Speculator identification: A microstructure approach

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Abstract

This paper suggests a methodology for identifying speculators in FX markets by examining both the speculative characteristics of all the players and the relationships between a player's net purchases and positions with market variables. A player is identified as a speculator only if his speculative characteristics are extreme compared to other players and his influence on exchange rates, implied volatility, and bid-ask spread, is significant.

Implementing the proposed methodology on Israel's FX market, which includes 366 large players, identified 47 speculators – most of them foreign institutions, local banks, and financial firms. Examining their activity during 2008-2009 revealed that several speculators purchased FX before outlier depreciation days, while before outlier appreciation days they sold FX. This means that some speculators joined or initiated the trend before outlier appreciation or depreciation days. Based on the behavior of these speculators, which were found during the sample period, it was possible to identify their speculative behavior before outlier days during an out-of-sample period.

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1. Introduction

Speculators usually provide FX markets with liquidity and sophistication. Many economies, however, suffer from speculator activity such as "carry trade". Moreover, it is argued that in small open economies speculators cause sharp movements in exchange rates and other market variables such as the Bid-Ask Spread (hereafter BAS) and Implied Volatility (hereafter IV). Thus, it is in the interests of the monetary authorities to identify and track a manageable amount of speculators. Tracking speculators is of high importance during 'outlier days', which are defined in this paper by exchange rate changes, IV, and BAS, using multivariate outlier detection techniques.

Speculators substantially influence FX markets around the world however there is no consensus either in the literature or by practitioners as to the definition of a speculation. There is a wide range of definitions for the term speculation, some of which essentially include all day-to-day investment activity while others have a narrower scope. Moreover, the term speculation or speculator in FX markets is more problematic than in other markets due the sophistication of the active players, the cross-country activity i.e. "carry trade", and the relative scarcity of information regarding trading and players.[1]

This paper suggests a methodology to identify speculators by examining the following two non-exclusive conditions: (1) a significant influence of the player's net purchases on market variables, especially on outlier days using TSLS regressions, and (2) extreme trading characteristics of a particular player. Outlier days are defined based on the above market variables (exchange rate, IV and BAS) and identified using using the multivariate outlier detection technique of Galeano, Pena, and Tsay (2006). A player is identified as a speculator by fulfilling both conditions i.e., his speculative characteristics are extreme compared to other players and his influence on market variables on outlier days, is significant. It was found that the financial grouping (domestic banks, financial firms, and foreign institutions) behavior was quite different from that of the commercial grouping (exporters, importers, and institutional investors) particularly on outlier days. Implementing the above methodology during the sample period (2008-2009) identified 76 large players whose net purchases significantly influenced market variables but of which only 47 players whose trading characteristics were extreme compared to other large players. Thus, there were 29 other players who fulfilled condition (1)

[1] Although, speculator and speculation are not the same e.g., some speculative activity is carried out by exporters or importers, this paper's focus is on speculators who actively trade in the FX market for financial profit thus, having a substantial influence on market variables.

but not (2). The speculators list is almost certainly not random since the probability of randomly selecting the very same players by both conditions is close to zero.

The suggested methodology also makes it possible to distinguish between players who are trading in the same direction as the market (appreciation/depreciation) and those who are trading in the opposite direction. Of the 47 speculators, 11 traded with the direction of exchange rate changes i.e. sold (bought) USD in appreciation (depreciation) outlier days and another 14 who acted as contrarians i.e., sold (bought) USD in depreciation (appreciation) outlier days. Tracking speculators during an out-of-sample period (2010) revealed that they behaved differently from other large players near outlier days. The rest of the paper is organized as follows. Section 2 surveys the literature. Section 3 presents basic statistics on the activity of the main sectors in the local FX market on normal and outlier days. The TSLS regression results are depicted and discussed in section 4, section 5 examines the behavior of speculators during the sample period and an out-of-sample period. Section 6 summarizes.

2. Survey of the literature

According to Graham and Dodd (1951) speculation is any risky financial activity. Grossberg and Schreiber (2005) defined a speculator in foreign currency markets as a player who is in general sophisticated and who operates simultaneously in more than one segment (credit in one currency and deposits in other currency) in order to exploit yield differentials (carry trade).

Osler (2006) characterized a speculator in foreign currency as a player who focuses on **changes** in exchange rates, in contrast to a real player (such as an exporter or importer) or an institutional investor who is interested in the **level** of exchange rates. Accordingly, a speculator will prefer shorter periods of investment, will seek greater leverage and will change his position from long to short and vice versa with a high frequency. His goal is to profit from short-term **changes**. As a result, financial traders (particularly speculators) initiate short-term movements in exchange rates while commercial traders react to such movements. In an interesting and exhaustive survey of the foreign currency markets, Osler (2008) pointed out that the proportion of speculators in a typical foreign currency market account for up to 80 to 90 percent of total activity though the definition she uses for a speculator is only one of many alternatives.
In order to determine which variables should be used to define a speculator, a small-scale survey was carried out among professionals in the local banking and financial sectors. According to the survey results and the relevant literature, speculative activity is characterized according to the following parameters: (1) a relatively short-term investment horizons; (2) use of financial leverage (limited equity relative to trading volume); (3) rapid shifts from a long to a

short position regardless of fundamentals; (4) the amounts of trade tend to be round numbers; (5) the number and size of trades tend to increase in a volatile market; and (6) the players either influence or are influenced by market variables.

3. Descriptive statistics by sector: normal versus outlier days

The database used in this paper is unique, as every single FX transaction done through local banks must be reported to the Bank of Israel. The analysis focuses on the large players who act as speculators and can affect market variables.

In order to determine which sectors influenced the exchange rate or were influenced by it (since net purchases and the exchange rate are simultaneously determined), this section focuses on sectors and financial instruments that influenced the ILS/USD exchange rate (or were influenced by it). The database includes the following sectors: exporters, importers, financial firms, foreign institutions, institutional investors, and households and the following financial instruments: spots (including same-day and TOM transactions), forwards, call options and put options. After omitting non-relevant observations, the remaining approximately 481 thousand records were grouped by sector and trading day.[2] Then, 'outlier days' were defined based on the daily changes in the ILS/USD exchange rate, the implied volatility (IV), and the Bid-Ask Spreads (BAS). The latter was calculated as $\frac{Ask - Bid}{(Ask + Bid)/2}$. Since there are three related variables involved, a trading day was classified as an outlier using the multivariate outlier detection technique proposed by Galeano, Pena, and Tsay (2006) (see Appendix 1). Overall, according to this technique, there were 38 outlier days during the sample period (2008-2009) and an additional 10 days during the out-of-sample period (2010). The total number of outlier days represents 6.5 percent of the total trading days. The following trading characteristics were selected to identify speculators:

1. Number of trades on outlier days over normal days - NUM: A large number of trades may be an indicator of speculative activity (day trading, for example). Furthermore, a large number/volume of trades on days with higher volatility (such as outlier days) is additional indirect evidence of speculative activity.
2. Number of days until expiration – DTE (weighted average of days for spot, forward and option trades): It is conjectured (see for example, Osler (2008)) that speculators prefer short-term liquid financial instruments in order to reduce BAS costs.

[2] Of about 2500 players in the market, the selected 366 large players accounted for approximately 90% of total volume.

3. Heterogeneity – HET, is calculated as (buy - sell)/(buy + sell), such that its values ranges from +1 to -1, respectively. Values close to 0 characterize a speculator.

4. The proportion of trades in round numbers - RND: Speculators often trade in round numbers, in contrast to exporters and importers who are seeking protection for export and import transactions that do not necessarily involve round numbers. An index closer to one indicates that there was a large proportion of trades involving round numbers while an index closer to zero indicates the opposite.

5. Changes in the direction of the position - CHG: Frequent changes in the direction of the net position - POS i.e. from a long position on the shekel to a short position or vice versa, might be an indicator of activity that is not for purposes of hedging or long-term investment.

6. Relative position - REL: Total net purchases relative to the overall position (in absolute terms) is meant to reflect the level of leverage in financial activity. Speculators are usually characterized by large relative positions.

The percentiles of the above parameters were calculated for each player and the simple mean of these percentiles was determined a speculative score from 1 to 366. The players then were sorted from high to low according to these scores (except DTE and HET, in absolute terms, which were sorted from low to high). Thus, a higher score indicates that the player is a speculator. Table 1 presents these parameters by sector.

[Enter Table 1 here]

The differences between sectors are quite noticeable; of the 366 large active players, 45% were foreign institutions, while financial firms, exporters, and importers accounted for 40%. The differences in trading characteristics between sectors were even more pronounced. For example, local banks and financial firms were active on more days relative to their proportions by number of players (13% versus 7% and 17% versus 14%, respectively) than were export and import firms (10% versus 14% and 8% versus 12%, respectively). Also, the average size of a transaction and the position of the **financial grouping** i.e. local banks, financial firms, and foreign institutions (mainly international banks) differ from those of the **commercial grouping** i.e. exporters, importers, and institutional investors. In this regard, the negative position of exporters and institutional investors (hedging future FX incomes) and the positive position of importers (hedging future FX expenditure) are much larger than the positions of the financial grouping (in absolute terms). The differences between the financial and commercial groupings can also be seen in DTE (panel b), HET (panel d), CHG (panel f), and REL (panel g). The players of financial grouping can be characterized as follows: they tend to trade in short-term instruments (DTE < 10 days), their heterogeneity is close to zero, they frequently change

positions (CHG > 0.06), and their relative net flow is larger than that of other sectors (REL > 0.74). In contrast, the RND of financial firms was unexpectedly low. The evidence in Table 1 shows different trading characteristics but do not reveal how, if any, the players' behavior changed during outlier days. Figure 1 presents the outlier days during the period 2008-2010 and the ILS/USD exchange rate changes divided by IV.

[Enter Figure 1 here]

There were 48 outlier days (with red markers) and 690 normal days. Outlier days were defined by the above 3 market variables (ILS/USD exchange rate changes, BAS, and IV) using multivariate outlier detection techniques suggested by Galeano, Pena, and Tsay (2006). This technique, which is described in Appendix 1, takes several related variables (multivariate time series) and projects them onto a single series without requiring pre-determined specifications of the multivariate model or the ARMA process. The outlier days were derived from that single series using LR tests. It can be seen that most outlier days are concentrated in clusters particularly in 2008 (26 days). During 2009 and 2010 there were only 12 and 10 outlier days, respectively. As can be seen from the figure, there are spikes in the exchange rate changes divided by IV above the outlier days (red markers).

4. The relationship between market variables and players' net purchases and positions

As mentioned above, speculative activity has a number of unique trading characteristics however, it can also be correlated with market variables (exchange rate changes, IV, and BAS). In other words, although it mainly influences market variables by initiating a move toward an appreciation or depreciation, speculative activity can also be influenced by market variables. In order to examine the relationships between market variables and the players' net purchases and positions, a two-equation system was estimated for each of the 366 players, using TSLS:

(1a) $X_t = \alpha_1 + \beta_1 NFL_t + \chi_1 App_t \cdot NFL_t + \chi_1 Dep_t \cdot NFL_t + \theta_1 POS_{t-1} + \varepsilon_{1t}$

(1b) $NFL_t = \alpha_2 + \beta_2 X_t + \theta_2 POS_{t-1} + \varepsilon_{2t}$

Where, X is the projected series derived from ILS/USD exchange rate changes, IV, and BAS using Galeano, Pena, and Tsay (2006)'s multivariate outlier detection technique, NFL is the net purchase, App and Dep are dummy variables for appreciation and depreciation outlier days, respectively, which take on the value 1 for an outlier and 0 otherwise, POS is the FX position, and ε is the noise term. Table 2 presents the regression results broken down by speculator type.

[Enter Table 2 here]

Panel (a) presents some basic statistics for speculator type and panel (b) presents the TSLS regression results. The four types of speculators are defined as follows:
(1) Pro – (with the trend) players that sell USD on outlier appreciation days and buy on outlier depreciation days; (2) Con – (contrarian) players that buy USD on outlier appreciation days and sell on outlier depreciation days; (3) Sell – players that sell USD on both appreciation and depreciation outlier days; and (4) Buy – players that buy USD on both appreciation and depreciation outlier days.
The upper part of panel (a) presents the number of players in each category. Of the 366 regressions (one for each player), only 212 yielded reasonable results (positive Adj. R^2 and number of observations > 50), of which 44 were for Pro players and 43 were for Con players. The other two types of speculators, i.e., Buy and Sell players are less important since their behavior is consistent across the sample period regardless of whether the outlier day was an appreciation or depreciation day.
According to the methodology used, a player is classified as a speculator only if he has both speculative characteristics and a strong relationship with market variables, especially near outlier days. Thus, among the 212 potential speculators by the regression results,162 had also an extreme speculative trading characteristics. Thus, 76% of the players fulfilled both conditions. The lower part of panel (a) presents the same information as the upper part except with the constraint that the significance level for the main exogenous variables, i.e. app*NFL and dep*NFL, exceeded 0.95. In this case, only 76 regressions yielded reasonable results with the above two constraints binding; of these, 19 were Pro (trend) players and 27 Con players. The combined list of speculators consisted of 47 players; of these, 11 Pro and 14 Con players (58% and 52% respectively of the reasonable regressions under the constraints). This is not a random result as the probability of randomly selecting the very same players that fulfill both conditions is close to zero.[3] An additional advantage of using this list is the combination of two independent sources of data: the exchange trades system for players' trading characteristics and the exchange rate system for market variables. Although all the selected speculators fulfilled both conditions, i.e. they had the trading characteristics of speculators and they influenced market variables, monetary authorities usually focus on Pro players since they are the ones that initiate trends and influence market variables.

[3] The probability to randomly selecting the very same 47 players from a given group of 76 players regardless of the internal order is: $\frac{1}{\binom{76}{47}} = \frac{1}{\left(\frac{76!}{47!*29!}\right)} \cong 0$.

Panel (b) presents means of coefficients and T-statistics of the TSLS regression of the four speculator types. By construction, the main exogenous variables in equation (1a) (given the constraints of a significance level greater than 0.95) i.e. app*NFL and dep*NFL, are significant. For example, on appreciation outlier days, the mean coefficient of Pro players is 3.38 (Prob. < 0.001) while that of Con players is 4.00 (Prob. < 0.001). Other variables in equation (1a) were insignificant, including the NFL and $POS._{-1}$. As the focus of the regressions is on speculative activity, especially on outlier days, these results indicate that speculators' behave differently on outlier days than on normal days. In general, the coefficients in equation (1b) were insignificant, implying that players' net purchases were not influenced by market variables, on average. Thus, the significance level of equation (1b) is much lower than that of (1a).

5. Analysis of the Pro players

Having divided the players from the combined list into four types of speculators, it was possible to examine the influence of each type on market variables, especially on outlier days, and the ability to forecast outlier days by tracking their behavior. This was done by estimating the following Fixed Effect pooled regressions (which have cross-section weights and White's Heteroscedasticity consistent standard errors and co-variances) for each player type:

$$X_{it} = \beta_i NFL_{it} + \theta_i POS_{it} + \chi_i App_t NFL_{it} + \delta_i Dep_t NFL_{it} + \varphi_i \frac{App}{3} \sum_{t=-1}^{-3} POS_{it} + \quad (2)$$

$$+ \kappa_i \frac{Dep}{3} \sum_{t=-1}^{-3} POS_{it} + \alpha_i X_{it-1} + C_i + \varepsilon_{it}$$

where, C is the fixed effect parameter. Table 3 presents the results.

[Enter Table 3 here]

As can be seen, all the types behaved as expected; the coefficients of Pro (Con) players were significantly and negative (positive) on outlier appreciation days (γ) and significantly and positive (negative) on outlier depreciation days (δ). The other two groups also behaved as expected; the coefficients of Sell (Buy) players are significantly negative (positive) on both appreciation and depreciation outlier days. An indication of the ability to forecast speculators' behavior can be obtained from the lagged variables. The coefficients of the Pro player positions (φ for appreciation and κ for depreciation) during the three days prior to an outlier appreciation (depreciation) day are significant and negative (positive) at the 0.95 significance level and the respective coefficients of the Con players were also found to be significant, with the opposite sign. Interestingly, the coefficients of the lagged variables for Sell and Buy players were

insignificant. The overall significance level of the pooled Fixed Effect regression for Pro players was much higher than that of the other types while the coefficients for the particular player in all categories found insignificant. In other words, the four types were quite homogenous. Thus, monetary authorities can choose to track only Pro players, in order to forecast outlier days. Moreover, the results indicate that it is Pro players that initiate a market trend, which ends with an outlier day, while other groups react to the move, particularly, Con players whose behavior is contrarian. Figure 2 presents the behavior (i.e. mean positions) of 11 Pro, 14 Con, 14 Sell, and 8 Buy players near 10 outlier days during the out-of-sample period (the year 2010). During that period, there were 10 outlier days derived by the same technique as the outlier days during the in-sample period. The 10 outlier days were evenly divided between appreciation and depreciation days.

[Enter Figure 2 here]

The upper part of the figure presents mean positions of the various player types around outlier appreciation days while the lower part presents mean positions around outlier depreciation days. As can be seen from the figure, Pro players initial position was around zero compared to other types especially Con players. In addition, Pro players actually changed their position before an outlier day in the direction of the move while Con players changed their position in the opposite direction, particularly on appreciation outlier days. Moreover, only Pro players and to some extent Con players returned to their initial position following an outlier appreciation days. This tends to confirm their status as initiators of trends in the FX market. The behavior of other types of players was less volatile and did not exhibit this type of behavior near outlier days.

6. Summary

Although the presence of speculators usually increases the liquidity and sophistication of an FX market, speculative activity, such as carry trade, is often not to the benefit of an economy, particularly small open ones. It is argued that in small open economies speculators cause sharp movements in exchange rates and other market variables such as the Bid-Ask Spread (BAS) and Implied Volatility (IV). Thus, it is in the interests of the monetary authorities to identify and track a manageable amount of speculators. Tracking speculators is of high importance during 'outlier days', which are defined in this paper by exchange rate changes, IV, and BAS, using multivariate outlier detection techniques.

The paper suggests a methodology for identifying speculators in FX markets by examining both the speculative characteristics of players and the relationship between market variables and a player's net purchases and positions. A player is identified as a speculator only if his speculative characteristics are extreme in comparison to other players and his influence on the above market variables is significant.

The data consisted of daily observations for the years 2008-9, which were obtained from two sources: the exchange trades system for players' trading characteristics and data from the foreign currency market, including changes in the ILS/USD rate, the BAS, and the IV. The findings indicate that the financial groping i.e. domestic banks, foreign institutions, and financial firms, differ significantly from other sectors in a number of important characteristics that were used to identify speculative activity.

The application of the proposed methodology to Israel's FX market identified 47 speculators who fulfilled both conditions: their speculative characteristics were extreme in comparison to other large players and their influence on the market variables, were significant.

An analysis of their activity during 2008-9 revealed that 11 of them purchased FX prior to outlier depreciation days and sold FX prior to outlying appreciation days. This indicates that there were speculators who initiated a market move, or at least joined in, prior to an outlier appreciation or depreciation day. Based on the classification of speculators into types during the sample period (2008-2009), it was possible to identify their speculative behavior prior to outlying days during an out-of-sample period i.e. the year 2010.

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Appendix 1: Detecting Outliers in Multivariate Time Series

The following method detects outliers in multivariate cross-dependent and autocorrelated time series. The basic idea, which was developed by Galeano, Pena, and Tsay (2006), is to project multivariate time series onto a single univariate series, which makes it possible to use then any standard outlier detection technique. This technique was used to project three related market variables (ILS/USD exchange rate changes, BAS and IV) onto a single projected series X, which made it possible to detect outliers using a Likelihood Ratio Test (LRT). Galeano, Pena, and Tsay (2006) show that the projection, which maximizes or minimizes the kurtosis coefficient of the projected series, yields the direction that maximizes the relative size of the outlier, i.e. the ratio between the outlier size and the variance of the projected observations. 2k-1 orthogonal projections were added to deal with any identification problems that might arise from the possible occurrence of multiple outliers. The following algorithm formally describes this method:

Suppose that $Y_t = (Y_{1t}, Y_{2t}, ..., Y_{kt})' \quad \{t \in 1, ..., T\}$ is the observed k dimensional vector series.

1. Let m = 1 and $Z_t^{(m)} = Y_t$.
2. Let $\sum_Z^{(M)} = \frac{1}{T}\sum_{t=1}^{T}\left(Z_t^{(m)} - \overline{Z^{(m)}}\right)\left(Z_t^{(m)} - \overline{Z^{(m)}}\right)'$ and find V_m such that

$$v_m = \underset{v_m' \sum_Z^{(m)} v_m = 1}{\arg\max} \frac{1}{T}\sum_{t=1}^{T}\left(v_m'\left(Z_t^{(m)} - \overline{Z^{(m)}}\right)\right)^4$$

3. If m = k then stop; otherwise define $Z_t^{(m+1)} = \left(I - v_m v_m' \sum_Z^{(m)}\right) Z_t^{(m)}$, that is, $Z_t^{(m+1)}$ is the projection of the observations in an orthogonal direction onto v_m. Let m = m + 1 and go to step 2.
4. Repeat the same procedure to minimize the objective function in step 2, in order to obtain another set of k directions - $(v_{k+1}, ..., v_{2k})$.

The next stage is to search for outliers in the univariate projected series. This can be done using any standard procedure, such as the Likelihood Ratio Test (LRT), as recommended by the authors.

Table 1

Basic statistics of the sectors' trading activity in the Israeli FX OTC market: 2008-2009

	financial grouping				commercial grouping				
	local banks	financial firms	foreign residents	households	institutional investors	export firms	import firms	others	total
# players	24	52	163	10	8	50	43	16	366
% of total	7%	14%	45%	3%	2%	14%	12%	4%	100%
# active days	8,711	10,904	29,405	1,304	1,382	6,381	5,555	2,004	65,646
% of total	13%	17%	45%	2%	2%	10%	8%	3%	100%
a) Net flow (NFL), USD millions									
Mean	-0.52	0.13	-0.13	0.07	-1.03	-2.83	4.53	0.56	0.00
Max	257	151	285	20	133	125	376	58	376
Min	-281	-239	-631	-28	-150	-105	-175	-100	-631
Std.	20	11	13	3	19	8	13	6	13
b) Position (POS), USD millions									
Mean	-3.11	-1.76	2.57	3.10	-85.81	-22.60	24.90	2.09	-1.17
Max	300	227	646	68	351	194	427	153	646
Min	-296	-506	-584	-18	-652	-1031	-103	-147	-1031
Std.	43	26	26	9	156	48	41	22	44
c) Days To Expiration (DTE)									
Mean	9.22	4.84	5.90	18.77	20.95	20.82	24.89	18.25	10.17
Max	369	301	859	253	2002	1529	584	278	2002
Min	0	0	0	0	0	0	0	0	0
Std.	22	17	21	32	70	51	48	31	31
d) Heterogeneity (HET)									
Mean	-0.05	0.00	-0.03	0.00	0.07	-0.64	0.57	0.06	-0.03
Max	1	1	1	1	1	1	1	1	1
Min	-1	-1	-1	-1	-1	-1	-1	-1	-1
Std.	0.61	0.81	0.86	0.81	0.91	0.72	0.74	0.93	0.84
e) Round transactions (RND)									
Mean	0.69	0.26	0.81	0.41	0.37	0.45	0.35	0.40	0.60
Max	1	1	1	1	1	1	1	1	1
Min	0	0	0	0	0	0	0	0	0
Std.	0.35	0.40	0.36	0.45	0.46	0.48	0.46	0.47	0.45
f) Changing Position (CHG)									
Mean	0.12	0.08	0.07	0.06	0.02	0.01	0.01	0.03	0.06
Max	1	1	1	1	1	1	1	1	1
Min	0	0	0	0	0	0	0	0	0
Std.	0.32	0.27	0.26	0.23	0.14	0.08	0.12	0.17	0.23
g) Relative Net Flow (REL)									
Mean	1.26	0.76	0.75	0.45	0.16	0.14	0.20	0.24	0.56
Max	700	373	2400	200	21	500	401	100	2400
Min	0	0	0	0	0	0	0	0	0
Std.	11.70	5.50	14.31	5.02	0.87	3.71	3.89	1.84	9.87

This table presents some activities of the main 8 sectors. Net flow (panel a) calculates as all buy flows - sell flows. In (panel b), Position includes all instruments (spot, TOM, same day, and futures and options in delta values) except swaps.
Hetereogeneity is calculated (panel d) as (buy - sell)/(buy + sell) so, the maximal and minimal values are +1 and -1, respectively.
Round transactions represents the ratio of transactions of a multiple of one million USD out of all transactions. Changing position (panel f) means that a player changed the position from long to short or vice versa (change = 1, no change = 0).
Relative Net Flow (panel g) is calculated as Net flow/Position in absolute terms.

Table 2

TSLS regression results of four types of speculators, 2008-2009

Panel A					
	Pro players (buy in depreciation days & sell in appreciation days)	**Con players** (sell in depreciation days & buy in appreciation days)	**Sell players** (sell in all outlying days)	**Buy players** (buy in all outlying days)	**All players**
# all coefficients	58	60	53	41	212
# all coefficients & speculative characteristics	44	43	40	35	162
% speculators (based on the combined list)	76	72	75	85	76
# robust coefficients (0.95)	19	27	18	12	76
# robust coefficients & speculative characteristics	11	14	14	8	47
% speculators (based on the combined list)	58	52	78	67	62
Panel B					
(1a) Endogenous variable: X_t					
β_1	0.07	-0.02	-0.15	-0.07	-0.03
	(0.63)	(0.06)	(-0.67)	(-0.15)	(0.04)
χ_1	-3.38	4.00	-4.24	3.13	-0.20
	(-4.74)	(4.03)	(-3.99)	(3.44)	(-0.16)
δ_1	13.35	-4.34	-3.81	4.34	0.58
	(3.56)	(-3.24)	(-3.03)	(2.69)	(-0.20)
θ_1	0.10	-0.03	-0.04	-0.04	0.00
	(0.45)	(-0.35)	(0.00)	(0.12)	(-0.03)
α_1	-0.87	-0.05	-0.50	-0.29	-0.45
	(-0.92)	(-0.14)	(-0.55)	(-0.04)	(-0.53)
Adj. R^2	0.30	0.28	0.35	0.29	0.19
D.W.	1.80	1.79	1.79	1.85	1.80
(1b) Endogenous variable: NFL_t					
β_2	0.08	-0.01	-0.17	0.19	0.02
	(0.35)	(0.04)	(-1.56)	(0.96)	(-0.08)
θ_2	0.01	-0.01	0.03	-0.02	0.00
	(0.17)	(-0.19)	(0.21)	(-0.23)	(0.23)
α_2	5.66	-3.38	-0.49	-0.41	0.44
	(2.91)	(-3.78)	(-0.51)	(-0.73)	(-0.35)
Adj. R^2	0.10	0.03	0.09	0.06	0.05
D.W.	1.93	2.00	1.94	1.92	1.93

This table presents the results of the following two equations system:

(1a) $X_t = \alpha_1 + \beta_1 NFL_t + \chi_1 App_t \cdot NFL_t + \chi_1 Dep_t \cdot NFL_t + \theta_1 POS_{t-1} + \varepsilon_{1t}$

(1b) $NFL_t = \alpha_2 + \beta_2 X_t + \theta_2 POS_{t-1} + \varepsilon_{2t}$

Where, X is the projected series derived from exchange rate changes, IV, and BAS using the Galeano et al. (2006) technique. NFL is net purchases, App and Dep are dummy variables for appreciation and depreciation outlying days, respectively, POS is the FX position, BAS is the Bid-Ask Spread, and e is the noise term.

By the TSLS regressions only 76 out of 366 players were found significant at the 0.05 level in the main variables i.e. App*NFL and Dep*NFL.

Of the 76 players 11 were defined as Pro (trend) players and 14 as Con (contrarians) by the combined criteria i.e. robust coefficients & speculative characteristics.

Table 3

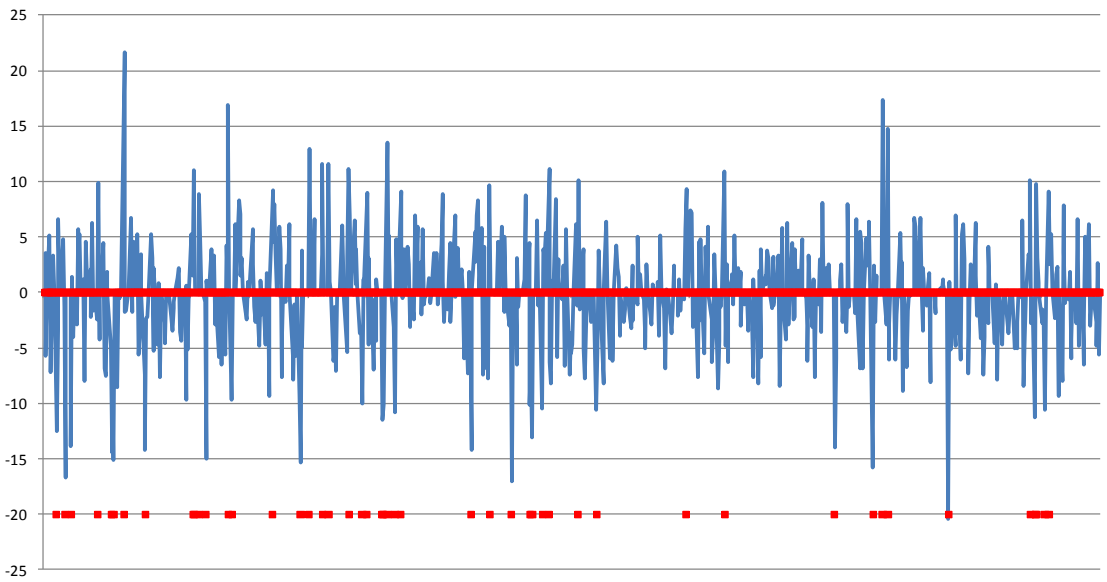
Pooled (Fixed effect) regression results of four types of players, 2008-2009					
	Pro players (buy in depreciation days & sell in appreciation days)	**Con players** (sell in depreciation days & buy in appreciation days)	**Sell players** (sell in all outlying days)	**Buy players** (buy in all outlying days)	**All players**
# robust coefficients (0.95) & speculative characteristics	11	14	14	8	47
Endogenous variable: X_t					
β_i	0.02	0.01	0.00	0.02	0.00
	(2.51)	(0.46)	(0.05)	(1.62)	(1.95)
θ_i	0.00	-0.01	0.00	0.01	0.00
	(0.50)	(-1.85)	(-0.82)	(1.19)	(0.94)
χ_i	-0.49	0.11	-0.68	0.34	-0.01
	(-3.09)	(1.34)	(-4.21)	(3.79)	(-0.47)
δ_i	0.11	-0.70	-1.08	0.80	0.04
	(2.29)	(-2.00)	(-4.57)	(3.50)	(1.59)
φ_i	-0.05	0.02	-0.01	-0.08	-0.05
	(-5.78)	(2.07)	(-0.33)	(-1.50)	(-5.13)
κ_i	0.07	-0.01	0.02	-0.01	0.02
	(5.63)	(-2.76)	(1.58)	(-0.27)	(2.16)
α_i	-0.77	0.23	-0.20	-0.20	0.24
	(5.63)	(6.21)	(7.51)	(3.83)	(23.25)
Adj. R^2	0.16	0.06	0.09	0.03	0.03
D.W.	1.95	1.94	1.88	1.96	1.91

This table presents the results of a pooled fixed effect estimaton:

$$X_{it} = \beta_i NFL_{it} + \theta_i POS_{it} + \chi_i App_t NFL_{it} + \delta_i Dep_t NFL_{it} + \varphi_i \frac{App}{3}\sum_{t=-1}^{-3} POS_{it} + \kappa_i \frac{Dep}{3}\sum_{t=-1}^{-3} POS_{it} + \alpha_i X_{it-1} + C_i + \varepsilon_{it}$$

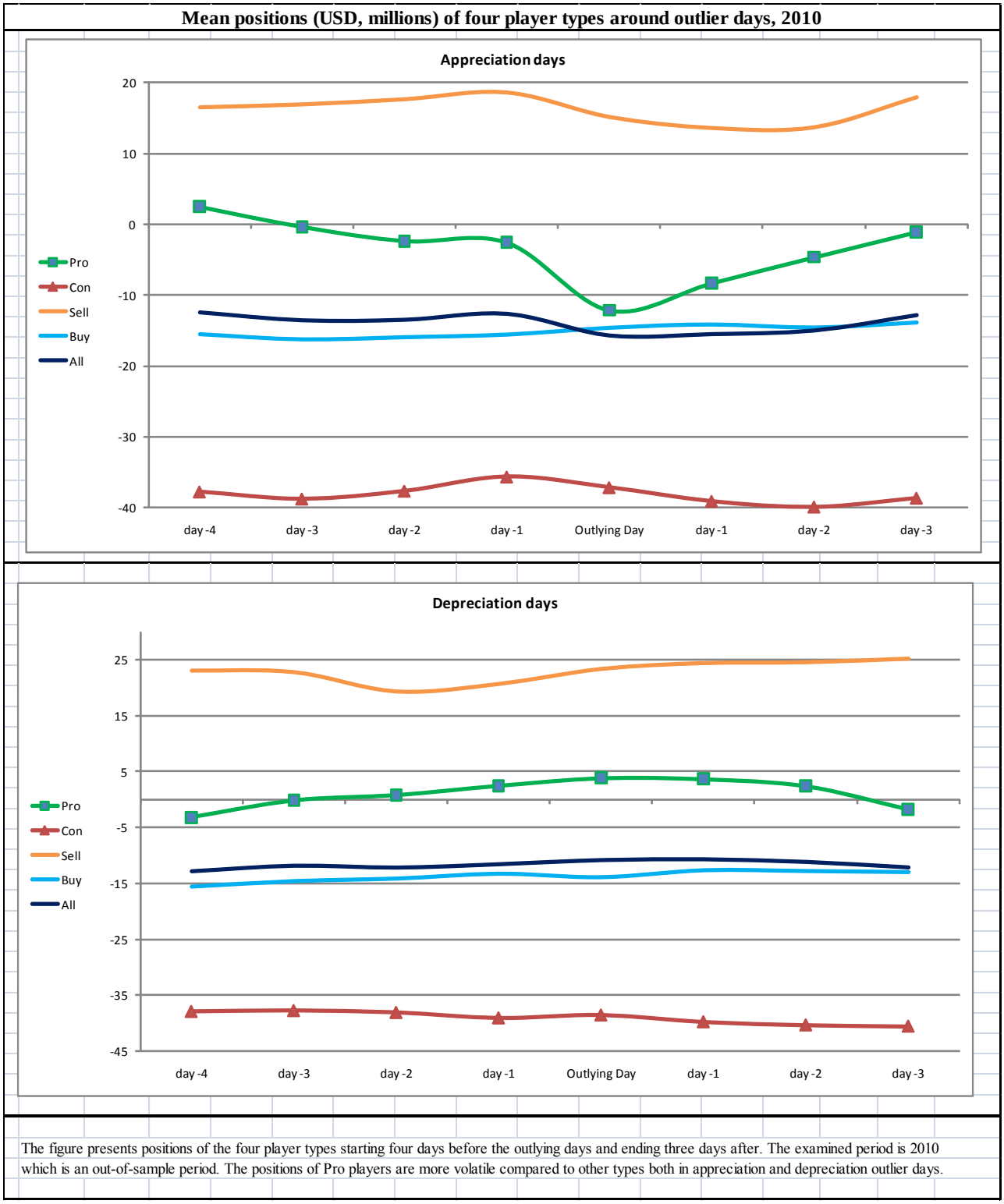
Where, X is the projected series derived from exchange rate changes, IV, and BAS using the Galeano et al. (2006) technique.
NFL is the purchases, App and Dep are dummy variables for appreciation and depreciation outlying days, respectively, POS is the FX position,
C is the fixed effect coefficient, and e is the noise term.
The player groups are derived from Table 2 i.e. found significant at the 0.95 level in the main variables (App*NFL and Dep*NFL) and had speculative characteristics (the combined criteria).

Figure 1



Outlier days are represented by red squared markers.

Figure 2



The figure presents positions of the four player types starting four days before the outlying days and ending three days after. The examined period is 2010 which is an out-of-sample period. The positions of Pro players are more volatile compared to other types both in appreciation and depreciation outlier days.