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Aggressive traders in the options market

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Motivation

- Trading activities and performance by option strategies
  - Previous studies on options have mainly examined the behavior and performance of various options trading strategies (Flint, Lepone, & Yang, 2014; Hu, Kirilova, Park, & Ryu, 2023; Kuo, Lin, & Zhao, 2015; Li, Subrahmanyam, & Yang, 2021).
  - For example, Hu, Kirilova, Park, & Ryu (2023) demonstrate that most of retail investors use a simple strategy of holding only one class of options, whereas institutional investors are more likely to use complex strategies. For both retail and institutional investors, selling volatility is the most successful strategy.
  - However, individual investors may employ multiple option strategies simultaneously, adapting to market conditions, and the effectiveness of the same strategy can vary among investors.

Motivation

- Trading activities and performance by investor classes
  - Several studies have categorized investor classes and examined the trading activities and performance within each class (Barber, Lee, Liu, & Odean, 2009; Bauer, Cosemans, & Eichholtz, 2009; Boehmer, Jones, Zhang, & Zhang, 2021; Jang, Kang, & Lee, 2023; Lakonishok, Lee, Pearson, & Poteshman, 2007).
  - For example, Jang, Kang, & Lee (2023) find that foreign investors in the options market are profitable in both intraday and interday trading, and that they trade more frequently and aggressively.
  - Most prior studies have categorized investors into retail and institutional, or domestic and foreign categories.
  - However, these classifications do not directly indicate the underlying nature of investors.

Motivation

- Categorizing investors based on trading activities
  1) Trading Volume: Price taking vs. Price impact
  - While small investors are price takers, large investors typically drive price changes.
  2) Aggressiveness: Liquidity providers vs. Liquidity consumers
  - Large investors who trade passively serve as liquidity providers.
  3) Open Interests: End users vs. Day traders
  - Large, aggressive investors who maintain open positions could be considered end users in the options market, engaging in hedging or informed trading.

- Who are large and aggressive investors with zero positions?
  → Professional day traders in the options market
  - Their trading activities, performance, and impact on the market have not been examined previously.

Data

- Account-level data
  - Complete history of trades in KOSPI 200 index options and futures.

- Sample period
  - The sample period is from January 4, 2010 to June 30, 2014 (1,115 trading days).
  - Market reform: On March 9, 2012, options with a 5-time increased option multiplier began trading, and on June 15, 2012, the option multipliers for all options were increased.
  → Two sub-periods according to options multipliers
  1) Pre-regulation period (January 4, 2010 to June 14, 2012): 100,000 KRW
  2) Post-regulation period (June 15, 2012 to June 30, 2014): 500,000 KRW

- Account-level information
  - Encoded identifiers of participants
  → We can check both options and futures trades for a specific account at the same time.
  - Information on investor types (domestic individuals, domestic institutions, foreigners)
  - Information about the initiator of a trade
  → Construct the real-time positions and cash flows of each account.
  → Calculate the exact trading profits of each account.

Identifying professional day traders

- Filtering account-day sequentially based on the following conditions:

  1) Large investor condition
  - Calculate the aggressive trading volume for all accounts daily, sort accounts by aggressive trading volume, and select the top 50 accounts.

  2) Liquidity consumer condition
  - Calculate the total trading volume for each account daily, and select accounts where the ratio of aggressive trading volume to total trading volume exceeds 60%.

  3) Zero position condition
  - Calculate the open positions at the end of each day for each account, and select accounts where the ratio of open positions to total trading volume is less than 3%.

  4) Persistence condition
  - Among accounts selected by conditions 1-3, select only those with more than 10 account-days per month.

Preliminary analysis: options

- Daily summary statistics for January 2010 (20 trading days)

	Avg	Std	Min	Q1	Median	Q3	Max
# of account	15						
# of account-day	226						
Ratio of active days	75.33%						
Ratio of foreigners	89.38%						
# of actively traded contracts	19.345	14.397	4.000	9.000	14.000	26.000	61.00
Trading volume	186,042	218,871	13,318	48,759	100,531	214,199	1,478,256
# of trades	32,643	77,309	1,342	8,201	12,863	20,733	547,626
Ratio of aggressive volume	0.789	0.161	0.422	0.657	0.742	0.966	1
Ratio of open interests	0.002	0.004	0.000	0.000	0.000	0.001	0.026
Ratio of call volume	0.477	0.107	0.158	0.413	0.482	0.539	0.822

- Most (89.38%) of professional day traders are foreign investors.
- On average, they execute over 30,000 trades per day, indicating that they are algorithmic traders.
- Professional day traders execute 78.9% of their trades aggressively on average.
- Professional day traders trade calls and puts in nearly equal proportions (47.7% calls vs. 52.3% puts).

→ These results suggest that the findings of Jang, Kang, & Lee (2023), indicating that foreign investors are highly aggressive and achieve substantial profits from options trading, may be attributed to professional day traders.

Preliminary analysis: futures

- Futures trading of professional day traders

	Avg	Std	Min	Q1	Median	Q3	Max
Ratio of futures traders	44.2%						
Trading volume	6,952	12,805	4	654	1,327	2,741	45,598
# of trades	2,656	4,458	4	397	654	1,368	16,024
Ratio of aggressive volume	0.613	0.365	0.006	0.218	0.735	1.000	1.000

- Roughly half of the professional day traders in the options market also participate in futures trading.
- Those professional day traders who engage in futures trading trade very frequently, an average of 2,656 times a day.
- Futures-trading professional day traders also consume market liquidity in the futures market (61.3%).

Preliminary analysis: liquidity consumption

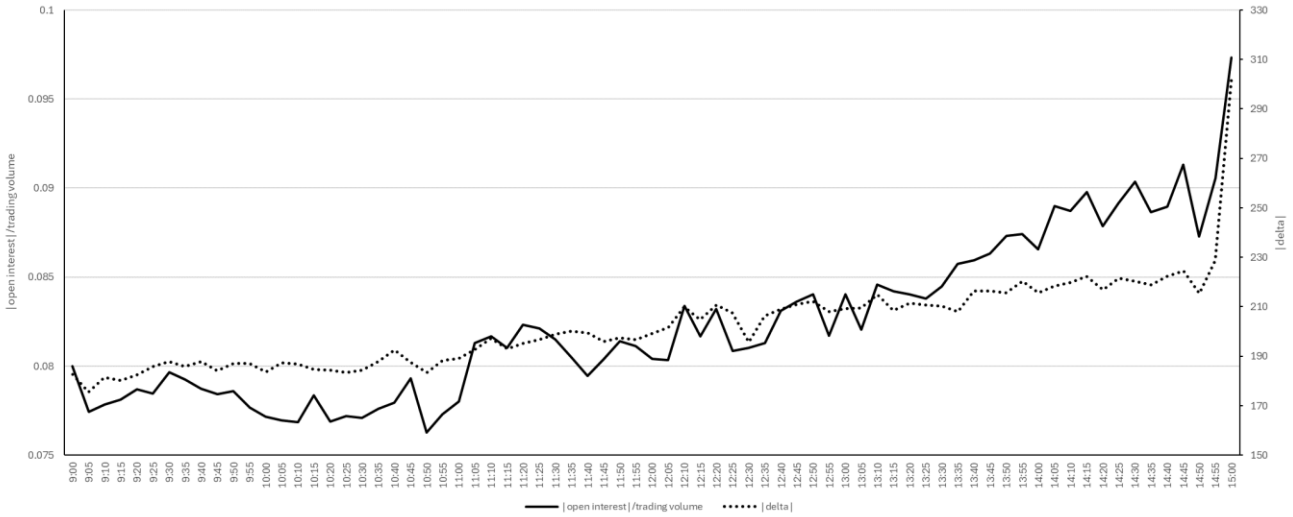
- Liquidity consumption of professional day traders
  1) Liquidity costs per trade: Calculate (half of the bid-ask spread)/(midpoint between the bid and ask prices) for each trade on the selected account-day. Invert the sign for passive trades, and compute the volume-weighted average for each account-day.
  2) Market depth burn rate: Calculate (size of trade)/(market depth at BBO prices) for each trade on the selected account-day, and compute the volume-weighted average for each account-day.
  3) Zero-position duration: Calculate the duration of holding a zero position for each account-day, and determine the ratio of zero-position duration to the total time elapsed from opening to closing.

	Avg	Std	Min	Q1	Median	Q3	Max
Liquidity costs per trade	0.421%	0.317%	0.010%	0.148%	0.384%	0.603%	1.814%
Market depth burn rate	1.588%	1.067%	0.233%	0.744%	1.260%	2.102%	5.821%
Zero-position duration	3.149%	7.365%	0.000%	0.129%	0.783%	2.437%	48.887%

- Professional day traders pay 0.421% per trade for liquidity consumption, indicating that they do not primarily trade deep out-of-the-money with low prices.
- They consume 1.588% of market depth per trade, which shows that professional day traders engage in frequent small trades rather than large trades at once, minimizing potential price impacts.
- They hold zero positions for only 3.149% of their total trading time, suggesting continuous trading activity.

Preliminary analysis: intraday pattern

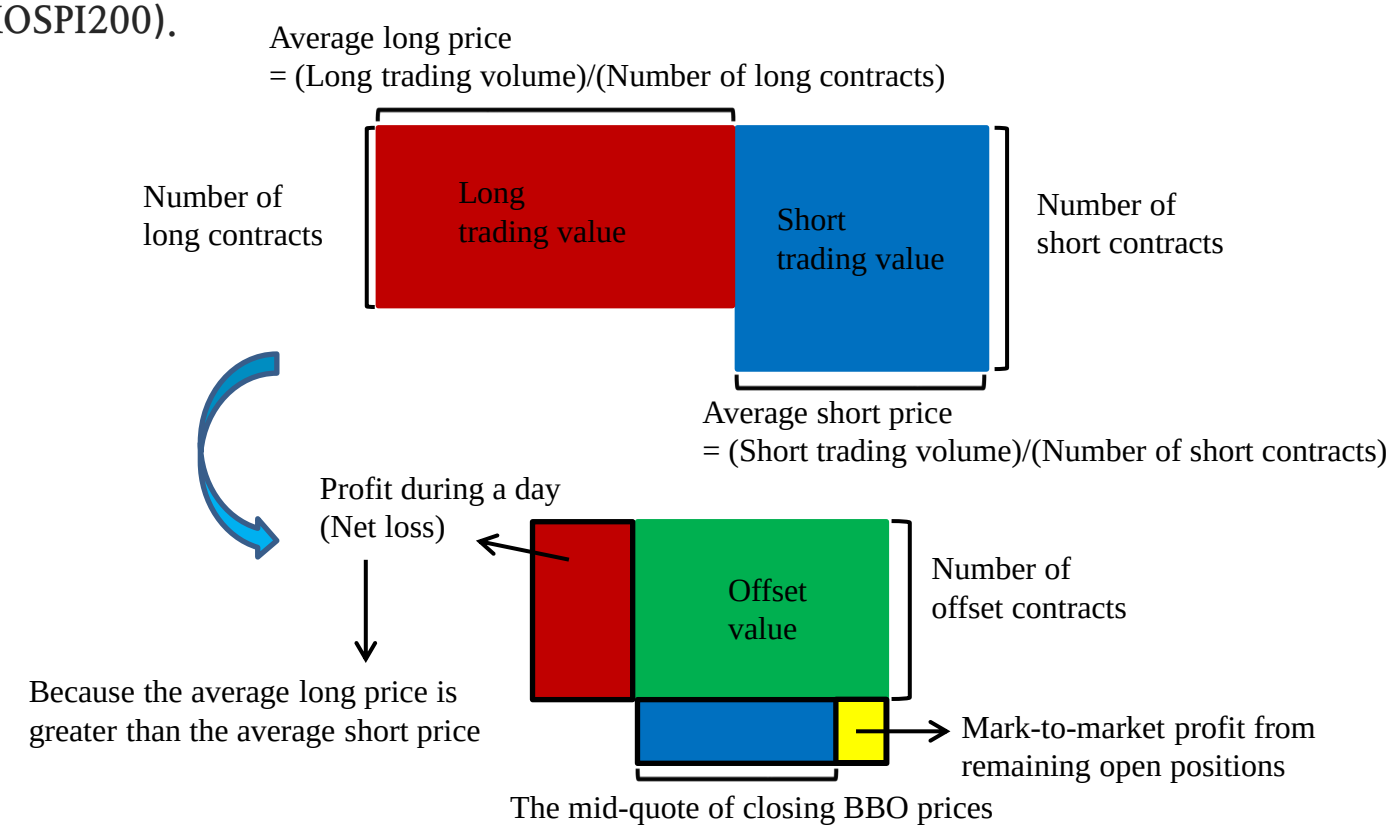
- Intraday patterns of open positions



- Professional day traders do not increase their open positions right after the market opens, opting instead to maintain near zero-positions.
- After 11:00 AM, there is a gradual increase in the open positions held by professional day traders.
- The trading behavior of professional day traders may vary between morning and afternoon trading sessions, indicating a transition from pure day trading to informed trading.

Trading performance

- Trading profit calculation
  - For each account, calculate the trading profit, assuming positions are closed on a FIFO (first-in, first-out) basis.
  - At the end of the day, remaining open positions are assumed to be closed at the mid-quote of closing BBO prices.
  - On the expiration date, remaining open positions are closed at the value of the underlying stock index (KOSPI200).



Trading performance

- Returns calculation
  - The daily return for options and futures is calculated as the daily trading profit divided by the maximum margin requirement for the day.
  - The position should be calculated for each trade, and the margin requirement at the end of each trade is calculated as follows:
  1) For long positions, the value of the open long position (equal to the sum of option premiums)
  2) For short positions, the value of the underlying asset of the open short position multiplied by the margin requirement rate
  3) For futures, the absolute value of the underlying asset value of the intraday position multiplied by the margin requirement rate
  - The maximum margin requirement for the day is the maximum intraday margin requirement value during the trading day.

- We will examine the profitability of professional day traders using their trading profits and returns.
  - Calculate the size and volatility of their profitability and evaluate their risk-return performance, such as the Sharpe ratio.
  - Analyze the impact of market conditions (such as price volatility and sharp drops) on their returns.

Information of day traders

- Event study of a professional day trader's trades
  - For each trade on the selected account-day, calculate the return and cumulative return of the mid-quote price at -15 minutes, -10 minutes, -5 minutes, +5 minutes, +10 minutes, and +15 minutes from the time of trade (time 0). Invert the sign of the return if it is a short trade, and compute the volume-weighted average of these values.

- Professional day trader's return predictability
  - Estimate a time-series regression model of the underlying index return on the lagged terms of professional day traders' 5-minute delta changes.

$$Ret_t = \alpha + \sum_{i=1}^{3} \beta_i \Delta Delta_{t-i} + \sum_{i=1}^{3} \boldsymbol{\theta}_i \boldsymbol{X}_{t-i} + \varepsilon_t$$

- Price contribution of professional day traders
  - Calculate the proportion of log returns of trades executed by professional day traders to the total log return on a half-hourly basis, and compute the absolute return-weighted average of these values.

$$PC_t = \frac{|R_t|}{\sum_{j=1}^{12} |R_j|} \times \sum_{i=1}^{n_t} \frac{r_i}{R_t}$$

Arbitrage trading of day traders

- Transactions (including futures) on a selected account-day are classified as consecutive transactions if they occur less than 0.5 seconds apart, forming a single trade sequence. A trade sequence is identified as arbitrage trades if:
  1) It includes both call and put option trades.
  2) It contains at least three different contracts (including futures as separate contracts).
  3) The sum of deltas of all trades within the sequence is close to zero (the ratio of the absolute total deltas to the sum of absolute deltas is less than 5%).
  4) The sum of vegas of all trades in the sequence is close to zero (the ratio of the absolute total vegas to the sum of absolute vegas is less than 5%).

- Calculate the proportion of arbitrage trading by professional day traders and their arbitrage trading profits.