Discretionary Trading: Evidence from the FIFA World Cup

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ABSTRACT

This paper rigorously tests the predictions of adverse selection models with discretionary trading. This is achieved by exploiting intra-day discretionary trading surrounding FIFA World Cup football matches that occur during trading hours. The extraordinary volatility and price discovery dynamics that occur on match days conform to the predictions of adverse selection models. Price volatility is increased by up to 0.223 standard deviations prior to matches. Volatility is reduced by 1.301 standard deviations when matches extend into extra-time. Consistent with the Back and Pedersen (1998) model, there is limited evidence of systematic patterns in transaction costs on match days.

1. Motivation

Adverse selection models with discretionary trading yield specific predictions regarding market quality dynamics. For example, Admati and Pfleiderer (1988) consider uninformed discretionary liquidity traders that optimize the timing of their trades to minimize transaction costs. Their model predicts that periods of high discretionary trading are associated with reduced price impact costs, increased price volatility, and increased price discovery. In contrast to Admati and Pfleiderer (1988), Back and Pedersen (1998) focus on the discretionary trading of informed traders with long-lived private information, in the context of exogenous time-varying liquidity trading. The model of Back and Pedersen (1998) predicts a positive correlation between liquidity trading, price volatility, and discretionary informed trading but does not produce any systematic patterns with respect to price impact costs. Collin-Dufresne and Fos (2016) show that discretionary informed trading can produce price impact patterns when private information is long-lived and the volatility of liquidity trading is stochastic. Similar to Admati and Pfleiderer (1988), the Collin-Dufresne and Fos (2016) equilibrium is characterized by a negative relation between trading volume and price impact costs, as well as a positive relation between trading volume and price volatility.

To rigorously test these predictions, the empiricist must identify a temporal shift in trading demand that is consistent with the discretionary trading models. Prior empirical studies have crudely approximated for discretionary trading by indiscriminately contrasting periods of high trading volume with periods of low trading volume. This approach is problematic when discretionary trading models assume constant information asymmetry. This is because time-series variation in trading volume is often associated with information shocks, as in the Mixture of Distribution Hypothesis (Clark (1973); Tauchen and Pitts (1983); Andersen (1996)). Accordingly, past empirical tests of discretionary trading models may misidentify discretionary trading effects. In light of this, the current paper proposes a novel empirical setting for testing adverse selection models with discretionary trading. This study exploits large variations in trading activity that are driven by uninformative intra-day market-orthogonal events. That is, individual Fédération Internationale de Football Association (FIFA) World Cup football matches that occur during trading hours.

2. Data

This study makes use of two datasets: football match data extracted from official match reports available from the FIFA website and intra-day stock market data from Thomson Reuters Datascope Select, previously Thomson Reuters Tick History.

The intra-day stock market data is comprised of five sub-samples. Each sub-sample corresponds to an iteration of the World Cup from 2002 to 2018. Since every World Cup is predominantly held in the month of June, intra-day stock market data is extracted from the months of May, June, and July of each World Cup year. Following Ehrmann and Jansen (2017), the cross-section of each World cup sub-sample is determined by two criteria. First, the country must have intra-day stock market data available. Second, the country's national stock exchange must be open for trading during at least one match of which the country's national football team is a participant. Stock market data is extracted from the constituent stocks of each country's national market index. The analysis is conducted at the five-minute frequency.

There are a total of 100 country-match observations that occur during trading hours from 2002 to 2018. The 100 country-match observations encompass 25 countries. The 25 countries are comprised of 18 European nations, six American nations, and South Africa. Brazil, Mexico, and Germany are the most well-represented countries in the sample with 10, 9, and 8 matches occurring in domestic trading hours, respectively.

3. Variables of Interest

The variables of interest are as follows:

- $DVOL_{m,t,w}$: The total dollar trading volume across the constituent stocks of market index m, at time t, in World Cup sub-sample w.
- $ESPREAD_{m,t,w}$: The dollar-weighted average percentage effective spread of all stocks in market m, at time t, in World Cup sub-sample w.
- $\sigma_{m,t,w}$: The logarithmic transformation of the cross-sectional mean of $\sigma_{i,t,w}$:

$$\sigma_{i,t,w} = \frac{1}{2\sqrt{\ln 2}} \ln\left(\frac{P^H_{i,t,w}}{P^L_{i,t,w}}\right) \tag{1}$$

  where $P^H_{i,t,w}$ and $P^L_{i,t,w}$ are the relevant high and low prices for stock i, respectively.
- $PD_{m,t,w}$: A market-level permanent price impact measure inspired by Hasbrouck (1993).
- $NOISE_{m,t,w}$: A market-level temporary price impact measure inspired by Hasbrouck (1993).

To allow for robust economic inference, each variable is standardized at the market-sub-sample (m and w) level to have a mean of zero and standard deviation of one. Further, all variables are adjusted using the methodology of Gallant, Rossi, and Tauchen (1992) to control for month-of-the-year; day-of-the-week; and, five-minute time-of-the-day effects.

4. Discretionary Trading on Match Days

Figure 1 plots the mean $DVOL_{m,t,w}$ values on match days. The x-axis indicates the number of minutes from kick-off time, with first-half and second-half time periods shaded in gray.

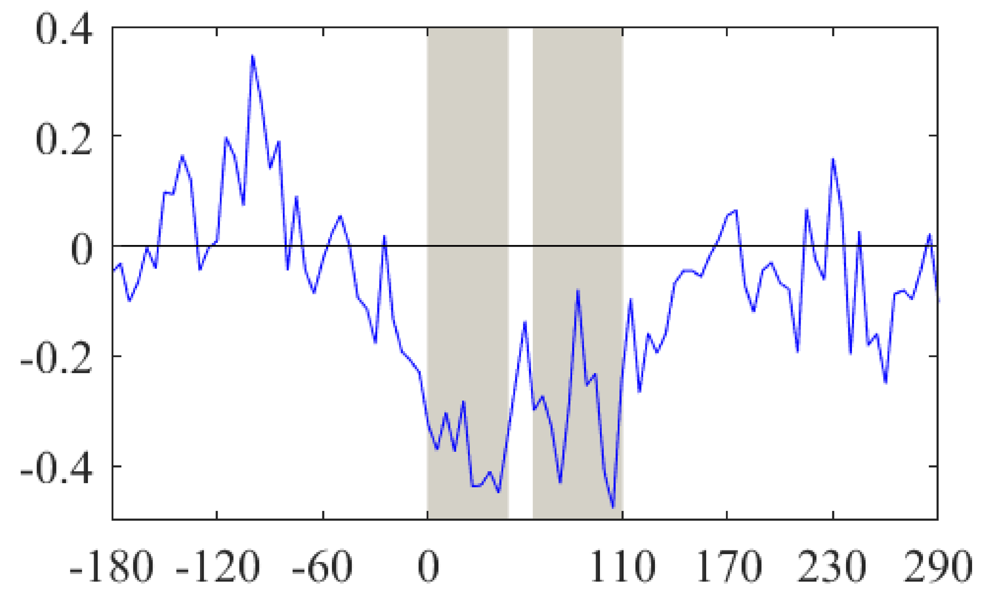

Fig. 1. Dollar Trading Volume ($DVOL_{m,t,w}$) On Match Days.

Figure 1 demonstrates that World Cup football matches have a very significant impact on the entire trading day. From 120 to 60 minutes before match time, there is a pronounced period of heightened trading activity. During this period, $DVOL_{m,t,w}$ peaks at 0.348 standard deviations. Following this period, trading activity declines sharply towards the start of match time. After kick-off time, there is a sustained period of reduced trading activity, lasting until full-time. For example, the mean $DVOL_{m,t,w}$ value on match days decreases to -0.478 standard deviations during the second-half of football matches. Following full-time, trading activity gradually converges to normal levels after approximately 60 minutes. A regression analysis confirms the statistical significance of the abnormal trading activity observed in Figure 1.

Overall, Figure 1 provides compelling evidence that investors refrain from trading during football matches. The decline in trading activity during match time can be partially explained by limited attention and distraction as in Ehrmann and Jansen (2017). In contrast, the positive abnormal trading activity that occurs prior to match time cannot be explained by contemporaneous distraction. This finding is consistent with discretionary trading whereby a portion of market participants fulfill their trading requirements in the pre-match period to avoid trading during match time. In this manner, the distraction and discretionary trading explanations are not mutually exclusive but complementary.

5. Testable Hypotheses

The discretionary trading models provide contrasting hypotheses with respect to transaction costs on match days. The Back and Pedersen (1998) model does not yield any systematic relationship between discretionary trading and transaction costs. On the other hand, Admati and Pfleiderer (1988) and Collin-Dufresne and Fos (2016) assert that discretionary trading is negatively associated with transaction costs. Accordingly, a suitable set of testable hypotheses are as follows:

H1a Discretionary trading is not correlated with transaction costs; and,

H1b Discretionary trading is *negatively* correlated with transaction costs.

Hence, Hypothesis H1a asserts that there should not be any observable intra-day patterns in transaction costs on match days. Under Hypothesis H1b, one should expect reduced transaction costs prior to match time and increased transaction costs during match time.

In addition, discretionary trading models predict that price volatility is positively correlated with discretionary trading. Price volatility is driven by informed traders increasing their trading demand during periods of greater liquidity trading. This motivates Hypothesis H2:

H2 Discretionary trading is *positively* correlated with price volatility.

According to Hypothesis H2, the period of increased discretionary trading prior to match time should be accompanied by increased volatility; while during match time, markets should exhibit reduced volatility. Further, as discretionary liquidity trading and informed trading are correlated in the discretionary trading models with constant information asymmetry, it should be expected that:

H3 Discretionary trading is *positively* correlated with temporary and permanent price innovations caused by uninformed traders and informed traders, respectively.

Therefore in the current empirical setting, the magnitude of temporary and permanent price innovations should be increased in the pre-match period of increased discretionary and reduced during match time.

6. Market Quality on Match Days

Equation 2 is employed to test hypotheses H1, H2, and H3:

$$DEP_{m,t,w} = \alpha_0 + \beta_{0,m} MD_{m,t,w} + \sum_{\tau=1}^{6} PRE^{K-\tau}_{m,t,w}\beta_\tau + \beta_7 D^F_{m,t,w}$$
$$+ \beta_8 D^H_{m,t,w} + \beta_9 D^S_{m,t,w} + \beta_{10} D^E_{m,t,w} + \sum_{\tau=1}^{6} POST^{F+\tau}_{m,t,w}\beta_{10+\tau} + \epsilon_{m,t,w} \tag{2}$$

where $DEP_{m,t,w}$ is the dependent variable and the subscripts m, t, and w indicate the relevant market, five-minute time period and World Cup sub-sample, respectively. The first independent variable, $MD_{m,t,w}$, is a match day indicator variable that takes the value of one if five-minute time period t coincides with a day in which the country associated with market m participates in a football match within the trading hours of market m. The first-half indicator variable, $D^F_{m,t,w}$, takes the value of one if country m is playing in the first-half of a football match at time t in World Cup sub-sample w. The $D^S_{m,t,w}$ and $D^E_{m,t,w}$ indicator variables are the analogous variables for the second-half and extra-time periods of a football match, respectively. The half-time indicator variable, $D^H_{m,t,w}$, takes the value of one if five-minute time period t coincides with the 15-minute half-time period of a match involving country m in World Cup sub-sample w.

The remaining independent variables in Equation 2 capture abnormal trading activity outside of match time. The $PRE^{K-\tau}_{m,t,w}$ variables are indicator variables for the six consecutive 30 minute periods leading up to the start of a football match. That is, the $PRE^{K-\tau}_{m,t,w}$ variables take the value of one if country m is participating in a football match and t falls between 30τ (inclusive) and $30(\tau-1)$ minutes before the match, for World Cup sub-sample w. The $POST^{F+\tau}_{m,t,w}$ indicator variables are constructed in a similar fashion for the post-match period. The $POST^{F+\tau}_{m,t,w}$ variables take the value of one if country m is participating in a football match and t falls between 30τ (inclusive) and $30(\tau+1)$ minutes after the match, for World Cup sub-sample w. Equation 2 is simultaneously estimated for all markets using errors clustered at the market-sub-sample (m and w) level.

Table 1. Estimation of Equation 2

$DEP_{m,t,w}$	$ESPREAD_{m,t,w}$	$\sigma_{m,t,w}$	$PD_{m,t,w}$	$NOISE_{m,t,w}$
$PRE^{K-4}_{m,t,w}$	0.004	0.223***	0.176*	0.240**
	0.05	*3.07*	*1.82*	*2.39*
$D^F_{m,t,w}$	0.033	-0.558***	-0.438**	-0.395**
	0.31	*-3.53*	*-2.28*	*-2.25*
$D^H_{m,t,w}$	0.070	-0.125	-0.134	-0.182
	0.71	*-0.95*	*-0.77*	*-1.02*
$D^S_{m,t,w}$	-0.085	-0.470***	-0.299**	-0.286**
	-1.04	*-4.99*	*-2.38*	*-2.45*
$D^E_{m,t,w}$	2.487	-1.301***	-1.990***	-1.144***
	1.38	*-3.75*	*-6.85*	*-4.51*
Obs.	308,940	308,940	264,480	264,480

Key statistics from the estimation of Equation 2 are presented in Table 1. With respect to Hypothesis 1, Table 1 does not provide any significant evidence of abnormal transaction costs on match days. That is, all key coefficients presented in Table 1 are statistically insignificant for the $ESPREAD_{m,t,w}$ dependent variable. Hence, it is difficult to reject Hypothesis H1a that discretionary trading is not correlated with transaction costs.

The third column of Table 1 presents the Equation 2 estimation results for the volatility measure, $\sigma_{m,t,w}$. Table 1 documents positive abnormal levels of market volatility during the greatest level of trading activity, from 120 to 90 minutes before match time. That is, the estimated β_4 is 0.223 and significantly different from zero at the 99% confidence level. With respect to match time, the estimated coefficients indicate a statistically significant decline in volatility. For example, on average market volatility is reduced by 0.558 and 0.470 standard deviations during the first-half and second-half of football matches, respectively. Thus, Table 1 provides strong evidence in favor of Hypothesis H2 and the assertion that informed investors trade more aggressively during periods of heightened trading activity.

The last two columns of Table 1 present the Equation 2 estimation results for the $PD_{m,t,w}$ and $NOISE_{m,t,w}$ dependent variables. Consistent with Hypothesis 3, Table 1 reveals increases to both permanent and temporary price innovations at the height of discretionary trading, from 120 to 90 minutes before match time. In further support of Hypothesis H3, all estimated coefficients associated with match time for the $PD_{m,t,w}$ and $NOISE_{m,t,w}$ dependent variables are negative and significant at the 95% confidence level. Thus, there is evidence of a lack of price variation due to reduced informed and uninformed discretionary trading during match time. Quite strikingly, the estimated β_{10} coefficients in Table 1 indicate that permanent price innovations and temporary price innovations are, on average, reduced by 1.990 and 1.144 standard deviations during extra-time, respectively. In sum, Table 1 provides evidence in favor of Hypothesis H3 and documents results consistent with correlated discretionary trading among informed and uninformed investors.

7. Conclusion

This paper exploits intra-day discretionary trading surrounding World Cup football matches to test the market quality predictions of adverse selection models with discretionary trading. In doing so, this paper overcomes a significant weakness of prior empirical studies. That is, the current study takes advantage of an explicit discretionary trading effect that is driven by a quasi-random market-orthogonal event. The empirical analysis shows that discretionary trading is positively correlated with price volatility, permanent price innovations, and temporary price innovations. This is consistent with the models of Admati and Pfleiderer (1988), Back and Pedersen (1998), and Collin-Dufresne and Fos (2016) that predict informed traders increase their trading demands during periods of heightened liquidity trading. Transaction costs appear to be mostly unrelated to discretionary trading. This is consistent with the Back and Pedersen (1998) discretionary trading model in which time-varying liquidity trading is exogenous and private information is long-lived.

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