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Central Bank Authorities' Beliefs about Foreign Exchange Intervention

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Abstract: This paper presents the results of a survey of monetary authorities with respect to foreign exchange intervention. The survey offers evidence on new issues that would otherwise be difficult to investigate, such as response times, non-foreign exchange factors in intervention and profitability. The survey also reveals new evidence on previously studied issues, such as channels of effectiveness. Respondents disagreed with predominant views on intervention and volatility and common arguments against intervention. Exchange rate regimes explain central bank beliefs about important aspects of intervention, including factors that lead to detection of secret interventions and the potential profitability of intervention.

JEL Codes: F31, E58, F42

Key words: Intervention, foreign exchange, survey, central bank

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1. Introduction

The frequency of foreign exchange intervention among developed nations has waned in the last 10 years. The Japanese authorities, for example, have not intervened since March 2004. Even as the frequency of developed country intervention has declined, intervention sizes have increased and intervention remains a policy tool for both developed and developing countries.

The study of the causes and effects of intervention remains pertinent, therefore, both for its own sake and as a way to shed light on microstructure issues such as the role of information transmission. The paucity of accurately timed intraday data on intervention and the simultaneity of intervention and exchange rate returns complicates the econometric study of intervention, however (Neely, 2005a; Neely, 2005b; Fischer, 2006).

The views of individuals familiar with the practice of intervention provide a natural complement to econometric inference or event studies. Central bankers who conduct intervention have collectively witnessed thousands of natural intervention experiments and presumably have important insights into its workings. This observation has motivated at least three surveys of central bankers on the subject of intervention: Neely (2000), Mihaljek (2004) and Lecourt and Raymond (2006).

These three surveys differed in their coverage and emphasis. Neely (2000) surveys the foreign exchange desk/reserve management departments of 22 central banks, asking about the mechanics of intervention. Most responding authorities conduct intervention in spot markets, with domestic commercial banks, during domestic business hours. Misalignments and volatility motivate interventions, while desire for market impact produces mixed effects on secrecy. Interestingly, Neely (2000) finds that central banks unanimously support the idea that intervention is effective in changing exchange rates. Lecourt and Raymond (2006) follow up by

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surveying only central banks of industrialized countries, exploring beliefs about the effectiveness of intervention through various channels. After emphasizing the importance of expectations and credibility to the effectiveness of intervention, the authors go on to describe the quantity and frequency of G3 intervention from publicly released data. Mihaljek (2004) exclusively focuses on authorities of developing countries, finding that interventions are small relative to market size and that most authorities view intervention as effective in calming disorderly markets. Mihaljek (2004) finds that respondents consider intervention to work through expectations of both future monetary policy and intervention. The study concludes that intervention's effectiveness depends on the consistency of macro/monetary fundamentals with intervention. Finally, a substantial part of the work deals with the beneficial effects of reserve accumulation on sovereign credit ratings and vulnerabilities to external shocks.

Instead of focusing on intervention mechanics, the present survey asks market participants about their beliefs about the motivations for, effects of, and arguments against intervention. Neither does survey participation require recent intervention, the cover letter specifically asked authorities to refer to past experiences if they have conducted little or no recent intervention. Several authorities declined to answer the survey, however, citing a lack of recent intervention experience and/or institutional memory.

In addition to studying authorities' beliefs on a wide variety of intervention topics, the present survey considers whether a country's exchange rate regime and per capita output explain the responses. As discussed earlier, the exchange rate regime can obviously influence the motivations for and outcome of intervention. Per capita output serves as a rough proxy for the sophistication of financial markets. Central banks that face deep and sophisticated financial markets might well have different views on the reasons for and efficacy of intervention than

those facing developing markets. To presage the results, central bankers' experiences with exchange rate regimes and—to a much lesser extent—the level of development of their financial markets are often correlated in sensible ways with their beliefs about intervention.

A number of papers have surveyed foreign exchange traders, including at least three that touch on beliefs about intervention. Cheung and Wong (2000), Cheung and Chinn (2001) and Cheung et al. (2004) survey traders in Asia, the United States, and the United Kingdom, respectively. None of these surveys encounter more than modest support for intervention among traders. Most traders believe that intervention raises volatility and are split about whether intervention achieves its goals or moves exchange rates toward fundamentals. The most positive response was in Cheung and Wong (2000). From 55 percent (in Tokyo) to 71 percent (in Hong Kong) of traders say intervention moves exchange rates toward fundamental values but only 32 to 61 percent believe that intervention achieves its goals.

It is worth noting that papers that ask central bankers about their intervention practices and beliefs—like the present paper—face different challenges and contribute a very different perspective than papers that query foreign exchange traders. The latter papers spend a good deal of time inquiring about job titles, seniority and position limits of their respondents in the belief that these characteristics explain beliefs about the foreign exchange market. In contrast, the present study surveys people with similar job titles and a fair amount of seniority, which makes it unlikely that these factors determine differences in their views on intervention.

The current survey contributes to the intervention literature by broadly surveying the beliefs of central bankers who have been directly involved in foreign exchange intervention and/or reserve management. It expands upon some previously considered issues, such as secrecy and factors in successful interventions. For example, this survey asks about factors that lead to the

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detection of secret interventions. But it also extends the methodology to new topics, including effects on volatility, intervention response time, non-foreign exchange motivations for intervention, the potential for profitable intervention and arguments against intervention.

Issues such as response time or non-foreign exchange motivations for intervention would be almost impossible to investigate with other methods but are of considerable importance for econometric investigations. For example, high frequency studies to investigate the effects of intervention are immune to endogeneity bias only if the frequency of the econometrician's data is greater than the response time of the intervening authority. Similarly, non-foreign exchange factors that influence intervention are potential instruments in a study of intervention.

It is also useful to emphasize the limitations of any such survey. While it might be desirable to ask a wide range of questions on intervention practices and interaction with monetary and other policies, a long survey would doubtless reduce the response rate and sample size. To maximize the response rate and sample size, the survey was kept concise (2 pages) and omitted many questions designed to catalogue specific intervention practices that Neely (2000), Mihaljek (2004), or Lecourt and Raymond (2006) covered. Keeping the survey short helped produce a very high response rate of 45 percent, compared to overall response rates in the range of 5 to 20 percent for Cheung and Wong (2000), Cheung and Chinn (2001) and Cheung et al. (2004).

Another potential limitation is that central bankers might have incentives to answer some questions dishonestly. For example, central bankers might be reluctant to report that intervention raises volatility. Systematic dishonesty seems unlikely for several reasons. First, the responses are anonymous, meaning that no central banker must justify or explain a potentially embarrassing response. Second, practically speaking, no central banker will be personally affected by the marginal effect of his/her own anonymous answers published in an academic

study. And third, many central bankers—even those who have been involved in intervention—will publicly criticize past intervention practices or oppose the practice itself.[1] Therefore, it seems likely that the respondents truthfully disclose their views.

2. Survey Structure

The author sent the intervention survey and an accompanying cover letter to the foreign exchange department and/or trading desks of 52 monetary authorities, the group that participated in the Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity (Bank for International Settlements, 2005). The cover letter specified that the survey questions pertained to sterilized intervention and that all responses would be kept confidential, with only aggregate results published. Of the 52 monetary authorities surveyed, 28 responded but only 23 answered some or all of the questions. Of the five authorities that did not answer any questions, several cited a lack of recent intervention activity. One Bank cited privacy concerns in declining to participate. Two of the 23 authorities that responded to some or all of the questions preferred to remain anonymous. Table 1 shows the 23 responding countries, along with their per capita GDP and their exchange rate regime in 1996, 2001, and 2006 according to the International Monetary Fund's Annual Report on Exchange Arrangement and Exchange Restrictions (1996, 2001, 2006).[2] Not all responding authorities answered all questions.

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[1] This author has spoken to several current or recent intervention policymakers who will argue that the practice of intervention is generally unwise and/or should be reserved for extreme situations. These conversations have convinced the author that central bankers are willing to criticize intervention.

[2] One might note that the list of respondents includes several members of the European Monetary Union (EMU). Although these countries do not currently conduct intervention operations, they do have their own institutional memories and beliefs about past intervention. As this paper is primarily concerned with beliefs about intervention rather than current practices, I treat the members of the EMU as separate respondents.

[Insert Table 1 about here]

While the survey did not specifically inquire about the individual respondent's job or seniority, the mailed and/or emailed responses often contained return addresses and/or titles that indicated that most of the responses were returned by the person to whom it had been sent or, in a few cases, a more appropriate office or subordinate. In summary, 13 responses came from the head or deputy head of a department that appears to combine monetary and foreign exchange operations, three responses came from heads of departments of foreign exchange/reserve management operations, and three replies came from economists in international/foreign exchange departments. One of the latter group was filled out in cooperation with the foreign exchange operations department. The vast majority of respondents appear to have a background in operations while a much smaller group has a background in economic research. Several returned surveys did not include any information that identified the individual respondent.

It should be noted that one cannot assume that completed questionnaires represent official positions of the authorities. In fact, at least one response specifically stated that the views were personal, not those of the authority. Instead, it might be more reasonable to interpret the survey evidence as personal beliefs/opinions of officials who are experienced in financial operations.

The survey first addresses whether the authority's intervention experience is in flexible or fixed exchange rates, or both. This issue is potentially important because the motivations for and the effects of intervention potentially depend on the exchange rate regime. To take a couple of simple examples: Intervention in fixed exchange rates is often found—at least ex post—to be done contrary to fundamentals and anecdotal evidence indicates that it is therefore very unprofitable. In contrast, intervention in flexible exchange rates has been found to be conducted in the direction of fundamentals. That is, central banks tend to purchase (sell) currencies that are

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undervalued (overvalued) relative to monetary or price level fundamentals and therefore such intervention has been very profitable for major central banks (Andrew and Broadbent, 1994; Leahy, 1995; Sweeney, 1997; Neely, 1998; Fischer, 2003; Becker and Sinclair, 2004).

In all, 17 banks reported that they had exclusively intervened in flexible exchange rates, 1 reported only intervening to support fixed rates and 5 reported that their responses pertained to both fixed and flexible rate regimes. The answers of the central bank that intervened exclusively in fixed rates will be aggregated with the 5 that reported intervention in both types of markets to assure the confidentiality of the former bank. To facilitate the exposition of results, authorities that intervened exclusively in floating markets will be known as "floaters" while all others will be known as "fixers." This terminology sacrifices literal accuracy for brevity; 5 of the 6 "fixers" also intervened in floating markets. It would be more accurate—but too wordy—to refer to the fixer authorities as "authorities with some experience in fixed rate markets."

This survey deliberately asked authorities to define the exchange rate regime that corresponded with their intervention experience, rather than using a definition from IMF or another source. The reason for this is that authorities might wish to report on beliefs and intervention experiences that pertain to a past—not current—exchange rate regime. Therefore, the information in Table 1 need not match the self-reported definitions. In addition, some authorities have had fixed/pegged experience that Table 1 fails to report. For example, Italy and Mexico have had fixed rate experience since 1991 and the two anonymous authorities might also have had such experience.

One might be concerned that there are too few fixers to justify a comparison of the beliefs of fixers versus floaters. Or, one might be concerned that some of the fixers might be better described as floaters with modest experience in fixing rates. It is true that both of these facts will

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potentially reduce the power of tests to contrast the beliefs of fixers and floaters. Whether one

can find such differences despite these problems is ultimately an empirical question, however.

This study finds some intriguing differences between the attitudes of the two groups, which

accord with intuition and are sometimes statistically significant. This fact shows that the

investigation is a useful exercise, despite its potential weaknesses.

The use of statistical analysis with small samples merits some explanation. This paper

computes standard errors and test statistics with the normal/linear approximations to the ordered

probit relations. A small bootstrapping exercise was used to determine the properties of the

standard errors and test statistics under the very small sample sizes. Using several of the

empirical distributions of the response, means of the sample were drawn with replacement to

construct the small sample distribution of the standard errors of the mean. Distributions for the t

statistics were constructed similarly. The bootstrapping exercise showed that although the

sample sizes are small, the asymptotic coverage intervals are fairly accurate, perhaps even

slightly conservative and the t statistics were correctly sized.[3] It seems likely that the asymptotic

properties of the statistics accurately describe the small sample behavior of the statistics because

the underlying data are sampled on a discrete space and are not subject to kurtosis or other

factors that would tend to make the asymptotic statistics misleading.

While the asymptotic properties of the statistics accurately describe their small sample

properties, it is worth noting that the power of the statistics might be relatively low, especially

when testing for differences between groups. This low power means that the risk of Type II

error—improperly failing to reject the null of equal means—is fairly high. Of course, failing to

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[3] Given that the small sample sizes mean relatively low power, it would be potentially valuable to reconsider the

exercises in this paper with Bayesian procedures that would balance the loss associated with types I and II errors.

reject the null does not mean accepting the null; failing to reject the null means that no conclusion is drawn. Therefore, this paper will sometimes note and speculate on the reasons for differences between groups that are not statistically significant.

Another potential concern with conducting statistical tests on mean responses is that one must impute numerical values (1, 2, 3, 4, 5) to qualitative responses (strongly disagree, disagree, neutral, agree, strongly agree). While it is sometimes incorrect to impute quantitative values to qualitative variables, the symmetry and clear, monotonic progression of the qualitative relation alleviates such concerns here.

The next sections of the paper report authorities' beliefs about four classes of issues: 1) the effects of intervention; 2) the intervention reaction function; 3) beliefs about intervention's profitability; and 4) arguments against intervention.

3. The Effects of Intervention

- Intervention has effects in markets other than the one in which it is conducted.

The first set of questions asks about the effects of intervention. While Neely (2000) established that central bankers unanimously believe that intervention influences exchange rates, researchers have recently begun to consider whether intervention has effects in markets other than the one in which it is conducted. Beine et al. (2005), for example, find that intervention has effects on currency components in markets other than that in which it is conducted. The first row of Table 2 shows that most central bankers agree with the statement that "Intervention has effects in markets (currencies) other than the one in which it is conducted." The mean response was 3.32, with a standard error of 0.20 and 12 of the 22 central bankers agreed or strongly agreed with the statement. The column labeled "Stat 1" shows that the t statistics for the null that the mean response is neutral (equals three) is 1.62. Floaters support the multiple-markets-effect

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while fixers do not: the mean responses for the two groups were 3.47 and 2.80, with t statistics of

2.10 and -0.48 (row 1). The column labeled "Stat 4" shows that this difference between the

estimated means of the two small groups is not statistically significant, however, with a *t* statistic

of 1.43. Given the very small sample sizes—17 and 6—this failure to find a statistically

significant difference between groups is unsurprising. Overall, the results support the findings of

Beine et al. (2005), who study floating rate, USD, markets.

   [Insert Table 2 about here]

- Authorities do not agree that intervention raises volatility.

   The effect of intervention on volatility is one of the most often studied issues in the

intervention literature, yet it remains unresolved. Many papers find that intervention seems to

cause (or be associated with) higher volatility (e.g., Baillie and Osterberg, 1997; Beine and

Laurent, 2003; Frenkel et al., 2003; Edison et al., 2006; Fratzscher, 2006). Many others find

mixed effects, either over time or subsamples: Kim et al. (2000), Dominguez (2006), Hillebrand

and Schnabl (2003), Smith et al. (2004), Fatum (2005) and Fatum and King (2005). Disyatat and

Galati (2007) find no effect on volatility. Aguilar and Nydalh (2000) reject the view that

intervention lowers foreign exchange volatility.

   While most studies find that intervention raises uncertainty, the literature is not unanimous

on this point. This predominant view is puzzling because intervention is often explicitly thought

to be implemented to counter volatility. The International Monetary Fund's (IMF) document:

"Surveillance over Exchange Rate Policies," for example, states that *"A member should*

intervene in the exchange market if necessary to counter disorderly conditions, which may be

characterized inter alia by disruptive short-term movements in the exchange value of its

currency."[4]

Failure to correctly resolve the difficult issues of simultaneity/identification of the cross-effects of volatility and intervention might explain the finding that intervention raises volatility. Given the difficulties with empirical investigations, the views of those who actually practice foreign exchange intervention might help resolve this unsettled question.

Both groups of monetary authorities largely disagreed that intervention causes higher exchange rate volatility (Table 2, row 2). The mean responses among all central banks was 2.86 and the response of banks that also intervened in fixed exchange rate markets was similar, only 3.20. Neither mean was significantly different from neutrality (3). Nine of the 22 central banks either disagreed (7) or strongly disagreed (2) with the statement.

- Central banks disagree on the horizon over which intervention raises volatility.

The survey then inquired as to how long it takes for intervention to have its maximal effect on volatility and how long it takes for volatility to return to normal. Central bankers who agreed that intervention increases volatility, estimated that the maximal effect occurs in a few minutes to a few hours, though 2 authorities allowed for the possibility that the peak might take days to show up. (Full responses are omitted.) There was also much dispersion in estimates of how long volatility takes to return to normal. The median view was that volatility returned to normal in 2 or 3 days and the maximal educated guess was 6 months.

- Intervention operates through multiple channels.

Another important issue is the channel through which intervention operates. Because sterilized intervention doesn't affect either prices or interest rates, it doesn't influence the exchange rate directly through the usual monetary mechanisms. But official intervention might

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[4] See http://www.imf.org/external/pubs/ft/sd/index.asp?decision=5392-(77/63).

affect the foreign exchange market indirectly through the *portfolio balance* channel, the *signaling* channel, and/or the *coordination channel*. The portfolio balance theory recognizes that sterilized intervention changes the relative supplies of bonds denominated in different currencies. If bonds in different currencies are imperfect substitutes, investors must be compensated with a higher expected return to hold the relatively more numerous bonds. The higher return must result from a change in either the price of the bonds or the exchange rate. The signaling channel suggests that official intervention communicates (signals) information about future monetary policy or the long-run equilibrium value of the exchange rate. Sarno and Taylor (2001), Taylor (2005), and Reitz and Taylor (2006) have emphasized the potential importance of the coordination channel, which suggests that intervention might be important in coordinating the expectations of rational speculators.

Knowledge of the channels by which intervention operates is potentially important for understanding microstructure issues, such as the transmission of information and the formation of expectations. This issue has recently received less attention than when it was the subject of studies like Dominguez and Frankel (1993), Lewis (1995), Kaminsky and Lewis (1996) and Fatum and Hutchison (1999), but it is still unresolved.

In Lecourt and Raymond's (2006) survey, 7 of 9 central banks reported believing in the efficacy of the signaling channel, as opposed to the portfolio balance channel and "direct effects."[5] This survey adds the options of the coordination channel and the restoration of liquidity in a one-sided market, a traditional view.

This survey asked about the effectiveness of each channel separately, allowing support for multiple channels. In accord with the literature, the central bankers don't take the portfolio balance channel very seriously. Row 3.1 of Table 2 shows that this channel elicited a mean

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[5] Vitale (2003) provides a model of the signaling channel.

agreement of only 2.77. Floaters were more somewhat more likely to agree with the statement than fixers, but the difference was not statistically significant. The respective mean agreement rates were 2.94 and 2.20 and the t statistic for their equality was 1.28. Rich countries were much more likely to disagree with the effectiveness of the portfolio balance effect, however. The t statistic for the regression of the portfolio-balance response on per capita GDP was -4, even after controlling for exchange rate regime. (Full GDP regression results are omitted for brevity.) This disagreement likely reflects the fact that rich countries have deep financial markets in which existing bond stocks are very large compared to the size of intervention. In addition, the bonds of developed countries might be fairly close substitutes for each other.

Table 2, rows 3.2 and 3.4, show that central bankers are most likely to agree that intervention is effective through restoring liquidity (mean 4.00) and signaling (3.64). The bankers also gave substantial support to the coordination channel (row 3.3) with a mean agreement of 3.59, among all banks. All of these mean agreement rates were statistically significantly greater than three.

Row 3.3 of Table 2 shows that floaters appear to support the coordination channel somewhat more strongly than the fixers (mean response of 3.71 for floaters vs. 3.20 for fixers) but support signaling less (3.53 versus 4.00). Although the differences are not statistically significant, they are consistent with one's intuition on the relative importance of the channels under different exchange rate regimes. Floating exchange rate markets are precisely where expectations are likely to become unmoored and intervention can provide coordinating signals (Frankel, 1996).[6]

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[6] Several features of floating exchange rate markets create concerns about expectations. Survey forecasts of exchange rates are inaccurate and often not internally consistent (Frankel and Froot, 1987; Sarno and Taylor, 2001); Engel (1996) blames expectations for the failure of uncovered interest parity (UIP); Trend-following trading rules make risk-adjusted excess returns (Neely, 1998); And switching from fixed to floating rates changes the volatility of real exchange rates and the ability of UIP to explain exchange rate changes (Mussa, 1986; Flood and Rose, 1996).

Banks with fixed exchange rate regimes, in contrast, might be more concerned with market impressions of fundamentals. Thus, they apparently emphasize intervention's role in signaling.

- Coordination, size, and market conditions increase the probability of successful intervention.

    Regardless of the channel by which intervention operates, one would like to know what factors play a role in its success or failure. The survey asked about the sorts of factors that make for successful intervention and the characteristics of a successful intervening authority. The factors listed are those that the intervention literature has deemed important: coordination, the first intervention in a series, size of transaction, market uncertainty about fundamentals, market uncertainty about current events, and leaning-with-the-wind intervention. Humpage (1999) and Fatum (2002), for example, find that *coordinated intervention* is more effective than unilateral. (Coordinated intervention is the practice of multiple authorities intervening in the same direction on the same day. It is unrelated to the coordination channel.) Chaboud and Humpage (2005) find that the large, infrequent interventions of the Bank of Japan are particularly effective. Fatum and Hutchison (2006) find that coordination and size are both important. Fischer and Zurlinden (1999) find that only the initial Swiss intervention in a series matters. The microstructure literature, e.g., Dominguez (2003) and Pasquariello (2002), motivated the market uncertainty options. And Neely and Weller (2006) show that in a model with limited arbitrage, the central bank intervenes less (more) aggressively when the exchange rate deviates a moderate (extreme) amount from fundamental value.

    Rows 4.1 through 4.6 of Table 2 show that all of these factors received substantial support from the combined set of central banks. In particular, the idea that coordination (3.90) and size (3.82) were important received the most agreement from the overall group. But the other factors also received support: uncertainty about fundamentals (3.73), first in a series (3.71), leaning-

with-the-wind (3.64), and uncertainty about current events (3.62). All these mean responses were highly significantly different from neutral.

The fixers were less sanguine than the floaters about all the factors noted, except coordination and leaning-with-the-wind. Despite the small sample size, the difference of opinion between floaters and fixed rate authorities was significant (marginally) for the size of intervention. That is, floaters put more emphasis on the size of interventions.

Looking at characteristic of successful authorities—rather than successful interventions—the survey asked if some authorities were more successful than others in intervening. Row 5 of Table 2 reports an overall mean agreement rate of 3.55, which had a t statistic of 3.68 against the null that it equaled 3 (neutral). Floaters and fixers agreed with this idea at similar rates.

- Successful authorities act consistently with fundamentals, have substantial resources, a reputation for past success and choose trading opportunities skillfully.

The survey then asked whether the following characteristics made for a successful intervening authority: substantial resources, consistency of strategy, skillful intraday choice of trading opportunities and reputation for past success. Rows 5.1 through 5.4 of Table 2 show that both floaters and fixers broadly agreed that consistency of intervention with fundamentals is important (overall mean was 4.50), a reputation for past success is helpful (overall mean was 4.18), substantial resources help an authority be successful (overall mean was 3.95) and that skillful choice of trading opportunities within the day is important (overall mean was 3.86).

The differences of opinion between the two groups of banks are mostly modest and insignificant on the factors that contribute to a successful intervention. The largest difference pertains to the importance of a reputation for success, which fixed rate central banks appear to find more important (4.06 for floaters versus 4.60 for fixers). This difference had a t statistic of -1.92 (see row 5.4). This is consistent with the emphasis placed on the credibility of fixed exchange rates.

- Authorities in rich countries are less likely to credit substantial resources for success.

Ironically, authorities of high-income countries are significantly less likely to agree that large interventions are helpful (Table 2, question 4.3) or that substantial resources improve an authority's intervention success rate (Table 2, question 5.1). When the responses to these statements are regressed on exchange rate regime and log of purchasing power parity adjusted per capita gross domestic product (GDP), the coefficients on GDP have t statistics of -2.18 and -2.24, respectively, indicating that rich countries are much less likely to agree that substantial resources are helpful. (These regression results are not in the tables.) Perhaps authorities of rich countries find it harder to influence the more developed, deeper markets that they face. Or, the authorities of high-income countries might be more cognizant of the limitations of great resources or less aware of the limitations imposed by lack of resources. Finally, it is also possible that central banks of developed economies have easier access to short-term financing and see less need to hold substantial reserves.

4. The Intervention Reaction Function

Although many researchers have investigated the intervention reaction function, many questions remain. Much research has found that central banks in floating markets intervene under a fairly consistent set of conditions (Edison, 1993; Almekinders and Eijffinger, 1996).

Intervention has, for example, often been deployed to counter "disordered markets" by leaning against short-term fluctuations. Such intervention has usually been combined with other features like targeting the "long-term" value of the exchange rate implied by fundamentals.

One question that traditional econometric (or event study) methodology cannot easily answer is whether intervention responds directly to factors outside the foreign exchange market. A second question is how long it takes for intervention decisions to be made and translated into actual intervention. That is, how long is the decision loop of the intervening authority? Both of these issues are important in the structural study of intervention.

External events that directly influence intervention are important because they help inform the search for instruments. For example, when one searches for instruments to be used in estimating the effects of intervention in a structural, linear model, one needs an instrument that predicts intervention, but does not directly influence exchange rates. Conversely, when one estimates an intervention reaction function, one typically searches for an instrument that predicts exchange rate changes but does not directly influence intervention.

The response time for intervention is important because the recent spate of high-frequency intervention studies depend on reaction time for their justification. That is, an important potential advantage of high-frequency studies is that they can avoid simultaneity between intervention and exchange rate returns at a frequency higher than the decision loop of the authority. If an authority takes 10 minutes to react to exchange rate developments but exchange rate returns are available at a 5 minute frequency, then there is no contemporaneous effect of exchange rates on intervention and a simple regression of returns on intervention can produce consistent estimates of the pseudo-structural impact of intervention.

In addition, a survey is useful in separating the factors in the decision to intervene from the

factors that govern conditional intervention size. The final issue in this section pertains to

secrecy. This survey extends previous work on secrecy (i.e., Neely, 2000; Lecourt and

Raymond, 2006) by asking about factors that increase the probability that a secret intervention

will be detected, and by considering the structural reasons for secrecy that Beine and Bernal

(2005) discuss and empirically investigate.[7]

[Insert Table 3 about here]

- Intervention does not respond directly to factors outside the foreign exchange market.

The survey asked for examples of cases in which "Intervention sometimes responds directly

to conditions or factors outside the foreign exchange market." The first column of Table 3 lists

the possible non-foreign exchange factors to which intervention directly reacts, which 15

authorities suggested. Five authorities suggested that some variation of "political events" or

"international events" might trigger intervention. One might interpret those to include wars,

political assassinations, elections or other changes in governments. Four central banks referred

to the desire to reinforce or signal changes in monetary policy. One authority voiced a

willingness to intervene to coordinate with other central banks.

[Insert Table 4 about here]

The first row of Table 4 shows that authorities do moderately agree with the idea that

intervention sometimes responds to factors outside the foreign exchange market. The overall

mean response is only 3.43, with a t statistic of 1.79. Fixers unanimously agree with the

statement, but floaters show less concurrence.

One might interpret the examples in Table 3 as factors outside the foreign exchange market

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[7] Bhattacharya and Weller (1997) and Vitale (1999) develop models to rationalize the use of secret intervention.

that could elicit intervention only through their effect on the foreign exchange market.[8] That is, if an assassination had no appreciable effect on the exchange rate, intervention would be an unlikely reaction. The most reasonable interpretation of the results in Table 3 is that while no non-foreign exchange factors would directly elicit intervention, some might indirectly elicit intervention through their effect on exchange rates.

- Central banks can respond quickly with intervention, especially if they are on alert.

How long does it take for intervention decisions to be made and to translate into actual intervention? Because reaction times might depend on whether a central bank expects to have to intervene, the survey asked about reaction times in 2 cases: 1) If there had been no recent intervention; and 2) if the monetary authority was already on "alert" for developments.

The second column of Table 3 shows that, if there was no recent intervention, all central banks but one reported being able to intervene within 6 hours and all but four within 2 hours. The median response time was less than 60 minutes. One central bank reported that it would take 1-5 days to initiate intervention if there had been none recently. Five central banks reported response times of 5 minutes or less.

If central banks were "on alert" to intervene, the response times declined precipitously (third column of Table 3). The median response time was one minute.[9] The longest response period that any central bank reported was "less than an hour." All other responses were 10 minutes or

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[8] Several central banks cited "non-FX" factors that I would consider to pertain directly to the foreign exchange market. For example, two central banks expressed the view that intervention responded to real appreciation. Another central bank referred to foreign exchange volatility as precipitating intervention. Also, two central banks referred to intervention to accumulate reserves, which is not usually considered intervention per se.

[9] I interpret responses such as "immediately" and "instantly" as one minute or less in this discussion. Although one could dispute this quantitative interpretation, no reasonable interpretation would change the inference.

less. Authorities that are "on alert" can react very quickly to developments.

What factors figure into the size of the intervention, conditional on the existence of intervention? Such a question is difficult to answer with traditional econometric methodology and the literature has been largely silent on this specific issue.[10]

- Market liquidity, trends and desire-to-make-an-impact influence the size of interventions.

Rows 2.1 through 2.3 of Table 4 show that central bankers tend to agree that each of the following three factors influence the size of interventions: 1) market liquidity (mean response was 4.18); 2) strength of market trends (4.14); and 3) desire to make an impact (4.09). All these means were significantly greater than three. Floaters offered somewhat greater agreement with the first two statements than did fixers, but the difference was not significant. Authorities' views on the determinants of a successful intervention (Table 2, rows 5.1 to 5.4) are positively correlated with views on the determinants of the size of intervention (Table 4, rows 2.1 to 2.3).

- Central bankers do not reinforce successful intervention.

Central bankers do not feel the need to reinforce success, however. Row 3 of Table 4 shows that respondents tend to disagree with the proposition that "after an initial intervention, my authority is more likely to intervene again if the initial intervention was successful." The mean response to this statement was 2.68. Responses of central banks that intervened exclusively in floating markets were similar to those with experience in fixed rate markets (2.65 versus 2.80).

Finally, we turn to the issue of secrecy. Interventions are usually considered to be secret if the monetary authority attempts to conceal its foreign exchange transactions, though such dealings may be made public at a later date. Central banks have widely varying policies on secrecy. The Swiss National Bank, for example, reveals all of its intervention activities on the

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[10] Kearns and Rigobon (2005) differentiate between the two decisions and discuss their endogeneity.

same day that they occur (Fischer and Zurlinden, 1999). The Bundesbank, in contrast, had a reputation for attempting to conceal its activities (Reitz and Taylor, 2006).

When asked, "How often does your authority conduct intervention secretly?" about ½ of responding authorities said "never." Several central banks reported percentages in excess of 80 percent, however.[11] The tables omit these results for brevity.

- Central banks modestly agree that Beine and Bernal's (2005) factors motivate secrecy.

Beine and Bernal (2005) suggest several reasons why central banks might want to keep their intervention secret: previous failure in intervention, inconsistency with an exchange rate target, inconsistency with monetary/macro fundamentals, and intervention contrary to recent trends.

Perhaps because so many central banks don't intervene secretly, there was only modest agreement that these factors motivated secret intervention. Rows 4.1 through 4.4 of Table 4 show that the mean agreement scores were 3.42 for previous failure in intervention, 3.47 for inconsistency with an exchange rate target, 3.42 for apparent inconsistency with monetary/macro fundamentals and only 3.26 for leaning-against-the-wind intervention. The first three mean scores are significantly greater than neutral (three) at the five percent, one-sided level.

Despite the modest levels of agreement, the overall results are consistent with the factors proposed by Beine and Bernal (2005). Mean scores for the floaters and fixers were similar and there was a high degree of correlation in authorities' answers on these questions. That is, a central bank that was likely to agree with one reason for secrecy was likely to agree with others as well. For example, there was a 93 percent correlation between answers to the two questions

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[11] Bhattacharya and Weller (1997) point out that there are two dimensions of secrecy, whether intervention occurs and how large it is. This paper focuses on the first dimension, while Bhattacharya and Weller (1997) suggest that central banks are more concerned with the second.

on inconsistency (4.2 and 4.3). This is clearly statistically significant; the standard error for a

correlation with 20 observations is about 0.22. Full correlation results are omitted for brevity.

- Large and coordinated secret interventions are more likely to be detected.

Central banks concur more about factors that increase the probability that a secret

intervention will be detected by market participants. Rows 5.1 through 5.5 of Table 4 show that

the respondents agree that large and coordinated interventions are more likely to be detected by

the market, with mean scores of 4.21 and 4.16, respectively. The idea that large interventions are

easier to detect is consistent with Klein's (1993) results on public reports of intervention. The

mean response to the idea that recent previous interventions also increase the probability of

detection is fairly high, 3.89 (row 5.3). A greater perceived misalignment of exchange rates

from fundamentals and past success are less likely to increase the probability of detection. Those

factors receive mean scores of 3.53 and 3.42, respectively (rows 5.5 and 5.4). All of these mean

rates of agreement were highly significantly greater than three (neutral) for the floaters and the

overall results.

Remarkably, fixer authorities unanimously strongly agreed that coordination with other

central banks would increase the probability of detection of a secret intervention. And the

difference between floaters and fixers on the revealing nature of coordination was also very

statistically significant, with a t statistic of -3.26 (row 5.2).

5. Profitability of Intervention and Active Reserve Management

Milton Friedman's (1953) conjecture that stabilizing speculation is equivalent to profitable

speculation has motivated much research on the profitability of intervention. While the link

between profitability and stabilizing speculation is tenuous—Salant (1974), Mayer and Taguchi

(1983), and De Long et al. (1989) provide counterexamples—researchers continue to find that

major central banks have made significant profits through intervention in floating rate markets (Andrew and Broadbent, 1994; Leahy, 1995; Sweeney, 1997; Neely, 1998; Fischer, 2003; Becker and Sinclair, 2004).

The subject of the profitability of intervention is very discomforting to central bankers despite the fact that almost all relevant studies have shown that major central banks have clearly made excess returns on intervention in floating rate markets. Central bankers are loath to lose taxpayer resources and almost equally unwilling to be seen as profiting from trades with the public. For example, the 21 central banks that took part in the survey by Neely (2000) were unanimous that profitability was never a motive for intervention.

[Insert Table 5 about here]

- Floating rate central banks believe that they can profit from intervention at all horizons but seem to be concerned about the risk.

The answers to the current survey illustrate this ambivalence toward profitability. The first question is "Suppose that the proper legal authority (government or bank governor) were to instruct your monetary authority to actively manage its reserve assets by buying/selling foreign exchange. (Both the size and currency composition of reserves are actively managed.) Could active management generate a positive excess return—in excess of opportunity cost—at reasonable risk for the taxpayer?" Row 1 of Table 5 shows that although more central bankers agreed with this statement than disagreed, the fact that 3 central bankers strongly disagreed lowered the mean agreement score to 2.95. The views of fixers (mean score 2.33) largely drive this overall disagreement. Central bankers who intervened exclusively in floating markets had a mean score of 3.21 and the difference between floaters and fixers (3.21 versus 2.33) has a t statistic of 1.82.

The responses to the next assertion: "I believe that my authority's trading desk could trade profitably with holding periods over the following horizons" underscore the ambivalence of central bankers' thinking on profitability. Rows 2.1 through 2.3 of Table 5 show that survey participants believe that their trading desks could trade profitably at intraday (3.29), weekly/monthly (3.38) and one-to-ten-year holding periods (3.38). The t statistics associated with these answers are 1.59, 2.07 and 1.54. In other words, while the overall responses tend to disagree that active return management could create a reasonable risk-return tradeoff, respondents think that their trading desks could trade profitably over all horizons.

There was positive correlation between the answers to all the profitability questions, however. Authorities that believed that their trading desks could trade profitably at one horizon were more likely to believe that they could trade profitably at other horizons. The correlations between the answers to statements 2.1 through 2.3 were 0.31, 0.58, and 0.31.[12] The tables omit full results for brevity. And authorities that believed that they could trade profitably with a reasonable risk were more likely to believe that they could trade profitably at all horizons. The correlations were 0.59, 0.47, and 0.57 between the responses to statement 1 and statement 2.1, 2.2, and 2.3 in Table 5.

- Fixers are less optimistic about profiting from intervention.

Central bankers who participated in fixed rate markets were less sanguine about the potential profitability than those that participated in only floating markets. The mean scores for the three horizons were 2.83, 3.17 and 3.00 for the fixed rate central banks and 3.47, 3.47 and 3.53 for the authorities that intervened exclusively in floating markets (rows 2.1 through 2.3). The responses of the floaters were significantly different from neutral while those of the fixers were not.

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[12] The correlations will all have asymptotic standard errors of approximately 0.21.

While the differences between the agreement rates for the two groups are not statistically significant, they do accord with publicly known, diverging experiences of monetary authorities in floating and fixed markets. For example, during the 1990s there were a number of successful speculative attacks on fixed exchange rate regimes: the ERM crises of 1992/93, the Mexican Peso crisis of 1994 and the Asian currency crises of 1997.[13] Market observers believe that central banks defending these fixed parities lost significant amounts of money. In contrast, a substantial amount of evidence indicates that all major central banks have made positive, significant, excess returns with intervention in floating markets.

To summarize the results on profitability, central bankers who act exclusively in floating rate markets tend to agree with the proposition that they can make risk-adjusted returns for the taxpayer with intervention (mean of 3.21, row 1). In contrast, authorities with experience in fixed rate markets tend to disagree that they could make risk-adjusted returns (mean of 2.33, row 1) and this difference has a t statistic of 1.82. And floaters were more optimistic in responding to the question as to whether their trading desks could make excess returns at various horizons. Central bankers in floating rate regimes have the greatest confidence in their trading desks over the longest horizons, precisely the horizons at which studies have shown that floating rate intervention has been profitable.

One way to reconcile the apparent contradiction in the answers is that the first question asked explicitly about "risk-adjusted" returns. It might be the case that some central bankers would subjectively consider the risk too great to justify. This seems to be particularly true to central bankers with experience in fixed rate markets.

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[13] The "fixed" exchange rate regimes are liberally defined to include target zones and crawling pegs.

6. Arguments Against Intervention

Finally, we ask the central bankers to evaluate arguments that are commonly used against foreign exchange intervention. Four arguments were considered: 1) Intervention will confuse the public with respect to monetary/other policies; 2) Intervention is ineffective at changing exchange rates; 3) Intervention will move exchange rates away from market determined values; and 4) Intervention will substitute for other necessary policy changes.

These arguments have been culled from a variety of sources. Mohanty and Turner (2005) suggest that intervention might confuse the public with respect to monetary policy. Schwartz (2000) and Humpage (1999) outline some arguments against intervention. Schwartz (2000), for example, implicitly argues that intervention is unlikely to be effective because central banks will have, at best, a very modest informational advantage over private agents. Truman (2003) points out that there is no empirical evidence of a long-run effect of intervention.[14] Finally, critics accused the Banco de Mexico of substituting intervention for necessary policy changes prior to the peso crisis of 1994.

[Insert Table 6 about here]

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[14] It is true that there is no evidence of a long-run effect of intervention, but there is a good reason for this: Uncertainty about the exchange rate's value grows with the forecast horizon, which precludes any conclusion about intervention's effect except at short horizons. In other words, if a random walk reasonably well approximates the exchange rate process, the size of the forecast confidence interval for future exchange rates increases with the square root of the forecast horizon, $\sqrt{H}$. As the forecast horizon increases, any finite effect of intervention will be swamped by the ever-increasing uncertainty about future exchange rates. Intuitively, because we are very uncertain about the value of the exchange rate one year ahead—with or without intervention—we cannot know if intervention has an effect at that horizon.

- Common arguments against intervention do not persuade the responding authorities.

Respondents did not strongly support any of these arguments against intervention. The argument that found the most agreement is that intervention will be used to substitute for other necessary policy changes, with an overall mean agreement score of 3.36 (see Table 6, row 1.4). The average agreement among floating-rate central banks is a statistically significant score of 3.53, while it is only 2.80 for fixers (row 1.4). In contrast to the modest support for this proposition, respondents show almost no support for the other three propositions: 1) Intervention will confuse the public with respect to monetary/other policies; 2) Intervention is <u>ineffective</u> at changing exchange rates; and 3) Intervention will move exchange rates away from market determined values. The mean overall agreement scores for these three assertions are 2.64, 2.55 and 3.00, respectively (rows 1.1 through 1.3). The mean for the statement that "intervention is ineffective" is significantly less than three, with a t statistic of –1.98. This disagreement with the statement that intervention is effective is consistent with findings in Neely (2000). Floating and fixed-rate central banks had similar rates of disagreement with these statements.

7. Discussion and Conclusion

This paper describes the results of a survey sent to 52 monetary authorities regarding their experiences with and beliefs about foreign exchange intervention. 23 of those authorities responded to some or all of the questions, including 17 with experiences exclusively in floating rate regimes and 6 that have experience in fixed exchange markets. Most responses came from heads of departments devoted to monetary and/or foreign exchange operations. The purpose of the survey was twofold: 1) to investigate questions that would be very difficult or impossible to investigate with more conventional empirical techniques; and 2) to challenge the results of the empirical literature on intervention with new evidence from participants.

The paper provided evidence on several issues that have been little researched—perhaps because they would be very difficult or impossible to investigate with traditional methods. For example, this paper established that reaction times for intervention are fairly rapid, but time-varying, dependent on whether the authority is alert to market developments. The paper also inquired about non-foreign-exchange factors in intervention decisions. All the factors cited—wars, assassinations, elections etc.—are unlikely to directly elicit intervention, but rather do so through their effects on the foreign exchange market. Further, the paper studied the determinants of the size of intervention, which Kearns and Rigobon (2005) emphasize is a separate empirical issue from the propensity to intervene. The paper finds that monetary authorities are unlikely to reinforce successful intervention. And the paper extended the literature on secrecy by inquiring about the factors in the probability of detection of secret interventions.

Reassuringly, the central bankers supported many of the conclusions of empirical research on intervention. For example, respondents agreed that intervention's effects are not confined to the market in which it is conducted and the signaling, coordination and liquidity channels are more plausible than the portfolio balance channel. And they found Beine and Bernal's (2005) motivations for secrecy to be plausible.

On other issues, however, correspondents dissented from academic conventional wisdom. Respondents were likely to disagree with the assertion that intervention increases volatility, for example. And central bankers who conduct intervention were unpersuaded by most of the common arguments against intervention. The only argument that participants tended to support is that intervention might be used to substitute for other necessary policy changes.

Despite the small sample size, exchange rate regime and national income sometimes significantly explain the attitudes and beliefs of authorities on intervention. For example, per-

capita GDP significantly explains whether a responding authority believes that substantial resources are important for the success of intervention. Floating rate authorities consider the size of intervention to be more likely to raise the probability of a successful intervention. And fixers are more likely to believe that coordination increases the probability that the market will detect secret interventions.

Monetary authorities are a bit schizophrenic about the profitability of intervention. The mean response to the statement that "active reserve management could generate a positive excess return—in excess of opportunity cost—at a reasonable risk for the taxpayer," was only 2.95 (Table 5, Row 1), indicating very mild disagreement, on average. But central bankers agreed that their trading desks could trade profitably at intraday horizons through multi-year holding periods. Floating authorities were more optimistic than fixers about their ability to generate excess returns at reasonable risk and the difference is marginally statistically significant, despite the very small samples. The discrepancy between the ability to actively manage reserves and the ability to trade profitably might be due to the reluctance of central bankers to take on such a potentially distracting responsibility, despite the fact that they believe that they could do so successfully.

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Table 1: Responding monetary authorities

Participant	Per-Capita GDP in PPP terms	Exchange Rate Regime		
		1996	2001	2006
Anonymous				
Anonymous				
Australia	32,000	MF	IF	IF
Canada	32,800	MF	IF	IF
Chile	11,300	Pegged Float; Crawling band against the USD, DEM and JPY	IF	IF
Ireland	34,100	Pegged with +/-15% EMS band	EMU; IF	EMU; IF
Israel	22,200	Pegged with +/- 7% band against basket of DEM, FRA, JPY, GBP, and USD	Pegged Float; Crawling band against the USD, EURO, GBP, and JPY.	IF
Italy	28,300	MF	EMU; IF	EMU; IF
Lithuania	13,700	Fixed at 4 LTL/Dollar	Fixed at 4 LTL/Dollar	Fixed at 3.4528 LTL/EURO
Mexico	10,000	IF	IF	IF
Netherlands	30,500	Pegged with +/-15% EMS band	EMU; IF	EMU; IF
New Zealand	24,100	MF	IF	IF
Norway	42,400	MF	MF	IF
Peru	6,000	IF	IF	MF
Philippines	5,100	MF	IF	IF
Russia	10,700	Pegged Float with a 4,300 to 4,900 rubles per dollar band	MF	MF
Slovakia	15,700	Pegged with +/- 1.5% band against two currencies	MF	Pegged with 15% target rate band of 38.4550 KOR/EURO
Slovenia	20,900	MF	MF	Pegged with 15% target rate band of 239.640 SIT/EURO
South Africa	11,900	MF	IF	IF
Spain	25,100	Pegged with +/-15% EMS band	EMU; IF	EMU; IF
Switzerland	35,000	MF	IF	IF
Turkey	7,900	IF	IF	IF
United States	41,800	MF	IF	IF

Notes: The table shows the respondents to the survey along with their per-capita PPP-adjusted GDP in USD and their exchange rate regimes as of 1996, 2001 and 2006, according to the International Monetary Fund (IMF) Annual Report on Exchange Arrangement and Exchange Restrictions (1996, 2001, 2006). Two of the 23 respondents preferred to remain anonymous. The acronyms IF, MF, and EMU stand for independent float, managed float and European Monetary Union. The IMF exchange regime definitions need not agree with the self-reported definitions used elsewhere.

Table 2: Attitudes toward the effects of intervention

		SD	D	N	A	SA	Overall mean	(s.e.)	Flexible mean	(s.e.)	Fixers mean	(s.e.)	Stat 1	Stat 2	Stat 3	Stat4
1	Intervention has effects in markets (currencies) other than the one in which it is conducted.	0	6	4	11	1	3.32	(0.20)	3.47	(0.21)	2.80	(0.44)	1.62	2.10	-0.48	1.43
2	Intervention typically increases exchange rate volatility.	2	7	5	8	0	2.86	(0.22)	2.76	(0.26)	3.20	(0.33)	-0.63	-0.93	0.43	-0.82
	Intervention influences exchange rates through the following channels:															
3.1	…by altering relative supplies of domestic/foreign bonds in private portfolios.	3	7	5	6	1	2.77	(0.24)	2.94	(0.28)	2.20	(0.33)	-0.95	-0.21	-1.58	1.28
3.2	…by signaling future monetary or other official exchange rate policy.	2	0	4	14	2	3.64	(0.21)	3.53	(0.25)	4.00	(0.28)	3.05	2.17	2.22	-0.92
3.3	…by coordinating the expectations of traders on fundamental values.	1	3	2	14	2	3.59	(0.21)	3.71	(0.22)	3.20	(0.52)	2.82	2.89	0.44	0.99
3.4	…restoring liquidity in a one-sided market	0	1	0	19	2	4.00	(0.11)	3.94	(0.13)	4.20	(0.18)	8.98	7.24	5.01	-0.95
	The following factors increase the probability of a successful intervention:															
4.1	Coordinated intervention with other central banks	1	2	1	10	6	3.90	(0.24)	3.80	(0.27)	4.20	(0.52)	3.69	2.73	2.36	-0.68
4.2	The first intervention in a series	1	2	3	11	4	3.71	(0.22)	3.75	(0.26)	3.60	(0.46)	3.18	2.78	1.24	0.27
4.3	Larger interventions	0	1	4	15	2	3.82	(0.14)	3.94	(0.15)	3.40	(0.22)	5.91	6.08	1.40	1.67
4.4	Market uncertainty about the relation of exchange rates to long-term fundamentals	0	2	6	10	4	3.73	(0.18)	3.82	(0.21)	3.40	(0.36)	3.96	3.84	1.01	0.94
4.5	High market uncertainty about current events	0	3	6	8	4	3.62	(0.21)	3.75	(0.21)	3.20	(0.52)	2.99	3.10	0.46	1.11
4.6	Intervention in the same direction as current market trends (e.g., purchase the USD as it is appreciating)	2	2	2	12	4	3.64	(0.25)	3.47	(0.30)	4.20	(0.18)	2.60	1.67	2.31	-1.23
5	Some authorities are more successful than most in intervening.	0	1	8	10	1	3.55	(0.15)	3.53	(0.15)	3.67	(0.54)	3.68	3.10	1.64	-0.31
	The following characteristics make for a successful intervening authority.															
5.1	Substantial resources for intervention (i.e., large trades)	0	1	3	14	4	3.95	(0.15)	3.94	(0.18)	4.00	(0.28)	6.34	5.25	3.02	-0.16
5.2	Consistency of intervention strategy with fundamentals/policy	0	0	1	9	12	4.50	(0.12)	4.47	(0.15)	4.60	(0.22)	12.05	9.94	5.87	-0.42
5.3	Skillful choice of trading opportunities within the day	1	1	2	14	4	3.86	(0.20)	3.94	(0.21)	3.60	(0.46)	4.41	4.07	1.41	0.70
5.4	Reputation for past success	0	0	2	14	6	4.18	(0.12)	4.06	(0.13)	4.60	(0.22)	9.64	7.88	6.46	-1.92

Notes: The table's columns show the number of respondents who strongly disagreed (SD), disagreed (D), were neutral (N), agreed (A), or strongly agreed (SA) with the statement in the left-hand column. The panels show the mean level of agreement and its standard error for 3 groups of respondents: 1) all respondents; 2) respondents intervening in flexible markets; 3) respondents intervening in both fixed and flexible markets. The test statistics labeled stat 1, stat 2, stat 3 and stat 4 are t statistics for the null hypotheses that the mean of these three groups equaled three (stat 1 through stat 3) and that the mean response for the floating and fixed groups was equal. Stat 1 through stat 4 were calculated from a regression of responses on floating/fixed indicators while the standard errors of the means were calculated from the distributions of the overall, floating and fixed responses, respectively. Shaded cells denote absolute values greater than 1.64.

Table 3: Intervention reaction function responses

"Non-FX" factors that might precipitate intervention	Response time with no warning	Response time if "on alert"
Accumulating reserves/customer transactions	Instantly	Instantly
Changes in Interest Rates/Monetary Policy (4)	Instantly	Instantly
Desire to coordinate with another central bank	Immediately	Immediately
Effect of appreciation on economic activity/trade	< 1 minute	Immediately
High transitory volatility that is not linked to fundamentals	5 minutes	Immediately
Inflation	10 minutes	Immediately
International Events	15 minutes after decision	< 1 minute
Liquidity management (2)	< 20 min	< 1 minute
Political Events (2)	30-60 minutes	1 minute
Political Factors: elections, referenda, etc.	< 1 hour	1 minute
Political Tension	< 1 hour	1 minute
	1 hour	2 minutes
	1 hour	3-5 minutes
	1 hour	5 minutes
	1-2 hours	5 minutes
	1-2 hours	Within minutes
	A few hours	< 10 min
	several hours	10 minutes
	6 hours	10 minutes
	1-5 days	< 1 hour

Notes: The first column shows "Non-FX" factors that respondents list as possibly precipitating intervention. Numbers in parentheses show the number of authorities that responded with the particular answer. The second column shows the intervention response time if there had been no intervention recently, while the third column shows the response times listed if the authority were "on alert" for exchange rate developments. The responses are sorted alphabetically or numerically in each column, not according to the list of responding authorities in Table 1. The three questions are as follows: 1. Intervention sometimes responds directly to conditions or factors outside the foreign exchange market? Please provide an example(s) of an economic variable or event to which intervention might respond. 2. Suppose that there had been no recent intervention, how quickly could the monetary authority intervene in response to market developments or events? 3. How quickly could the monetary authority react (begin intervening) if it was already on "alert" for exchange rate developments?

Table 4: Intervention reaction functions

							Overall		Flexible		Fixers					
		SD	D	N	A	SA	mean	(s.e.)	mean	(s.e.)	mean	(s.e.)	Stat 1	Stat 2	Stat 3	Stat4
1	Intervention sometimes responds directly to conditions or factors outside the foreign exchange market?	2	3	1	14	1	3.43	(0.24)	3.25	(0.30)	4.00	(0.00)	1.79	0.91	2.03	-1.33
	The following factors influence the size of the intervention.															
2.1	Market liquidity	0	2	0	12	8	4.18	(0.18)	4.29	(0.18)	3.80	(0.44)	6.65	6.30	2.11	1.15
2.2	Strength of market trends	0	2	2	9	9	4.14	(0.20)	4.24	(0.20)	3.80	(0.52)	5.80	5.39	1.89	0.91
2.3	Desire to make an impact	0	1	2	13	6	4.09	(0.16)	4.06	(0.19)	4.20	(0.18)	6.98	5.70	3.50	-0.36
3	After an initial intervention, my authority is more likely to intervene again if the initial intervention was successful.	3	7	7	4	1	2.68	(0.23)	2.65	(0.28)	2.80	(0.33)	-1.41	-1.31	-0.40	-0.27
	The following factors increase the likelihood that a central bank will want to keep an intervention secret															
4.1	Previous failure in moving the exchange rate in the desired direction.	1	2	7	6	3	3.42	(0.24)	3.36	(0.30)	3.60	(0.36)	1.76	1.22	1.22	-0.43
4.2	Desired intervention is seen as inconsistent with an exchange rate target.	1	2	6	7	3	3.47	(0.24)	3.50	(0.28)	3.40	(0.46)	1.98	1.70	0.81	0.17
4.3	Desired intervention is inconsistent with monetary/ macro fundamentals.	1	2	7	6	3	3.42	(0.24)	3.43	(0.28)	3.40	(0.46)	1.76	1.46	0.81	0.05
4.4	The intervention leans against the wind (is contrary to recent trends).	1	5	3	8	2	3.26	(0.26)	3.43	(0.31)	2.80	(0.33)	1.03	1.40	-0.39	1.06
	The following characteristics increase the probability that secret intervention will be detected by the market.															
5.1	Large interventions	0	0	1	13	5	4.21	(0.12)	4.21	(0.15)	4.20	(0.18)	10.13	8.25	4.87	0.05
5.2	Coordinated intervention with other monetary authorities	0	1	2	9	7	4.16	(0.19)	3.86	(0.20)	5.00	(0.00)	6.22	4.76	6.64	-3.26
5.3	Existence of recent previous interventions	0	0	3	15	1	3.89	(0.10)	4.00	(0.10)	3.60	(0.22)	8.73	8.62	3.09	1.77
5.4	Past success in moving the exchange rate in the desired direction	0	2	8	8	1	3.42	(0.17)	3.43	(0.19)	3.40	(0.36)	2.45	2.03	1.13	0.07
5.5	Greater perceived misalignment of exchange rates from long-run values	0	3	4	11	1	3.53	(0.19)	3.50	(0.24)	3.60	(0.22)	2.80	2.16	1.55	-0.22

Notes: See the notes to Table 2.

Table 5: Beliefs about the profitability of intervention

							Overall		Flexible		Fixers					
		SD	D	N	A	SA	mean	(s.e.)	mean	(s.e.)	mean	(s.e.)	Stat 1	Stat 2	Stat 3	Stat4
1	Could active management generate a positive excess return —in excess of opportunity cost—at reasonable risk for the taxpayer?	3	2	8	7	0	2.95	(0.23)	3.21	(0.25)	2.33	(0.38)	-0.22	0.81	-1.65	1.82
	I believe that my authority's trading desk could trade profitably with holding periods over the following horizons:															
2.1	Intraday strategies	1	2	8	10	0	3.29	(0.18)	3.47	(0.16)	2.83	(0.44)	1.59	2.22	-0.50	1.61
2.2	Weeks or months	1	2	6	12	0	3.38	(0.18)	3.47	(0.19)	3.17	(0.44)	2.07	2.06	0.47	0.71
2.3	One- to 10-year holding periods.	2	2	6	8	3	3.38	(0.25)	3.53	(0.26)	3.00	(0.53)	1.54	1.77	0.00	0.95

Notes: See the notes to Table 2.

Table 6: Arguments against intervention

		SD	D	N	A	SA	Overall		Flexible		Fixers		Stat 1	Stat 2	Stat 3	Stat4
							mean	(s.e.)	mean	(s.e.)	mean	(s.e.)				
	The following arguments persuade you that intervention is unwise. That is, with which arguments do you (personally) agree?															
1.1	Intervention will confuse the public with respect to monetary/other policies.	2	11	4	3	2	2.64	(0.24)	2.59	(0.26)	2.80	(0.52)	-1.54	-1.46	-0.39	-0.36
1.2	Intervention is ineffective at changing exchange rates	4	7	7	3	1	2.55	(0.23)	2.65	(0.28)	2.20	(0.33)	-1.98	-1.31	-1.61	0.79
1.3	Intervention will move exchange rates away from market determined values.	0	9	5	7	1	3.00	(0.20)	2.94	(0.24)	3.20	(0.33)	0.00	-0.24	0.45	-0.51
1.4	Intervention will be used to substitute for other necessary policy changes.	1	4	6	8	3	3.36	(0.23)	3.53	(0.24)	2.80	(0.52)	1.60	2.03	-0.42	1.34

Notes: See the notes to Table 2.