a lack of available data obviated this line of research. But the collection and, limited, dissemination of customer order flow databases by some leading financial institutions has alleviated this constraint.[1] Accordingly, in this paper we employ novel databases on exchange rate intervention and communication to investigate the impact of these series on the behavior of private agents in the foreign exchange market, which we measure using order flow data from Citibank. We consider this impact in terms of the level and volatility of order flow. In particular, whereas much of the extant literature considers either the impact of actual or verbal intervention, we assess whether these two strategies are mutually reinforcing compared with the impact of either in isolation. There are a number of examples where verbal and actual intervention has been deployed in tandem. We focus upon the case of Japan during the period 2003-2004, but the European Central Bank (ECB) during the latter months of 2000 is another noteworthy example. Although of secondary importance, we also consider the price impact of actual and verbal intervention on the level of daily exchange rate returns.

[1] Order flow may be defined as transaction volume signed according to the initiator of the trade (Lyons, 2001); positive for a buy order and negative for a sell. Order flow therefore provides an indication of the relative strength of buy as opposed to sell orders between, say, customers and dealers. In this way, order flow within particular investor groups will not necessarily sum to zero, but can instead exhibit persistent trends (Sager and Taylor, 2008).

We report a number of new findings. In the context of recent, broad reviews of communication policies by, inter alia, the Federal Reserve and the Bank of England, our findings related to verbal intervention are of particular interest.[2] Although we find evidence of a significant relationship between verbal communication *as a whole* and returns, evidence related to end-customer order flow is weak. One explanation for these contrasting findings is that price adjustment in response to official foreign exchange communication is mediated quickly in the interdealer market, without any commensurate behavioral shift by customers. Consistent with the conclusion of Chui (2003), Blinder (2004) and Woodford (2005), this interpretation would suggest that frequent, uninformative communication undermines the overall behavioral impact of verbal intervention and that its resulting price effect occurs rapidly, but is relatively small, making it of secondary interest to policymakers. This finding can be useful as a means of improving the design and future implementation of official communication strategies.

This overarching conclusion notwithstanding, there are additional findings worthy of some emphasis. For instance, our results suggest that only a subset of official comments actually exert a significant impact upon returns and the behavior of end-customers. We term this finding the 'Selectivity hypothesis', and explore it by classifying verbal intervention based upon the degree of clarity in official statements, as well as the degree of concern expressed and the type of institution communicating. Our results also suggest a complementary relationship between actual and verbal intervention that magnifies the impact on private sector behavior of either strategy deployed in isolation.

The remainder of the paper is organized as follows. Section 2 presents a selective review of the literature and section 3 describes the source and construction of data to be used in our empirical analysis. Estimation results are presented and discussed in section 4. Finally, section 5 presents our conclusions and suggestions for future research.

[2]For instance, see King (2007), comments by Federal Reserve Chairman Bernanke on February 14 and March 28, 2007, as reported by Reuters. Also relevant are comments by ECB Governing Council members Weber on 28 May and Liikanen on 30 May, 2007, as reported by the Financial Times and Market News International, respectively, as well as speeches by GC member Bini Smaghi on November 20, 2007, and President Trichet on January 16, 2008. Although none of these comments relate specifically to exchange rate communication, this is an integral aspect of broader central bank communication policy.

2 Literature Review

Foreign exchange intervention remains an extremely fertile area of empirical research. For recent comprehensive reviews of the literature, see Sarno and Taylor (2001) and Neely (2005). Most work has focused upon the price impact of actual and verbal intervention. To this end, there is widespread agreement in the literature that actual intervention has no demonstrable longer-term impact upon either exchange rate volatilities or levels (Beine and Laurent, 2003; Dominguez, 2006; Edison, Cashin and Liang, 2006; and Fratzscher, 2006). This may be either because intervention is simply ineffectual at longer time horizons, or because the large volume of news that impacts exchange rates over these horizons makes it impossible to disentangle the price impact of intervention from that of other factors.

Over shorter time horizons conclusions are more equivocal. Earlier studies of foreign exchange intervention focused primarily upon actual intervention, and often concluded against any significant impact upon exchange rate levels, but in favor of some evidence of a consequent rise in the volatility of returns (Baillie, Humpage and Osterberg, 2000). As Sarno and Taylor (2001) discuss, more recent studies with access to reliable data on both intervention and market expectations have often reported a significant impact of sterilized intervention on exchange rate levels (Ito, 2002; Dominguez and Frankel, 1993; Fatum and Hutchison, 2003; Girardin and Lyons, 2006) and an increase in volatility at both intra-day (Chang and Taylor, 1998; Dominguez, 2006) and daily frequencies (Dominguez, 2006; Fratzscher, 2006). In an interesting recent contribution, Mark and Moh (2006) argue that unanticipated actual intervention in mark-dollar and yen-dollar has significant explanatory power for the Forward Rate Bias anomaly to Uncovered Interest Parity (UIP). But Kearns and Rigobon (2005) report stark differences in the magnitude of the direct impact of Reserve Bank of Australia (RBA) and Japanese Ministry of Finance (MoF) actual intervention, and Galati, Melick and Micu (2005) report no significant evidence of a direct impact of MoF intervention on the moments of the yen-dollar probability density function during the period 1993-2000.

Although apparently perverse given the outcome expected by a majority of central bankers (Neely, 2006), the finding that intra-day volatility increases on days when actual intervention occurs is consistent with a core hypothesis of the market microstructure literature; namely, that markets are engaged in aggregating dispersed information and the arrival of even public news – in this case intervention – can affect that aggregation in ways not predicted in common knowledge models (Lyons, 2001; Dominguez, 2006). Recognition and inclusion of the central predictions of the market

microstructure literature has been an important innovation in empirical intervention studies, as well as exchange rate research more generally, and is an issue to which we return below.

The emphasis placed by monetary authorities upon verbal communication has grown substantially in recent years. As with actual intervention, the implicit purpose of this strategy is to impact private sector behavior in order to induce shifts in exchange rate levels or volatility in periods when these are considered to be inconsistent with macroeconomic fundamentals, and therefore longer-term policy objectives. The origins of this new communication strategy can be traced to the G5 Plaza and Louvre Accords of the mid-1980s and, in a multilateral context, the increased use of this strategy can be seen from a comparison of the prominence and extent of exchange rate-related comments in G7 communiqués in the years immediately prior to and since the Dubai meeting of September 2003. But as with actual intervention, there is now at least as much emphasis on unilateral communication that may or may not be consistent with communication by official counterparts in other countries. Japanese verbal intervention during 2003-04 in support of BoJ actual intervention is the example that we analyze in this paper, but ECB verbal intervention designed to resist the strength of the euro in 2004 and 2006-07 are other recent examples where policy authorities have deployed this policy tool on a unilateral basis. In either strategy—multi- or unilateral communication, and communication in tandem with or in isolation of actual intervention—the ability of verbal intervention to significantly influence private sector behavior in a direction consistent with the policy objectives of monetary authorities will depend upon both the consistency of communication and the information it is perceived to convey regarding future monetary policy stance (Blinder, 2004; Woodford, 2005). As Chui (2003) emphasizes, when verbal intervention occurs on an excessively frequent basis, it risks providing little new information to private market practitioners, and, as another source of extraneous noise filtered by the market, may even undermine official policy objectives. Vitale (1999) implicitly goes further, and argues that intervention is only effective when conducted secretly, with no announcement of either intervention activities or objectives to market participants.

Early verbal intervention studies followed a well-trodden path in assessing only the price impact of communication upon exchange rates. For instance, Beine et. al. (2004) trace official statements confirming or commenting on actual intervention operations and find that, for yen-dollar or mark(euro)-dollar over the period 1990 through 2003, such statements are associated with a larger impact of actual intervention upon exchange rate levels than in the absence of such statements, as well as

a reduction in exchange rate volatility.

Fratzscher (2006) applies both EGARCH and event-study analysis to daily observations of dollar-euro and yen-dollar and a database of official commentary collated from Reuters over the sample period 1990 to 2003. He also finds evidence in favor of a significant, dampening impact upon exchange rate volatility, as well as levels, that last up to two to three days. By contrast, Jansen and de Haan (2005), on the basis of an event study analysis of ECB communication—using the sample period January 1999 to May 2002 and 5-minute indicative tick data for dollar-euro—conclude that the impact of verbal intervention is at best small and short-lived. But their evidence does suggest that ECB comments reported in the headline of Bloomberg news stories do have more impact, and that communication that coincides with macroeconomic data releases has some dampening impact upon exchange rate volatilities, but not levels.

Greater use of verbal communication as a policy tool has been facilitated in part by rising policy credibility. But it has also been encouraged by rapid financial globalization, as reflected, inter alia, in the growth of cross-border portfolio capital flows and the increasing substitutability of financial assets denominated in the major currencies. All three factors have important implications for the efficacy of the various intervention transmission mechanisms proposed in the literature, without adversely impacting the case for actual intervention per se. In particular, these changes imply that the importance of the Portfolio Balance channel—the most obvious route by which actual intervention may impact prices—has been diminished since the ability of discreet episodes of actual intervention to meaningfully disturb the optimal portfolio composition of private sector participants is reduced. Indeed, on the basis of survey evidence Neely (2006) concludes that central bankers no longer consider this channel important for the transmission of actual intervention to prices, although Dominguez and Frankel (1993) and Dominguez (2006) present more favorable results. Clearly, as no commitment of official reserves is either required or necessarily implied by incidences of verbal exchange rate communication, the Portfolio Balance channel is not relevant to verbal intervention, with any impact upon private sector behavior transmitted via some combination of the other channels proposed in the literature. These include the Signalling, Coordination and Chartist channels. There is a substantial degree of overlap between these three channels.

2.1 Signalling Channel

The Signalling channel suggests a role for verbal and actual intervention in impacting market participant expectations, via the provision of new information to the market

regarding the future stance of monetary policy (Mussa, 1981). A number of studies have investigated this channel, and many have found evidence in favor of a signalling role for announced sterilized intervention (Dominguez, 1992, Dominguez and Frankel, 1993a,b, Kaminsky and Lewis, 1996). By contrast, Vitale (1999) argues that sterilized intervention can provide important signals to market participants even if conducted anonymously and in small size, as the associated trades are disseminated into the wider market by transacting brokers. Furthermore, secret intervention is the only credible policy option when an inconsistency exists between the level of the exchange rate targeted by intervention and the level implied by economic fundamentals.

2.2 Coordination Channel

The Coordination channel argues that the impact of intervention, whether actual or verbal, may be greatest in periods when there exists widespread agreement amongst private market participants that significant exchange rate disequilibria exist—perhaps on the basis of a comparison of forward exchange rates and levels implied by Purchasing Power Parity—but where a coordination failure between investors allows these disequilibria to persist (Sarno and Taylor, 2001; Taylor, 2004, 2005; Reitz and Taylor, 2006a, b). These failures can particularly occur in instances where the emergence of significant disequilibria is due to the predominance of market positioning driven by technical investors whose investment style perpetuates recent exchange rate trends.[3] During these episodes, active risk-taking by fundamental-based investors may be low due, for instance, to conflicting information between cyclical and equilibrium signals within associated investment processes. In such cases, by coordinating fundamental participants' exchange rate expectations, actual and verbal intervention may be the catalyst for a rebalancing of positioning in favor of these investors, who then arbitrage away the disequilibria.

According to the Coordination channel, therefore, order flow initiated by fundamental investors will depend upon their assessment of the likely profitability of arbitrage activity exploiting disequilibria. In turn, this profitability will be a function of current and past actual and verbal intervention as the authorities are assumed to possess superior information regarding the equilibrium value of an exchange rate. Central bank purchases of a currency which fundamental-based investors perceive to be undervalued reveals incremental official private information to the market. Observing intervention (I_t) in support of a currency, fundamental investors' confidence in the probability of mean-reversion to equilibrium rises and they too purchase the

[3] For a comprehensive discussion of investor types and styles, see Sager and Taylor (2006).

currency. Order flow of fundamental investors (D^I) can thus be modelled as,

$$D_t^i = \sum_{j=0}^{n} a_j I_t \tag{1}$$

In one of the first studies of its kind, Girardin and Lyons (2008) exploit the same end-customer order flow database used in this study to find significant evidence in favor of the Coordination channel for the yen-dollar exchange rate during the sample period 1995 to 2004. Girardin and Lyons explain disaggregated customer order flow as a function of lagged Japanese and Federal Reserve actual intervention, as well as lagged order flow, the lagged conditional variance of yen-dollar returns, lagged interest differentials. They also include exchange rate returns and a moving average term in regressions to capture the impact of technical traders on the yen-dollar exchange rate. They find significant evidence of a change in private sector behavior, with order flow from corporates and hedge funds shifting significantly in a direction consistent with Bank of Japan intervention (on behalf of the Ministry of Finance) on the previous day. As noted above, Girardin and Lyons also find significant evidence of a direct price impact of actual intervention by regressing returns on the same intervention dummies, as well as, inter alia, disaggregated customer order flow.

Evidence in favor of the Coordination channel is also presented by Scalia (2004), Peiers (1997) and Reitz and Taylor (2006a, b). Scalia (2004) examines the direct relationship between Czech koruna-euro order flow and returns during the period July to December 2002 using tick data from Reuters and intervention dates from the Czech National Bank. He concludes that increases in order flow, for instance due to actual intervention, have a significant impact upon returns that persists throughout the day of occurrence. Peiers (1997) utilizes Reuters reports of Bundesbank interventions and tick data on mark-dollar over the sample October 1992 to September 1993 to provide evidence of significant price leadership by one informed investor during time periods that occur between the placement of intervention-related orders by the Bundesbank and public dissemination of intervention reports via Reuters. And Reitz and Taylor (2006a, b) also conclude in favor of the Coordination channel using a STAR GARCH model applied to daily observations of the dollar-mark exchange rate and Federal Reserve actual intervention data from 1980 to 1992, and yen-dollar exchange rate data allied with Federal Reserve and Japanese Ministry of Finance actual intervention data over the sample period 1980 to 1998.

2.3 Chartist Channel

In a variant of the Coordination channel, called the Chartist channel, intervention may also impact the positioning of positive feedback investors. This group includes technical investors that follow trend-extrapolating strategies dependent upon past returns (Hung, 1997, Barberis, Schleifer and Vishny, 1998).The resultant order flow will be consistent with the direction of intervention (Hung, 1997). The complexity of specific investment strategies employed by technical investors ranges from naïve momentum rules to more sophisticated approaches, such as, inter alia, Elliott Wave analysis.[4] Order flow initiated by technical investors, D^U, can be expressed as a positive function of recent lagged exchange rate returns (Δe_{t-k}),

$$D_t^u = \sum_{k=0}^{n} c_k M * \Delta e_{t-k} \tag{2}$$

where the multiplicative dummy, M, represents the incidence of verbal intervention.

The effectiveness of the Chartist channel will partly depend upon its ability to induce either a trend reversal in exchange rate returns – in the case where a central bank is resisting the direction of the exchange rate - or to accelerate an existing trend that is subsequently magnified by the behavior of technical investors. Clearly, verbal intervention that induces reverses directional trends in the presence of estimated level disequilibria may successfully harness both the fundamental and technical aspects of the Coordination channel.

Reitz (2005) explores this channel with an examination of the impact of actual intervention upon the behavior of technical, or chartist traders—in the footsteps of Hung (1997), he terms it the Noise Trading channel, but this would appear to minimize the sophistication and profitability of some technical investors active in the foreign exchange market—using daily mark-dollar exchange rate data from 1979 to 1992 in a Markov-switching framework. Consistent with the findings of LeBaron (1999), Reitz concludes that the profitability of technical investment strategies is enhanced during periods of actual intervention by the Bundesbank or Federal Reserve. As the profitability of fundamental-based strategies was not similarly enhanced during these episodes, Reitz concludes that intervention does not alter exchange rate direction, but is instead able to enhance existing trends. This evidence would seem contradictory to empirical studies above that are supportive of the Coordination channel.

We are not aware of any empirical intervention research that rigorously explores the quantity impact on private sector behavior of verbal intervention deployed in

[4] As more complex strategies often rely upon an element of subjectivity, we do not consider them in the empirical analysis that follows and instead concentrate upon a more naïve momentum strategy.

tandem with actual intervention. This is a key focus of our empirical analysis in a following section.

3 Data Sources & Description

Our data set incorporates daily observations of all series over the sample period 02 January, 2003 to 28 April, 2004. The start of the sample coincides with the appointment of Messrs. Mizogushi as vice-Finance Minister for International Affairs and Watanabe as Head of the International Bureau of the Finance Ministry.[5] It also coincides with important changes in Japanese foreign exchange intervention policy, including a request by the MoF to the Bank of Japan (BoJ) to cease the active conduct of foreign exchange operations and place confidential standing orders with a few dealing banks, thereby entering the market *intuitu personae* (Girardin and Lyons, 2008). The end of the sample is chosen to coincide with the end of actual official yen intervention. Although our sample is short, therefore, it represents a well-defined, unique period in the history of the yen-dollar exchange rate that facilitates empirical analysis of the effectiveness of verbal intervention strategies.

As well as examining the impact of verbal and actual intervention on private sector behavior and exchange rate returns over this full sample period, we divide our sample into two parts, with the first running from 02 January, 2003 until 19 September 2003, and the second from 20 September until 28 April, 2004. This division coincides with the Dubai statement of the Group of Seven Finance Ministers and Central Bank Governors that represents an important milestone in the recent strategy of coordinated verbal intervention within this forum.

Data for the dollar-yen exchange rate was provided by Reuters-Ecowin, and express the exchange rate as the yen price of one US dollar. To mitigate against potential endogeneity effects, we use New York close-to-close daily returns. Daily Bank of Japan intervention data were provided by the Japanese MoF. Actual intervention occurred on 140 days between January 2003 and April 2004—official intervention was reported on 43% of sample days, therefore—with an average daily amount of $2.36 bn. Intervention activity was particularly heavy in the second sub-sample, with 85 intervention days during this period and an average associated intervention value of $2.39 bn, versus 55 days and $1.4 bn in the first sub-sample. Our actual intervention data are plotted in Figure 1 below.

[5] In addition, Toshihiko Fukui succeeded Masaru Hayami as Governor of the Bank of Japan in March 2003. Fukui was much more supportive of the Ministry of Finance's yen policy than was Hayami.

The overt objective of Japanese intervention during our sample period, as stated by various Japanese officials, was to limit sharp changes in the external value of the yen unwarranted by the evolution of underlying fundamentals. By contrast, as Girardin and Lyons (2008) argue, market participants considered the implicit objective of actual intervention to be aimed at ensuring the dollar-yen exchange rate remained within a stable corridor; the stability of dollar-yen during the first half of our sample gives at least some credence to this view (Figure 2a). Over the sample as a whole, the dollar-yen exchange rate traded in a range ¥122-103; the exchange rate ended the period close to the bottom of this range, having started near the top at ¥119. Consistent with the behavior of the exchange rate level, dollar-yen conditional volatility was also stable during the period January-September 2003, but spiked higher at the end of our sample (Figure 2b).

Our communication and order flow databases are relatively unique. The communication data were collected from Factiva, and include all comments from relevant Japanese and US officials during the sample period. A full list of officials and their affiliations is provided in Table 1. In terms of search criteria, we gathered comments using "[name]" and "yen" for both Japanese, US, G7 and IMF officials, and "[name]" and "dollar" for US officials specifically. As Factiva includes statement reporting by multiple news sources, as well as updated versions of statements from the same source, we ensure that our database includes only a single, original occurrence of any statement. Comments made on weekends—for instance around the margins of regular G-7 meetings—are included in the comment count for the following Monday. This differs from Jansen and de Haan (2005), who exclude weekend comments from their study of ECB communication; our prior is that these comments may have an impact as trading begins again after the weekend.

Our database incorporates 368 exchange rate-relevant comments, indicating that this form of intervention was frequent during our sample period. Furthermore, as discussed by Chui (2003), a stark contrast exists during our sample between the conduct of verbal and actual intervention, with the tone of verbal commentary often explicit, and occasionally indicating the possibility of actual intervention operations at specific exchange rate levels; the operation of actual intervention was rather more discreet.[6] Although the total number of statements in our database is large relative to other studies, in terms of statements per trading day, our database is comparable; for instance, in their study of ECB verbal communication Jansen and de Haan (2005) report an average of 1.2 statements per trading day, whereas our database has an

[6] Clearly, in instances where actual intervention is fully transparent, the role for verbal intervention as a policy tool will be largely eliminated.

average of 1.06; furthermore, as our sample period spans an unprecedented period of actual intervention, this would seem to justify a high absolute number of verbal statements.

Within the total communication database, 165 statements occurred between January 2003 and 19 September and 203 between 20 September and end-April 2004. This mirrors the distribution of actual intervention between the two sub-samples. The MoF is the Japanese institution responsible for the conduct of foreign exchange intervention, with the Bank of Japan responsible, as the agent of the MoF, for executing intervention operations in line with MoF instructions. Consistent with this hierarchy, our database incorporates 253 comments by MoF officials and 44 by the BoJ. In addition, 71 comments were made by Non-Japan officials, including from the US, IMF and in the context of G7 statements.[7] Our verbal intervention database therefore incorporates comments from a wide group of institutions. In principle, comments by representatives of some of these institutions should be more relevant to the yen-dollar exchange rate than others; we explicitly test this hypothesis in the following empirical section.[8]

We also divide statements by officials of each institution into level- and volatility-specific comments, and then sub-divide each of these categories into concerned, ambiguous and unconcerned comments. Examples of each statement category are provided in Table 1b, and the full data set is presented in Figures 3-5. To ensure objectivity, this categorization of statements was performed, independently, by two of the co-authors of this paper. The categorization generates various verbal intervention dummies which we incorporate individually within regressions, but also interact with our actual intervention series to assess the relative impact on private sector behavior of harnessing these variables within a coordinated intervention strategy. It should, however, be emphasized that separation of comments between those addressing exchange rate levels and those framed in terms of volatility is somewhat arbitrary. In particular, market anecdote suggests that public officials often veil exchange rate level concerns behind references to excessive volatility. Accordingly, we caution against putting too much weight upon the results associated with level and volatility verbal intervention dummies. Instead, primary focus should be afforded to our aggregate dummies (i.e. those that combine level and volatility comments).

Order flow data were provided by Citibank, and cover all yen-dollar trades—with a sign corresponding to the direction of trade—between Citibank and its end-user

[7] Statements by US officials not explicitly referring either to the Strong Dollar policy or the yen are not included in our database.

[8] Although it may also be instructive to differentiate between individuals as well, for many of the speakers in our dataset the number of observations is insufficient to make this analysis viable.

customers, in both spot and forward contracts; trades that use foreign exchange swaps are not included in the data as these do not constitute order flow in the foreign exchange market.[9] The data disaggregate order flow between the three predominant private sector customer groups in the foreign exchange market: non-financial corporations; unleveraged financial institutions, such as mutual funds, asset management firms, life insurance companies and pension funds; and leveraged financial institutions, such as hedge funds.[10] This disaggregation of customer order flow facilitates examination of the behavior of the various, heterogeneous private market participant groups in response to actual and verbal foreign exchange intervention, and represents one important source of value-added in our analysis.[11]

Aggregate customer order flow accounts for a little more than half of global daily market turnover in foreign exchange, with the remainder due to inter-bank trading (BIS, 2007). Customer order flow is directly related to innovations in fundamental exchange rate determinants, including monetary policy innovations (Evans and Lyons, 2005; 2006; Jansen and de Haan, 2005), and also incorporates knowledge of the decision-making process that leads to shifts in strategic portfolio benchmark hedge ratios in response to changing risk appetite or return objectives that occur independently from innovations in published fundamentals (Lyons, 2001). This suggests that knowledge of customer order flow allows the wider market to learn about the private information and trading strategies of better informed participants, and that is the main conduit through which private information is embedded in market prices (Lyons, 1995; Rime, 2001; Evans and Lyons, 2005a,b). This is a central theme that runs through this paper. Over our sample period as a whole, and focusing only on period averages, corporations and mutual funds were net buyers of yen against the dollar, with average purchases by corporations twice as big again as mutual fund purchases, whereas hedge funds were net sellers (Table 2a). It is interesting to cast these trends in order flow in terms of the impact that each investor group expected from actual intervention: by selling yen concurrent to official sales, Hedge Funds ex-

[9] According to the latest Euromoney Foreign Exchange Survey, Citibank was the third most important foreign exchange counterpart, and was on one side of 9% of global foreign exchange turnover (Euromoney, 2007).

[10] Unleverage financial institutions are often termed Real Money investors in market jargon, with leveraged financial institutions termed Speculative Money. A blurring between unleveraged and leveraged institutions has occurred in recent years, as many mutual funds and asset management firms now offer to some clients leveraged investment vehicles with similar risk levels to those provided by hedge funds. Although potentially an interesting direction for future research, our order flow data do not allow distinction between Japanese and foreign investors, in aggregate or disaggregated by customer group.

[11] Customer heterogeneities include, inter alia, different investment time horizons and styles.

pected the yen to depreciate over the sample as a whole, whereas corporations and mutual fund purchases reveal an expected yen appreciation.

It is useful to draw a distinction between our customer order flow data and those examined by Sager and Taylor (2008). In their paper, Sager and Taylor concluded that the practical value of commercially available customer order flow is limited, reflecting in part the extent to which the order flow data they analyzed are manipulated prior to their dissemination to a select subset of investors. This manipulation includes indexation and filtering to ensure client anonymity.[12] By contrast, our customer order flow data are raw signed transactions in yen-dollar. As such, they are not available to market participants, beyond a select group of Citibank employees, and their information content has not been lessened by any form of prior manipulation. Importantly, whereas Sager and Taylor (2008) assess the out-of-sample forecasting power of commercially available order flow, our primary focus is on the contemporaneous information that these data convey regarding the process of price discovery in the foreign exchange market. Hence, our results and those of Sager and Taylor are perfectly compatible.

4 Empirical Results

The overwhelming focus of the empirical intervention literature has been on the behavior of exchange rate levels or volatility in response to episodes of actual or verbal intervention. The resulting evidence in favor of both intervention strategies is equivocal. Although we initially estimate return-based regressions, the principal focus of this paper is on the quantity impact of verbal intervention on the behavior of private sector market participants, as measured by order flow, with only a secondary interest in the price impact upon returns. This emphasis reflects the likelihood that without any end-customer behavioral response, the impact of intervention—actual or verbal—is likely to be small and transitory.

As a starting point to our empirical analysis, Table 2b presents correlation analysis of actual and verbal intervention with daily exchange rate returns and end-customer order flow. For many of the communication dummies that we examine, correlation with our actual intervention series is low ("BoJ" in Table 2b). This is particularly so for comments by the MoF ("lmofjap", 8% correlation with BoJ) and Bank of Japan ("lbojjap", 2% correlation with BoJ). At first blush, this would appear to undermine any suggestion that the two strands of foreign exchange intervention policy were closely coordinated by Japanese officials during our sample period. Indeed, the

[12] For details, see JP Morgan (2005).

highest full-sample correlations with actual intervention exist for communication by Other Japanese institutions with no responsibility for intervention policy (14%), and Non-Japanese institutions (10%).

Table 3 presents our initial regression results. A noteworthy finding is the significant, contemporaneous relationship between customer order flow and exchange rate returns. This is consistent in spirit with the results of Evans and Lyons (2002), which demonstrate a significant contemporaneous correlation between daily interbank order flow and both dollar-deutschemark and dollar-yen returns. Table 3 also reports estimates of the relationship between verbal intervention and dollar-yen exchange rate returns. The regressions first consider a separation of verbal intervention between concerned, ambiguous and unconcerned comments regarding the level of the exchange rate regardless of the institution making the comment (specifications 1a and 1b), then all volatility comments without any differentiation between the degree of concern (all specifications in the table), and finally level comments aggregated by institution, again without differentiation between the degree of inherent concern (specifications 2a and 2b). The estimates indicate a significant correlation between yen-dollar returns and both level comments categorized by degree of concern and volatility comments. These correlations are largely contemporaneous, but there is some evidence also of a lagged impact from ambiguous and unconcerned level comments in general, volatility comments and level comments by Other Japanese institutions upon exchange rate returns.

From Table 3, the sign of estimated coefficients appears unintuitive. Concerned level comments are associated with a strengthening of the yen, and both ambiguous and unconcerned level comments in aggregate are associated with a weakening. These results contradict the anecdotal market view that the bias of the Japanese authorities in 2003-04 was to maintain the yen-dollar exchange rate in a range and that, if there was an official directional bias, it reflected concern over the consequences of a stronger yen. In terms of level comments by institution, our finding that estimated coefficients for comments by the MoF and, to a lesser extent, Non-Japanese institutions are statistically significant is reasonable, given the primary importance of these two groups in determining national exchange rate policies. The relationship between BoJ comments and yen-dollar returns is not statistically significant, whereas that between comments by Other Japanese institutions and returns is. Again, though, the positive sign attached to MoF comments is unintuitive, whereas the negative relationship between Non-Japanese comments—ostensibly US reaffirmations of the Strong Dollar policy—and the dollar-yen exchange rate seems plausible (recall that a positive coefficient indicates yen weakness).

Arguably more important than an assessment of the price impact of verbal intervention is the significance of its quantity impact on end-customer order flow. Table 4 provides evidence on this relationship, as well as on the relationship between end-customer order flow and actual intervention. For actual intervention, evidence of a significant impact upon mutual fund order flow is clear. This impact lasts typically for two days and, in aggregate, is associated with mutual fund yen sales. A similar relationship, albeit borderline significant, exists between actual intervention and hedge fund flow as well. By contrast evidence of a significant correlation between verbal intervention and order flow is limited, with only BoJ comments-with a four day lag-impacting mutual fund flow significantly in Model 3 in Table 4. In Model 4, only concerned and unconcerned comments for mutual fund flow, and concerned comments for hedge funds are significant. Encouragingly, though, the signs of estimated coefficients do at least switch between concerned (negative) and unconcerned (positive) comments, and are intuitively consistent with the perceived aim of the Japanese authorities to limit yen strength. Evidence of a significant impact for volatility comments is limited to corporate flow only, is negative and exists with a two-day lag. Intuitively, this delay seems consistent with the perception that Corporate investors typically exhibit slower reaction speeds to news than either mutual or hedge funds.[13]

The general absence of significant results is largely confirmed by Tables 5a-c. Here, order flow disaggregated by customer type is regressed on level communication dummies categorized by institution (results for each institution are reported separately in columns I-IV in each of the tables) and an aggregate volatility comment dummy. The results in Table 5a-c also suggest that the various customer groups often do not pay attention to statements by the same institutions. For instance, and surprisingly given its determining role in the decision to undertake actual intervention, there is no significant relationship between corporate flow and MoF statements (Table 5a, Column I), whereas both mutual (Table 5b) and hedge funds (Table 5c) pay at least some attention to this institution. Interestingly, both funds appear to react—counter-intuitively in the case of mutual funds, given the estimated sign of significant coefficients—to MoF statements with a four day lag. The same conclusion also appears valid for BoJ and Other Japanese commentary, in this case for all three customer groups, and for Non-Japan comments for hedge funds. This result may indicate that statements sometimes lack clarity, or that there is a lack of certainty regarding each institutions area of responsibility.[14]

[13] Given the market view that volatility comments may be simply a veil for level concerns, a division of commentary along the lines of levels and volatility may be a little spurious. The relatively low number of observations for the volatility comment series underlines this risk.

[14] For instance, King (2007) criticizes the practice of monetary policy by code word, and a similar

The relative lack of significant correlation between verbal intervention dummies and end-customer order flow is striking, and compares unfavorably with the relationship between verbal intervention and exchange rate returns. Tentatively, and under the premise that changes in the behavior of heterogeneous private market participants—as measured by order flow—are the mechanism by which news is disseminated to prices, these results imply that the main price adjustment in response to Japanese verbal intervention *as a whole* occurs in the inter-dealer sector of the foreign exchange market, as traders adjust bid-ask spreads, and their own interdealer trades, in the immediate aftermath of commentary.[15] By contrast, there is no discernible, consistent behavioral shift by end-customers in response to verbal intervention, although as we have discussed, a more splintered reaction is visible. As a result, we can offer little support yet for the Coordination or Signalling transmission channels, at least as far as they relate to the impact of verbal intervention on end-customer expectations and behavior.[16]

Thus far, we have implicitly assumed that all official commentary has an equal probability of impacting prices and end-customer behavior. However, the sheer volume of official commentary during our sample period is striking—Figures 3-5—and suggests that estimation results may be improved by filtering the verbal intervention data to remove comments that provide no information to end-customers. This possibility gives rise to what we term a 'Selectivity Hypothesis' whereby end-customers listen and respond only to a small subset of official comments and essentially tunes out the remainder as noise. Essentially, the hypothesis implies that the market impact of commentary by certain key individuals reflects their high credibility, which in turn they seek to maintain for fear of reputational loss. By contrast, other individuals with less credibility have less reputational risk, and therefore exhibit a predilection to less targeted commentary. This hypothesis is consistent with the assertion by Vitale

issue could be at play here with respect to foreign exchange communication.

[15] An alternative explanation may be that Citibank end-customer order flow data are not representative of the market, and that participants who do not transact through Citibank tend to be the marginal drivers of yen-dollar. The results, inter alia, of Evans and Lyons (2005b), that show Citibank order flow data exhibit significant out-of-sample forecasting power for exchange rate returns, albeit for dollar-euro rather than yen-dollar, encourage us to discount this explanation.

[16] In addition, Table 5, and others, provide evidence of a significant contemporaneous and lagged relationship between actual intervention and end-customer order flow, particularly for mutual funds and in the context of non-Japan verbal intervention. This finding implies that the two intervention strategies may be more effective when deployed in tandem. But the sign of significant parameters contradicts general findings in the existing literature, as it implies that on average end-customers bet against the authorities, buying yen as the BoJ was selling. As physical intervention per se is not the primary focus of this paper, we leave this puzzle to future research.

(1999) that announced intervention is not credible if the level of the exchange rate targeted conflicts with the value implied by economic fundamentals, and in such cases secret actual intervention can be far more impactful. We move on to various tests of this Selectivity Hypothesis in the analysis that follows.

One approach to filtering our communication database is to regress order flow on verbal intervention conditional on whether or not there is an episode of actual intervention concurrent to the official comment. We initially perform this analysis separately on level and volatility comments regardless of the communicating institution, before repeating it using an aggregation of level comments separated by institution. The results of this conditioning exercise are reported in Table 6. Overall, these results appear a little tepid. But there are some interesting subtleties supportive of the Coordination Channel. For instance, in the absence of actual intervention, statements by Other Japanese institutions exert a significant negative effect on corporate and hedge fund order flow, whereas in tandem with actual intervention, similar statements have no effect. This implies that episodes of actual intervention may help neutralize the—negative—effect on end-customer order flow of commentary by institutions not directly involved in the actual intervention process. Also, volatility statements in isolation of actual intervention exert a negative effect on corporate order flow, but this impact becomes insignificant when commentary is deployed in tandem with actual intervention.

Implementation thus far of the 'Selectivity Hypothesis' has uncovered some, limited findings supportive of a significant impact of verbal intervention via the Coordination and Signalling transmission channels, when deployed in tandem with episodes of actual intervention. These channels largely relate to the impact of intervention on the behavior of fundamental-based end-customers. But the foreign exchange market encompasses a range of investment styles, including also chartist analysis (Allen and Taylor, 1990; Taylor and Allen, 1992; Menkhoff and Taylor, 2006; Sager and Taylor, 2006). A further step in our analysis, therefore, is to consider evidence in favor of the Chartist transmission channel. The existing intervention literature has used only reduced form equations to examine the direct and contemporaneous effect of both actual and verbal intervention on exchange rate returns. By contrast, the Chartist transmission channel suggests that both forms of intervention may condition the impact of past returns on current market participant behavior, as measured by end-customer order flow. To consider the importance of this channel, we study whether the incidence of verbal intervention at time t-n significantly alters the relationship between returns at time t-n and end-customer order flow at time t. The maintained hypothesis is that such influence is different from the usual effect of returns at time

t-n on order flow at time t; we test this hypothesis by separately estimating regressions with dummies that equal one on days on which verbal intervention occurs and zero otherwise. In a second step, we study whether the additional presence of actual intervention at time t-n (in addition to verbal intervention) enhances the effect of time t-n returns on order flow at time t. The results of this analysis are reported in tables 7-10.

Table 7 provides results from regressions of end-customer order flow on interactive terms that combine lagged yen-dollar returns and verbal intervention. Compared with earlier analysis, explicitly accommodating the impact of trend-following investors does appear to uncover more evidence of significance in estimated coefficients, particularly for hedge funds and related to the first sub-sample of our dataset. Thus, during January-September 2003 hedge funds on average sold yen whenever official commentary by the MoF or BoJ, or volatility commentary in general was consistent with the prevailing exchange rate trend. This is consistent with the findings of Reitz (2005). But they also bought yen following comments by Other Japanese officials or Non-Japanese commentary which, as noted above, were ostensibly US reaffirmations of the Strong Dollar policy.

Despite some more evidence in favor of verbal intervention, the results from Table 7 remain patchy. This suggests that further filtering of our verbal communication database may be useful to uncover additional information in favor of our 'Selectivity Hypothesis'. To this end, Table 8 presents the results of analysis using an interactive dummy that considers the effectiveness of verbal intervention when deployed in tandem with actual intervention and with explicit account taken of feedback trading via the Chartist transmission channel. In this case, supporting evidence for the effectiveness of verbal intervention in altering end-customer behavior is both more copious and a little more evenly distributed across sub-periods of our data sample, level and volatility comments, and all three end-customer groups. Again, though, the reaction of hedge funds during the first sub-sample is the most striking. Furthermore, and relative to results in Table 7, in a number of cases the presence of actual intervention either amplifies the positive effect on current order flow of past returns associated with verbal intervention, or when such an effect is negative in Table 7, negates or even reverses the sign of estimated coefficients. Again, these effects are particularly apparent for hedge funds in the first sub-sample related to level comments by BOJ and Non-Japanese institutions, and for volatility statements with respect to both hedge and mutual funds.[17]

[17] Again, though, the caveat regarding the separation of commentary between level and volatility comments applies.

Table 9 mirrors the analysis of Table 8, but in this case the interactive dummy combines past exchange rate returns and verbal intervention in the *absence* of actual intervention. As the number of significant coefficients is less in this case, this would suggest further, tentative support for a policy strategy that harnesses episodes of verbal and actual intervention and also takes into account prevailing exchange rate trends. Interestingly, in this case hedge funds on average sold yen in the context of MoF commentary, but bought yen following BoJ verbal intervention. Finally, Table 10 attempts to formalize the interdependencies between verbal and actual intervention and the behavior of trend-following chartist investors by replacing lagged exchange rate returns in the interactive terms with a moving average calculation that mimics a simple momentum trading rule employed by many chartists in the foreign exchange market. The results of this analysis are generally consistent with the preceding findings: there is some evidence in favor of the Chartist transmission channel for both level and volatility comments. In particular, the significant negative effect of volatility statements on corporate order flow reported in the top panel of Table 10 is eradicated once we consider the concurrence of verbal and actual intervention in the context of prevailing market trends. Similarly, the magnitude of the negative impact of statements of Other institutions upon hedge fund flow in the absence of actual intervention (Table 10, top panel) is much reduced when actual intervention occurs (lower panel).

Thus far, we have considered only the level impact of verbal communication upon end-customer order flow. A final consideration, therefore, is whether verbal communication significantly impacts the volatility of order flow.[18] Evidence of such effects would suggest that verbal intervention is able to induce important changes in market participant behavior. The results of this analysis, based upon estimation of various EGARCH model specifications, are reported in Table 11. They indicate some evidence of an important behavioral impact of verbal intervention, particularly related to the change in results between panels (a) and (c). Panel (a) considers the impact of volatility comments by institution. The results are somewhat confused, for instance with both concerned and unconcerned MoF comments exerting a dampening impact upon Corporate order flow, and only ambiguous commentary from the MoF and, particularly, the BoJ significantly dampening the volatility of hedge fund flow. Once we consider only consensus days—that is, days on which all comments by a particular institution expressed the same degree of concern—the picture becomes a little clearer. In particular, in most cases the magnitude of significant volatility impacts reported under panel (a) is reinforced in panel (c), and insignificant impacts

[18] We are grateful to Martin Evans for this suggestion.

now become statistically significant. Greater clarity and discipline in communication therefore appear to increase its behavioral market impact.

Overall, our results offer some, tentative evidence that the ability of verbal intervention to induce changes in the behavior of private sector market participants is increased by implementation of infrequent, well-timed and informative commentary in tandem with episodes of actual intervention and in a direction consistent with the prevailing exchange rate trend. In terms of transmission channels, although we find some support for the Coordination channel, more is apparent for the Chartist channel discussed, inter alia, by Reitz (2005). These positive findings notwithstanding, the frequency with which verbal intervention was deployed by the Japanese authorities during 2003-04 risked undermining even the most modest policy objectives.

5 Conclusions

In this paper, we have assessed the merits of official verbal intervention in the foreign exchange market, with an application to the yen-dollar exchange rate during the period January 2003 to April 2004. We have considered the impact of this policy tool using daily data, in isolation of and in tandem with actual intervention conducted by the Japanese authorities, and in relation to both end-customer order flow and exchange rate returns. This is the first paper to have considered in a rigorous manner the interaction between end-customer order flow, verbal and actual intervention. We examined this relationship, and also the direct price impact of verbal intervention, from the perspective of various potential transmission mechanisms, including the Coordination, Signalling, and Chartist channels proposed in the literature. We found that verbal intervention in general significantly affects daily exchange rate returns, often with a lag of several days, but has only a very limited impact upon end-customer order flow.

In an effort to reveal a significant relationship between verbal intervention and order flow, we relaxed the assumption maintained in the existing literature that all official comments are perceived to be of equal importance by the market in conveying new information. In its place we proposed a 'Selectivity Hypothesis', whereby only a subset of official comments, deployed in tandem with episodes of actual intervention and taking into account the prevailing exchange rate trend, are likely to significantly impact private sector behavior. Our various realizations of this hypothesis generated some evidence of a significant relationship between verbal intervention and end-customer order flow, consistent with both the Coordination and, particularly, Chartist transmission channels. Furthermore, and given their growing importance in

global capital markets, our results also revealed an interesting behavioral pattern for hedge funds that arguably merits further investigation. In particular, although hedge fund order flow was consistent on average with the direction of actual intervention—over our sample period as a whole, they sold yen against the dollar—their behavior altered whenever confronted with statements by Other Japanese institutions in the absence of concurrent actual intervention, in which case hedge funds bought yen.

Our findings lend support to the conclusion of Chui (2003), Blinder (2004) and Woodford (2005) that the information content of verbal intervention is sensitive to the frequency with which this policy strategy is deployed. Its ability to impact the behavior of private market participants is minimized by excessive commentary that fails to provide news that informs market expectations or to coordinate the positioning of market participants in periods of significant exchange rate disequilibria. Our future research will seek to validate these findings using verbal intervention and end-customer order flow data for other major central banks—for instance, the ECB—which have been proponents of this strategy during recent years.

These results are particularly relevant in the context of recent communication policy reviews undertaken by the Federal Reserve, Bank of England, and, less formally, the ECB. Although these reviews related to communication policy in its broadest form, official comment on exchange rate levels and volatility forms an important element of this policy for many central banks and government authorities. Our results suggest that this communication has failed to achieve the implicit objectives of policy makers and could benefit from a more disciplined implementation. Excesses are rarely optimal in most walks of life, and this certainly seems to be true in the case of verbal intervention.

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Chart 1: Actual Intervention

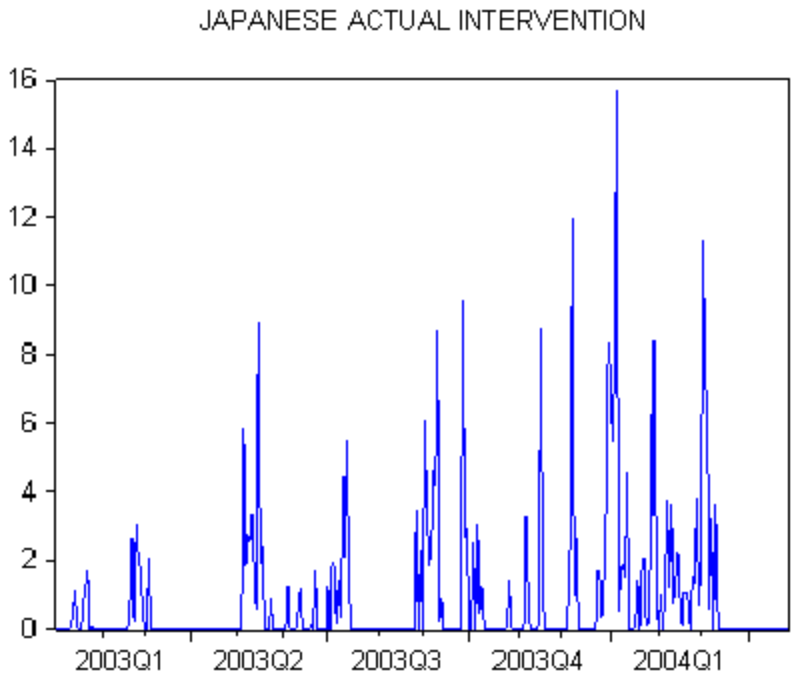

Chart 2a: Dollar-Yen Exchange Rate (Level)

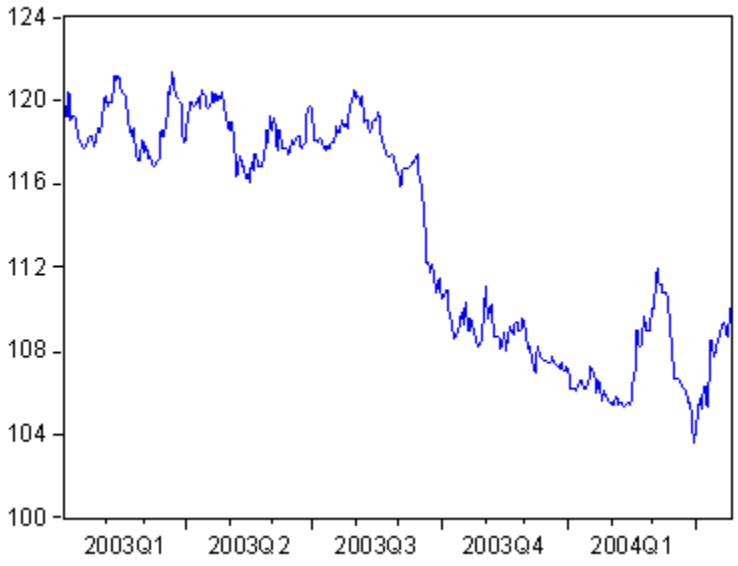

Chart 2b: Dollar-Yen Exchange Rate (Volatility)

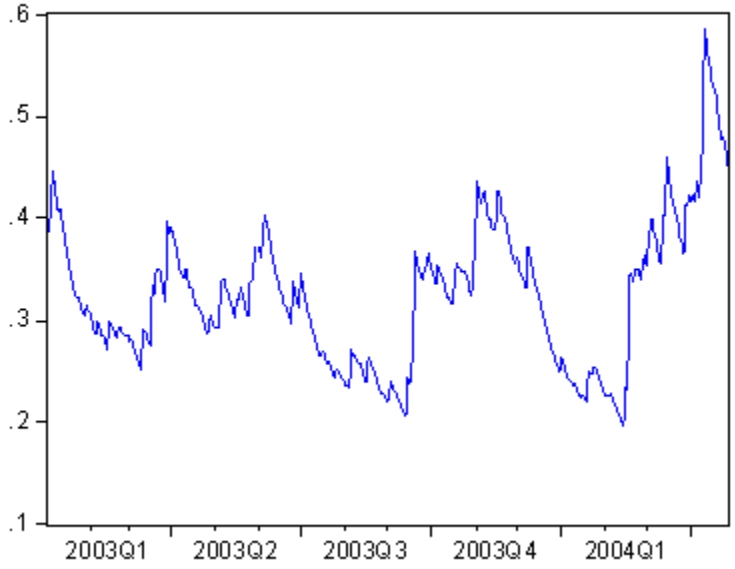

Chart 3: All Statements about Exchange Rate

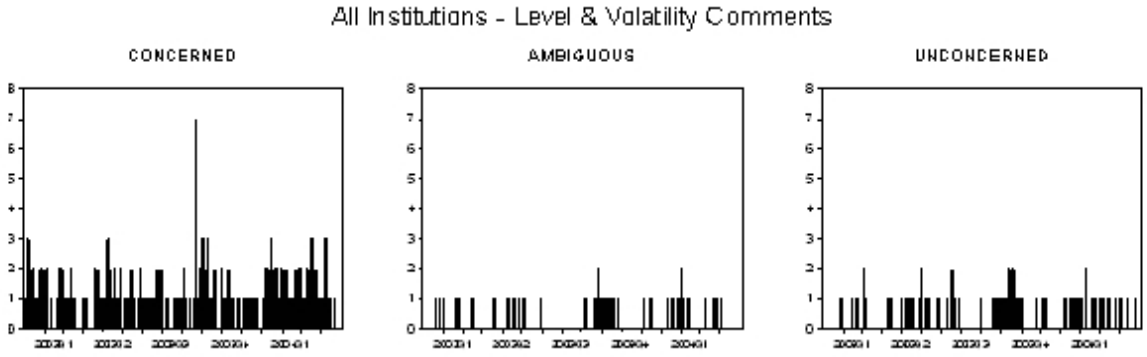

Chart 3 (continued): All Statements about Exchange Rate Level

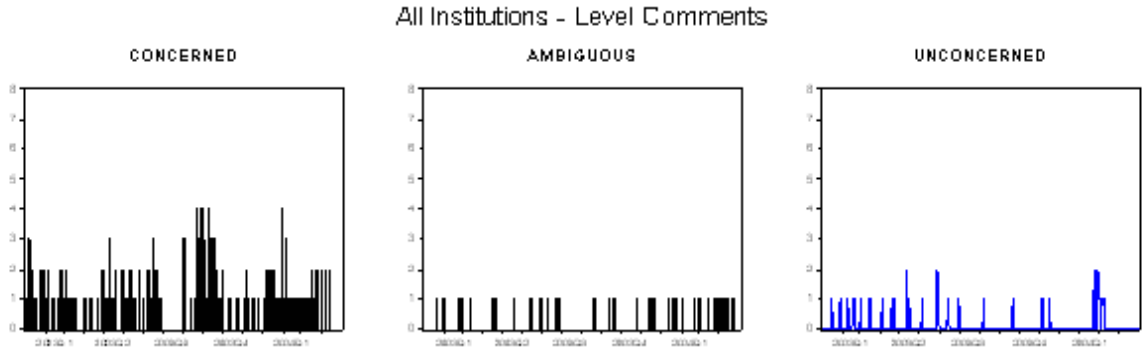

Chart 3 (continued): All Statements about Exchange Rate Volatility

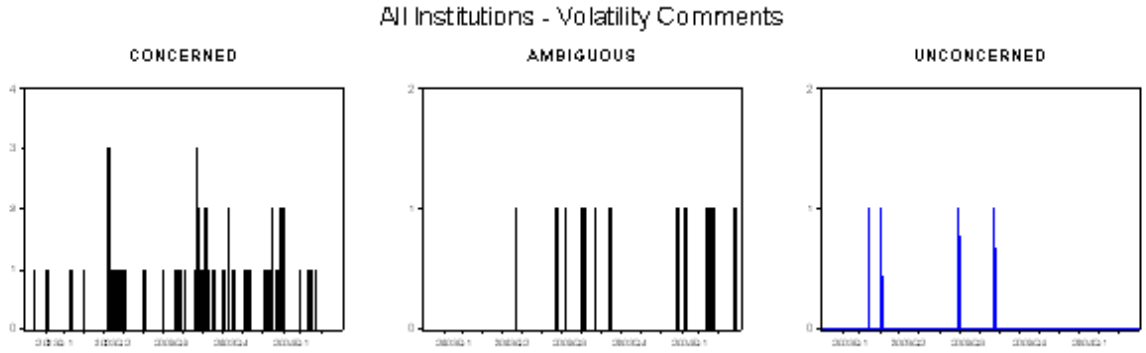

Chart 4: Exchange Rate Statements by Institution - MoF

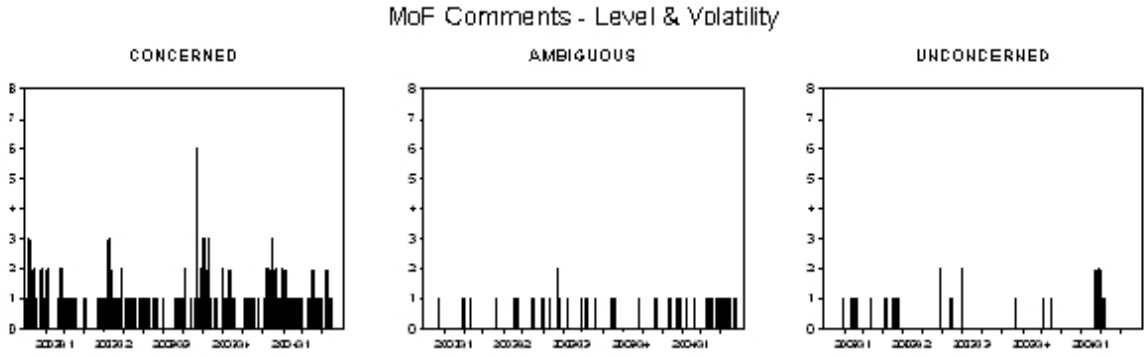

Chart 4 (continued): Exchange Rate Statements by Institution - BoJ

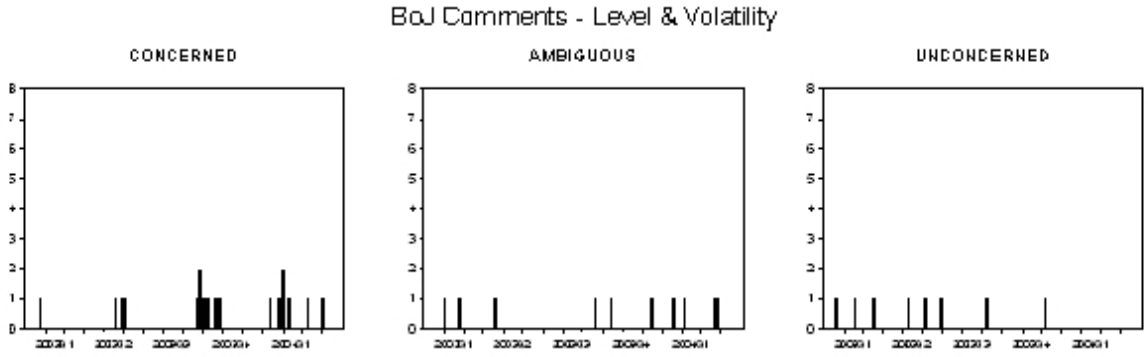

Chart 4 (continued): Exchange Rate Statements by Institution - Non-Japan

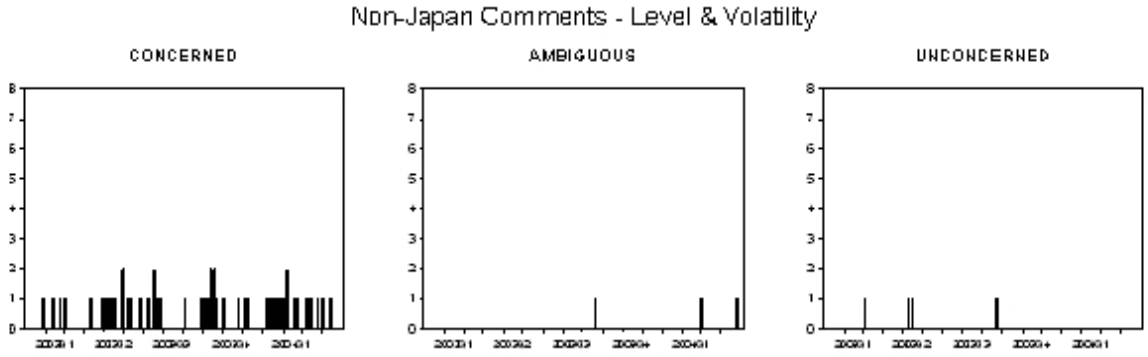

Table 1a. Verbal Communication Database - Officials and Institutions

Speaker	Position	Speaker	Position
Japan		**US**	
M. Shiokawa	Fin. Min., until 09/2003	G. Bush	President
S. Tanigaki	Fin. Min., from 09/2003		
T. Muto	Vice Fin. Min., until 01/2003	A. Greenspan	Federal Reserve Chm.
	then, BoJ Dep. Gov.		
H. Watanabe	Vice Fin. Min., from 01/2003	J. Snow	Treasury Secretary
H. Kuroda	Vice FM for Int. Affairs, until 01/2003	J. Taylor	Treasury Undersec.
"	then, PM's special advisor	R. Nicholls	Treasury Spokesman
Z. Mizoguchi	Vice FM for Int. Affairs, from 01/2003		
		G. Mankiw	Council Econ.Advisers
M. Hayami	BoJ Governor, until 03/2003	G. Aldonas	Under Sec. of Comm.
T. Fukui	BoJ Governor, from 03/2003	R. Shelby	Senate Banking Chair
K. Iwata	BoJ Deputy Governor		
S. Nakahara	"		
T. Taya	"	IMF	
T. Fukuma	"	H. Köhler	MD, until 03/2004
Hidehiko Haru	"		
Miyako Suda	"		
Kazuo Ueda	"		

Table 1b *Examples of Concerned, Ambiguous and Unconcerned Statements*

Date	Speaker	
		Concerned Comments
20/08/03	Mizoguchi	"The latest rise is a little too sharp, and we are watching market movements closely. "
06/01/04	Tanigaki	"We will act if there are speculative or rapid moves (...) We have been seeing some speculative moves recently."
		Ambiguous Comments
01/09/03	Mizoguchi	The market was stable in August and did not require intervention but we will act if it turns volatile."
05/02/04	Fukui	"A strengthening of the currency in itself is fine for us. But in the short term we must carefully watch its impact."
		Unconcerned Comments
19/02/03	Hayami	said that he was not overly concerned about the yen's recent rise. "It's not a big deal. The dollar is weak. Look at the euro, it's really strong."
31/07/03	Watanabe	"Developments have been natural (...) and smooth,"

Notes:

Table 2a. Descriptive Statistics

	Dlclose	Corp	Mutual	Hedge	Bojdolclose
Mean	−0.0236	−11.455	−5.1610	0.0792	0.9193
St. Deviation	0.5298	82.569	131.93	124.80	2.067

Table 2b. Correlations between actual and Verbal Intervention

	Dlclose	Corp	Hedge	Mutual	BoJ
Dlclose	1.0000				
Corp	−0.0133	1.0000			
Hedge	0.0869	−0.0995	1.0000		
Mutual	0.1756	0.0061	0.0688	1.0000	
BoJ	0.0106	−0.0103	−0.1443	−0.1159	1.0000
Latot	0.1785	0.0102	−0.0192	0.0932	0.0020
Lctot	-0.2473	0.0558	−0.0272	−0.0407	0.0786
Lutot	0.1831	0.0168	−0.0108	−0.0647	0.1381
Lmofjap	-0.1111	0.0035	0.0035	−0.0096	0.0831
Lbojjap	-0.0902	0.0219	−0.0771	−0.0346	0.0233
Lotherjap	−0.0447	−0.0524	−0.1782	−0.0676	0.1434
Lnonjaptot	0.1007	0.0476	0.0015	0.0008	0.1045
Voltot	−0.0146	−0.1012	−0.0489	0.0088	−0.0123

Notes: Dlclose is New York close to close dollar-yen exchange rate returns; Corp, Mutual and Hedge are dollar-yen order flow series (net dollar purchases) transacted by corporate, Mutual fund and Hedge fund customers with Citibank; BOJ is BoJ actual intervention; Latot, Lctot and Lutot are total ambiguous, concerned and unconcerned level comments by all institutions; Lmofjap, Lbojjap, Lotherjap and Lnonjaptot are total level comments by the MoF, BoJ, Other Japanese institutions and Non-Japanese institutions; Voltotbin is all volatility comments.

Table 3. Return Equations

	Model 1		Model 2	
	(1a)	(1b)	(2a)	(2b)
BOJ	0.0361 (2.70)***	0.0481 (3.93)***	0.0466 (3.39)***	0.0513 (3.81)***
Corp		−0.4786 (1.18)		−0.5475 (1.27)
Mutual		0.6686 (3.83)***		0.7969 (4.08)***
Hedge		1.0477 (4.58)***		1.1583 (4.53)***
LC	−0.2688 (4.96)**	−0.2066 (4.07)***		
LA	0.1873 (3.47)**	0.1266 (2.55)**		
LA(-1)		−0.0896 (1.74)*		
LA(-3)	0.1112 (2.13)**	0.1165 (2.32)**		
LU	0.3290 (2.78)***	0.2551 (2.50)**		
LU(-4)	−0.1839 (1.96)**			
V	−0.0100 (0.109)	0.0389 (0.52)	0.0008 (0.01)	0.0574 (0.77)
V(-2)			−0.1771 (2.15)**	−0.1703 (2.00)**
LMOF			−0.1044 (1.94)*	−0.1043 (1.99)**
LBOJ			−0.097 (1.18)	−0.0644 (0.79)
LOTHER			−0.1064 (1.40)	−0.0789 (1.01)
LOTHER(-1)			−0.1616 (1.85)*	
LNONJ				0.1177 (1.71)*

Notes: dependent variable in regressions is log daily exchange rate returns. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Sample is 2 January, 2003 to 28 April, 2004. EGARCH(1,1) estimation. AR(4) coefficients not reported. We only report significant lagged coefficients in the table. MODEL 1 regression

equation is:

$$\begin{aligned}\Delta e_t &= \alpha_0 + \alpha_1 BOJ_t + \alpha_2 CORP_t + \alpha_3 MUTUAL_t + \alpha_4 HEDGE_t \\ &+ \sum_{j=1}^{4} \alpha_{5j} V_{t-j} + \sum_{j=1}^{4} \alpha_{6j} LA_{t-j} + \sum_{j=1}^{4} \alpha_{7j} LC_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{8j} LU_{t-j} + \sum_{j=1}^{4} \alpha_{9j} \Delta e_{t-j} + \varepsilon_t \end{aligned} \tag{3}$$

MODEL 2 regression equation is:

$$\begin{aligned}\Delta e_t &= \alpha_0 + \alpha_1 BOJ_t + \alpha_2 CORP_t + \alpha_3 MUTUAL_t + \alpha_4 HEDGE_t + \sum_{j=1}^{4} \alpha_{5j} V_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{6j} LMOF_{t-j} + \sum_{j=1}^{4} \alpha_{7j} LBOJ_{t-j} + \sum_{j=1}^{4} \alpha_{8j} LOTHER_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{9j} LNON_{t-j} + \sum_{j=1}^{4} \alpha_{10j} \Delta e_{t-j} + \varepsilon_t \end{aligned} \tag{4}$$

where

Δe = dollar-yen close to close New York returns;

BOJ= Bank of Japan intervention (USD million);

Corp = dollar purchases by Corporates (USD million);

Mutual = dollar purchases by Mutual Funds (USD million);

Hedge = dollar purchases by Hedge Funds (USD million);

Lj = Dummies for level statements of type j;

j = ambiguous (A), concerned (C), unconcerned (U);

Lk = Dummies for level statements of type k;

k = Japanese Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ).

V = Dummies for volatility statements by all types of institution;

Table 4. Order Flow Equations

	Model 3			Model 4		
	Corp	Mutual	Hedge	Corp	Mutual	Hedge
BOJ	−0.0007	−0.0071	−0.0079	−0.0005	−0.0072	−0.0086
	(0.29)	(2.39)**	(1.51)	(0.20)	(2.94)**	(1.57)
BOJ(-1)		−0.0061				
		(2.41)**				
BOJ(-2)		0.0078				
		(2.36)**				
LA				−0.0028	0.0133	0.0290
				(0.28)	(1.02)	(2.31)**
LC				−0.0014	−0.0095	−0.0357
				(0.16)	(0.66)	(2.41)**
LC(-4)					0.0315	
					(2.10)**	
LU				−0.0015	0.0426	0.0100
				(0.13)	(0.86)	(0.41)
LU(-4)					−0.0571	
					(2.11)**	
V	0.0168	−0.0354	−0.0043		−0.0202	−0.0003
	(0.65)	(0.92)	(0.13)		(0.54)	(0.01)
V(-2)	−0.0377			−0.0322		
	(2.21)**			(2.46)**		
LMOF	0.0031	0.0160	−0.0146			
	(0.29)	(1.12)	(1.13)			
LMOF(-3)	−0.0081					
	(0.89)					
LBOJ	0.0009	−0.0099	−0.0416			
	(0.06)	(0.73)	(1.51)			
LBOJ(-4)		0.0269				
		(2.00)**				
LOTHER	−0.0057	−0.0122	−0.0039			
	(0.49)	(1.11)	(0.24)			
LNONJ	0.0076	0.0175	−0.0012			
	(0.57)	(0.51)	(0.08)			
R^2	0.035	0.045	0.039	0.028	0.089	0.065
AR	1.28	0.88	0.77	1.22	1.29	1.34
	[0.28]	[0.42]	[0.47]	[0.30]	[0.28]	[0.26]
ARCH	0.09	0.01	1.17	0.05	0.01	0.97
	[0.76]	[0.93]	[0.28]	[0.82]	[0.99]	[0.33]

Notes: dependent variable in regressions is end-customer order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Sample is 2 January, 2003 to 28 April, 2004. Four lagged coefficients for dependent variable, returns and

conditional variance not reported but available on request. Model 3 regression equation is:

$$\begin{aligned} YV_{kt} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} LMOF_{t-j} \\ &\quad + \sum_{j=1}^{4} \alpha_{4j} LBOJ_{t-j} + \sum_{j=1}^{4} \alpha_{5j} LOTHER_{t-j} + \sum_{j=1}^{4} \alpha_{6j} LNON_{t-j} \\ &\quad + \sum_{j=1}^{4} \alpha_{7j} V_{t-j} + \sum_{j=1}^{4} \alpha_{8j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{9j} \sigma^2_{t-j} + \varepsilon_t \end{aligned} \tag{5}$$

Model 4 regression equation is:

$$\begin{aligned} YV_{kt} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} LC_{t-j} + \sum_{j=1}^{4} \alpha_{4j} LA_{t-j} \\ &\quad + \sum_{j=1}^{4} \alpha_{5j} LU_{t-j} + \sum_{j=1}^{4} \alpha_{6j} V_{t-j} + \sum_{j=1}^{4} \alpha_{7j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{8j} \sigma^2_{t-j} + \varepsilon_t \end{aligned} \tag{6}$$

where variables are defined as above, except:

YV_k= dollar purchases by Corporates, Mutual Funds, Hedge Funds (USD millions);

σ^2 = conditional variance of dollar-yen close to close returns.

Table 5a. Order Flow Equations (Corporates)

		I	II	III	IV
BOJ		−0.0002 (0.01)	−0.0088 (3.29)***	−0.0001 (0.08)	−0.0001 (0.04)
V		0.0182 (0.70)			
V(-2)		−0.0409 (2.45)**		−0.0418 (2.84)**	−0.0341 (2.50)**
V(-4)			0.0353 (1.99)**		
LMOF	LC	0.0018 (0.17)			
	LA	−0.0107 (0.94)			
	LU	−0.0145 (0.88)			
LBOJ	LC(-4)		0.0454 (2.56)***		
	LA		−0.0135 (0.90)		
	LU		0.0271 (1.19)		
LOTHER	LC			0.0025 (0.21)	
	LA(-2)			−0.0576 (2.45)**	
	LU(-2)			0.0972 (2.40)**	
LNONJ	LC				0.0007 (0.034)
	LA				0.0088 (0.54)
	LU				0.0300 (1.69)*
R^2		0.046	0.103	0.08	0.04
AR		1.36 [0.26]	0.02 [0.98]	1.28 [0.28]	1.53 [0.22]
ARCH		0.03 [0.87]	0.002 [0.96]	0.14 [0.71]	0.031 [0.86]

Notes: dependent variable in regressions is corporate order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Four lagged coefficients for dependent variable, returns and conditional variance not reported but available on

request. The regression equation is:

$$\begin{aligned} YV_{kt} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} V_{t-j} + \sum_{j=1}^{4} \alpha_{4j} LMOFn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{5j} LBOJn_{t-j} + \sum_{j=1}^{4} \alpha_{6j} LOTHERn_{t-j} + \sum_{j=1}^{4} \alpha_{7j} LNONn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{8j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{9j} \sigma^2_{t-j} + \varepsilon_t \end{aligned} \tag{7}$$

where variables are defined as above, except:

YV_k= dollar purchases by Corporates (USD millions);

Ljn = Dummies for level statements of type j;

n = ambiguous (A), concerned (C), unconcerned (U);

j = Japanese Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ);

Table 5b. Order Flow Equations (Mutual Funds)

		I	II	III	IV
BOJ		−0.0086 (2.82)***	−0.0088 (3.29)***	−0.0088 (3.02)***	−0.0085 (2.37)**
BOJ(-1)					−0.0049 (1.68)*
BOJ(-2)					0.0062 (1.85)*
V					−0.0257 (0.49)
V(-4)		0.0267 (1.51)	0.0353 (1.99)**	0.0345 (1.99)**	
LMOF	LC(-4)	0.0248 (1.79)*			
	LA(-4)	−0.0214 (1.28)			
	LU(-4)	−0.757 (2.12)**			
LBOJ	LC(-4)		0.0454 (2.56)**		
	LA		−0.0135 (0.90)		
	LU		0.0271 (1.19)		
LOTHER	LC(-3)			0.0326 (2.16)**	
	LA			−0.0125 (1.02)	
	LU			0.0322 (0.79)	
LNONJ	LC				0.0276 (0.75)
	LA				0.0033 (0.74)
	LU				0.0284 (1.30)
R^2		0.12	0.10	0.10	0.10
AR		0.96 [0.39]	0.73 [0.48]	0.69 [0.51]	0.80 [0.45]
ARCH		0.003 [0.96]	0.01 [0.99]	0.01 [0.95]	0.01 [0.99]

Notes: dependent variable in regressions is mutual fund order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Sample is 02 January, 2003 to 28 April, 2004. Four lagged coefficients for dependent variable, returns and

conditional variance not reported but available on request. The regression equation is:

$$\begin{aligned} YV_{kt} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} V_{t-j} + \sum_{j=1}^{4} \alpha_{4j} LMOFn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{5j} LBOJn_{t-j} + \sum_{j=1}^{4} \alpha_{6j} LOTHERn_{t-j} + \sum_{j=1}^{4} \alpha_{7j} LNONn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{8j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{9j} \sigma^2_{t-j} + \varepsilon_t \end{aligned} \tag{8}$$

where variables are defined as above, except: YV_k= dollar purchases by Mutual Funds (USD millions).

Table 5c. Order Flow Equations (Hedge Funds)

		I	II	III	IV
BOJ		−0.0108 (2.11)**	−0.0105 (2.14)**	−0.0115 (2.37)**	−0.0112 (2.11)**
BOJ(-1)					
BOJ(-2)					
BOJ(-3)				0.0068 (1.88)*	
V		−0.0011 (0.04)	−0.0018 (0.06)	−0.0082 (0.31)	0.0027 (0.85)
V(-4)					
LMOF	LC	−0.0136 (0.95)			
	LA(-4)	0.0535 (2.82)**			
	LU	−0.0102 (0.28)			
LBOJ	LC		−0.0627 (1.37)		
	LA		0.0254 (1.25)		
	LU(-4)		0.0872 (3.86)***		
LOTHER	LC			−0.0330 (1.95)*	
	LA(-2)			−0.0631 (2.02)**	
	LU			−0.0157 (0.48)	
LNONJ	LC(-4)				−0.0744 (2.31)**
	LA				−0.0135 (0.93)
	LU(-1)				−0.1149 (2.01)**
	LU(-2)				0.0924 (3.42)***
R^2		0.14	0.14	0.15	0.15
AR		0.62 [0.54]	0.95 [0.39]	0.50 [0.61]	1.18 [0.31]
ARCH		0.29 [0.59]	0.20 [0.65]	0.46 [0.50]	0.50 [0.48]

Notes: dependent variable in regressions is hedge fund order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Sample is 2 January, 2003 to 28 April, 2004. Four lagged coefficients for dependent variable, returns and

conditional variance not reported but available on request. The regression equation is:

$$\begin{aligned} YV_{kt} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} V_{t-j} + \sum_{j=1}^{4} \alpha_{4j} LMOFn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{5j} LBOJn_{t-j} + \sum_{j=1}^{4} \alpha_{6j} LOTHERn_{t-j} + \sum_{j=1}^{4} \alpha_{7j} LNONn_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{8j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{9j} \sigma^2_{t-j} + \varepsilon_t \end{aligned} \tag{9}$$

where variables are defined as above, except: YV_k= dollar purchases by Hedge Funds (USD millions).

Table 6. Order Flow Equations

	Model 5			Model 6		
	Corp	Mutual	Hedge	Corp	Mutual	Hedge
DLA	−3.05 (0.22)	44.3 (1.21)	−24.87 (0.86)			
DLC	19.60 (1.51)	−10.70 (0.51)	−7.84 (0.37)			
DLU	34.70 (1.57)	−30.30 (0.87)	−42.16 (0.97)			
DV	−0.25 (0.00)	−0.98 (0.02)	−0.53 (0.01)	6.34 (0.19)	11.90 (0.34)	−10.70 (0.18)
DNOLA	1.08 (0.09)	14.80 (1.01)	−3.86 (0.26)			
DNOLC	−6.71 (0.62)	−16.10 (1.13)	11.58 (0.55)			
DNOLU	−31.20 (1.58)	−32.90 (0.96)	23.08 (0.76)			
DNOV	−56.46 (2.34)**	1.74 (0.07)	−33.00 (1.33)	−54.40 (2.23)**	−1.72 (0.07)	−37.9 (1.36)
DLMOF				14.80 (1.46)	7.71 (0.27)	−22.50 (1.18)
DLBOJ				−14.70 (1.10)	25.40 (0.91)	−28.20 (0.93)
DLOTHER				−10.60 (0.61)	−47.8 (2.04)**	−46.70 (1.24)
DLNONJ				−4.09 (0.36)	−6.41 (0.34)	−0.64 (0.02)
DNOLMOF				−16.20 (1.41)	−0.10 (0.00)	8.64 (0.60)
DNOLBOJ				30.70 (1.64)	−38.30 (1.11)	1.58 (0.06)
DNOLOTHER				−54.70 (2.07)**	8.36 (0.51)	−56.40 (1.99)**
DNOLNONJ				14.50 (1.07)	−2.12 (0.12)	11.50 (0.51)
R^2	0.087	0.057	0.048	0.105	0.052	0.084
AR	1.41 [0.24]	1.69 [0.18]	2.62 [0.08]	0.13 [0.87]	2.31 [0.10]	1.35 [0.26]
ARCH	0.13 [0.72]	0.02 [0.89]	1.83 [0.17]	0.02 [0.86]	0.01 [0.90]	2.01 [0.16]

Notes: dependent variable in regressions is end-customer order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Sample is 2 January, 2003 to 28 April, 2004. Four lagged coefficients for dependent variable, returns and

conditional variance not reported but available on request. Model 5 regression equation is:

$$\begin{aligned} YV_{it} &= \alpha_0 + \alpha_1 DNOV_t + \alpha_2 DV_t + \alpha_3 BOJ_t + \sum_{j=1}^{4} \alpha_{4j} YV_{kt-j} \\ &+ \sum_{j=1}^{4} \alpha_{5j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{6j} \sigma^2_{t-j} + \alpha_7 DLA_t + \alpha_8 DLC_t \\ &+ \alpha_9 DLU_t + \alpha_{10} DNOLA_t + \alpha_{11} DNOLC_t + \alpha_{12} DNOLU_t + \varepsilon_t \end{aligned} \quad (10)$$

Model 6 regression equation is:

$$\begin{aligned} YV_{it} &= \alpha_0 + \alpha_1 DNOV_t + \alpha_2 DV_t + \alpha_3 BOJ_t + \sum_{j=1}^{4} \alpha_{4j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{5j} \Delta e_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{6j} \sigma^2_{t-j} + \alpha_7 DLMOF_t + \alpha_8 DLBOJ_t + \alpha_9 DLOTHER_t \\ &+ \alpha_{10} DNONJ_t + \alpha_{11} DNOLMOF_t + \alpha_{12} DNOLBOJ_t \\ &+ \alpha_{13} DNOLOTHER_t + \alpha_{14} DNOLNONJ_t + \varepsilon_t \end{aligned} \quad (11)$$

where variables are defined as above, except

YVi= dollar purchases by Corporates, Mutual Funds or Hedge Funds:

DLj = Dummies for level statements of type j * Dummy for actual intervention by BOJ;

DNOLj = Dummies for level statements of type j * Dummy for NO actual intervention by BOJ;

DLk = Dummies for level statements of type k * Dummy for actual intervention by BOJ;

DNOLk = Dummies for level statements of type k * Dummy for NO actual intervention by BOJ;

DV = Dummies for volatility statements * Dummy for actual intervention by BOJ;

DNOV = Dummies for volatility statements * Dummy for NO actual intervention by BOJ;

*Table 7. Order Flow Equations - with interactive dummy (past returns * verbal intervention)*

	1st Sub-Sample			2nd Sub-Sample			Full Sample		
	Corp	Mutual	Hedge	Corp	Mutual	Hedge	Corp	Mutual	Hedge
LMOF 1			114.10 (3.10)**						
2						−87.20 (2.04)**			
3									
4			−62.60 (1.67)*						
LBOJ 1					−90.10 (1.91)*				
2			100.30 (2.13)**						
3									
4								45.10 (2.07)**	95.80 (1.86)*
LOTHER 1		71.70 (1.99)**							
2			−89.20 (1.93)*						
3									
4									
LNONJ 1			−128.20 (2.49)**						
2									
3				−134.50 (3.47)**					−78.10 (2.83)**
4				−116.90 (2.04)**					
LVOL 1				−110.10 (1.95)*					
2			180.40 (2.92)**						
3									
4									
actual 1		−0.009 (2.41)**	0.008 (1.77)*		−0.009 (2.41)*			−0.008 (3.10)**	
2								0.005 (1.72)*	
3									

Notes: dependent variable in regressions is daily customer order flow. T-stats in parentheses. Standard errors estimated using Newey-West estimator. Full sample is 2 January, 2003 to 28 April, 2004. First and second sub-samples divided around September 20, 2003.

Table reports on significant coefficients for listed variables for lags 1 to 4. Four lagged coefficients for dependent variable, returns and conditional variance not reported but available on request. The regression equation is:

$$\begin{aligned} YV_{it} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{4j} \sigma^2_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{5j} (LMOF^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{6j} (LBOJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{7j} (LOTHER^* \Delta e_{t-j}) \\ &+ \sum_{j=1}^{4} \alpha_{8j} (LNONJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{9j} (VOL^* \Delta e_{t-j}) + \varepsilon_t \end{aligned} \tag{12}$$

where variables are defined as above, except:

Lk = Dummies for level statements of institution type k;

VOL = Dummy for volatility statements by all types of institution;

k = Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ).

*Table 8. Order Flow Equations - with interactive dummy (past returns * verbal intervention * actual intervention)*

	1st Sub-Sample			2nd Sub-Sample			Full Sample		
	Corp	Mutual	Hedge	Corp	Mutual	Hedge	Corp	Mutual	Hedge
DMOF 1			194.5 (2.77)**						
2			−115.4 (2.64)**						
3			−124.4 (2.87)**					−85.0 (2.49)**	
4								74.1 (2.10)**	
DBOJ 1				−151.8 (3.16)**			−74.5 (2.41)**		
2			214.8 (2.14)**						
3		−82.8 (1.89)*							102.8 (2.34)**
4						151.9 (2.18)**			131.9 (3.23)**
DOTHER 1			−360.4 (1.88)**					−114.5 (2.06)**	
2			−389.0 (2.36)**						
3					−82.5 (2.35)**			−65.1 (1.96)**	
4	182.5 (2.05)**		298.6 (2.00)**		−93.9 (2.63)**			−63.7 (2.07)**	
DNONJ 1			−274.1 (2.80)**						
2									
3				−81.0 (1.87)*	−124.0 (2.19)**	−146.5 (1.83)*			
4			−238.5 (2.45)**						
DVOL 1									
2			523.2 (3.34)**			268.50 (1.93)*			318.0 (3.69)**
3		195.1 (3.46)**				279.90 (3.63)**		202.7 (2.54)**	220.3 (2.44)**
4									
actual 1			0.012 (2.90)**		−0.012 (2.61)**			−0.009 (3.41)**	
2									
3		0.012 (2.40)**				0.007 (1.75)*			

Notes: dependent variable in regressions is daily customer order flow. HACSE t-stats in

parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Full sample is 2 January, 2003 to 28 April, 2004. First and second sub-samples divided around September 20, 2003. Table reports on significant coefficients for listed variables for lags 1 to 4. Four lagged coefficients for dependent variable, returns and conditional variance not reported but available on request. The regression equation is:

$$\begin{aligned} YV_{it} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} \Delta e_{t-j} \\ &\quad + \sum_{j=1}^{4} \alpha_{4j} \sigma^2_{t-j} + \sum_{j=1}^{4} \alpha_{5j} (DLMOF^* \Delta e_{t-j}) \\ &\quad + \sum_{j=1}^{4} \alpha_{6j} (DLBOJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{7j} (DLOTHER^* \Delta e_{t-j}) \\ &\quad + \sum_{j=1}^{4} \alpha_{8j} (DLNONJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{9j} (DVOL^* \Delta e_{t-j}) + \varepsilon_t \end{aligned} \tag{13}$$

where variables are defined as above, except:

DLn = Dummies for level statements of institution type n * Dummies on days of BOJ actual intervention;

n = Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ);

DVOL = Dummy for volatility statements by all types of institution * Dummies on days of BOJ actual intervention.

*Table 9. Order Flow Equations - with interactive dummy (past returns * verbal intervention * NO actual intervention)*

	1st Sub-Sample			2nd Sub-Sample			Full Sample		
	Corp	Mutual	Hedge	Corp	Mutual	Hedge	Corp	Mutual	Hedge
MOF 1						99.3 (2.25)**			51.8 (1.76)*
2									
3						105.3 (2.56)**			52.2 (2.00)**
4			90.9 (2.32)**	−48.9 (1.77)*			−29.4 (1.77)*		49.9 (1.81)*
BOJ 1					−145.7 (2.13)**	−190.7 (3.22)**			
2			87.1 (1.69)*						
3			−122.3 (1.85)*						
4									
OTHER 1							−50.3 (1.84)*		
2		92.7 (2.83)**						82.8 (2.13)**	
3									
4									
NONJ 1			−113.6 (2.06)**						
2									
3				62.6 (1.96)**					65.9 (1.76)*
4									
VOL 1						−174.7 (2.80)**			
2				164.8 (3.23)**				101.9 (2.03)**	
3									
4									
actual 1		−0.009 (1.85)**			−0.009 (2.01)**			−0.009 (2.99)**	
2									
3						−0.008 (1.93)**			

Notes: dependent variable in regressions is daily customer order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Full sample is 2 January, 2003 to 28 April, 2004. First and second sub-samples divided around September

20, 2003. Four lagged coefficients for dependent variable, returns and conditional variance not reported but available on request. The regression equation is:

$$\begin{aligned} YV_{it} &= \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} \Delta e_{t-j} \\ &+ \sum_{j=1}^{4} \alpha_{4j} \sigma^2_{t-j} + \sum_{j=1}^{4} \alpha_{5j} (DNOLMOF^* \Delta e_{t-j}) \\ &+ \sum_{j=1}^{4} \alpha_{6j} (DNOLBOJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{7j} (DNOLOTHER^* \Delta e_{t-j}) \\ &+ \sum_{j=1}^{4} \alpha_{8j} (DNOLNONJ^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{9j} (DNOVOL^* \Delta e_{t-j}) + \varepsilon_t \end{aligned} \quad (14)$$

where variables are defined as above, except:

DNOLn = Dummies for level statements of institution type n * Dummies on days of NO BOJ actual intervention;

n = Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ);

DNOVOL = Dummy for volatility statements by all types of institution * Dummies on days of NO BOJ actual intervention.

Table 10. Order Flow Equations - with & without interactive dummy (dummy between moving averages and verbal intervention and no actual or actual intervention)

		Corporate			Mutual			Hedge		
		1st	2nd	Full	1st	2nd	Full	1st	2nd	Full
No Actual &										
MOF		12.7 (2.78)**								
BOJ					−38.70 (2.85)**					
OTHER			−14.9 (1.86)*	−12.60 (2.62)**					−19.2 (1.71)*	−19.2 (2.07)**
NONJ										
VOL		−40.55 (3.68)**	−36.8 (2.70)**	−34.0 (4.46)**	38.2 (2.75)					
Actual &										
MOF										
BOJ									−7.15 (1.69)*	−8.09 (1.83)*
OTHER		24.5 (1.78)*								
NONJ										
VOL										
actual	1					−0.007 (2.16)**	−0.008 (3.03)**			
	2						0.008 (2.07)**			
	3				0.01 (1.80)*				0.009 (1.79)*	0.008 (1.75)*

Notes: dependent variable in regressions is daily customer order flow. HACSE t-stats in parentheses [p-values in square parentheses]. * significant at 10%, ** 5% level. Full sample is 2 January, 2003 to 28 April, 2004. First and second sub-samples divided around September 20, 2003. Four lagged coefficients for dependent variable, returns and conditional variance

not reported but available on request. The regression equation is:

$$
\begin{aligned}
YV_{it} \quad = \quad & \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} BOJ_{t-j} + \sum_{j=1}^{4} \alpha_{2j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{3j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{4j} \sigma^2_{t-j} \\
& + \sum_{j=1}^{4} \alpha_{5j} (MAVLMOF^* \Delta e_{t-j}) + \sum_{j=1}^{4} \alpha_{6j} (MAVLBOJ^* \Delta e_{t-j}) \\
& + \sum_{j=1}^{4} \alpha_{7j} (MAVLOTHER^* \Delta e_{t-j}) + \alpha_8 MAVLNONJ + \alpha_9 MAVVALL \\
& + \alpha_{10} MAVNOLMOF + \alpha_{11} MAVNOLBOJ + \alpha_{12} MAVNOLOTHER \\
& + \alpha_{13} MAVNOLNONJ + \alpha_{14} MAVNOVALL + \varepsilon_t \qquad (15)
\end{aligned}
$$

where variables are defined as above, except:

MAV = difference in long (one year) and short (one month) moving averages of returns.

MAVLn = Dummies for level statements of institution type n * Dummies on days of BOJ actual intervention * MAV;

n = Ministry of Finance (MOF), Bank of Japan (BOJ), Other Japanese institutions (OTHER), and Non-Japanese institutions (NONJ);

MAVVALL = Dummy for volatility statements by all types of institution * Dummies on days of BOJ actual intervention * MAV;

MAVNOLn = Dummies for level statements of institution type n * Dummies on days of NO BOJ actual intervention * MAV;

MAVNOVALL = Dummy for volatility statements by all types of institution * Dummies on days of NO BOJ actual intervention * MAV.

Table 11. Communication & Volatility

	Corporate			Mutual			Hedge		
	C	A	U	C	A	U	C	A	U
Panel (a)		(1)			(1)			(1)	
MOF	−2.252 (3.44)***		−1.54 (3.94)***					−0.456 (1.74)*	
BOJ	0.64 (1.81)*	3.20 (2.10)**			−1.39 (2.07)**			−3.01 (4.58)***	
NONJ			0.84 (1.97)**						
Panel (b)		(1)			(1)			(2)	
ALL						0.97 (2.01)**	−0.232 (2.52)**	−0.592 (2.38)**	
Panel (c)		(1)			(1)			(2)	
MOF	−0.232 (2.52)**		−1.89 (4.40)***	−0.34 (1.61)*		2.16 (2.57)**			
BOJ	−0.742 (1.94)*			−1.70 (3.45)***			1.97 (2.96)**		
NONJ				−16.92 (17.80)***		1.60 (5.09)***	−14.20 (10.90)***		6.77 (5.75)***
Panel (d)					(2)			(2)	
MOF		−0.0009 (2.43)**							
BOJ					1.34 (2.02)**			1.89 (2.51)**	
NONJ								−1.89 (3.03)***	
Panel (e)		(1)			(2)			(3)	
ALL									

Notes: dependent variable in regressions is daily customer order flow. Panels (a) to (e) based upon various collations of volatility communication: Panel (a) - concerned, ambiguous, unconcerned comments by institution; panel (b) - concerned, ambiguous, unconcerned comments for all institutions; panel (c) - consensus comments, defined as days on which all volatility comments by an institution are either all concerned or unconcerned; panel (d) - all volatility comments by institution; panel (e) - all volatility comments. HACSE t-stats in parentheses. * significant at 10%, ** 5% level. Sample is 2 January, 2003 to 28 April, 2004. The regression equations are:

Model (1)

$$YV_{it} = \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} YV_{kt-j} + \varepsilon_t \tag{16}$$

Model (2)

$$YV_{it} = \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{2j} \Delta e_{t-j} + \varepsilon_t \tag{17}$$

Model (3)

$$YV_{it} = \alpha_0 + \sum_{j=1}^{4} \alpha_{1j} YV_{kt-j} + \sum_{j=1}^{4} \alpha_{2j} \Delta e_{t-j} + \sum_{j=1}^{4} \alpha_{3j} \sigma^2_{t-j} + \varepsilon_t \tag{18}$$

where in all cases

$\varepsilon_t = (h_t)^{1/2} \varsigma_t$, $\varsigma_t \tilde{} N(0,1)$

$h_t = \beta_0 + \beta_1 |\varepsilon_{t-1}|^2 + \beta_2\ h_{t-1} + \beta_3\ \varepsilon^2_{t-1} + \sum_j \beta_j D_j$ (EGARCH model); where Dj= Dummy for volatility statement of type j, and all other variables are defined as above.