주가지수 파생상품 시장 내 외국인투자자의 국내투자자에 대한 투자 성과와 정보우위

Do foreign investors take advantage of domestic investors in index derivatives markets?*

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Abstract

This study examines whether foreign investors have informational edge over domestic investors using the unique data on the complete trading history of the KOSPI 200 index futures and options. Foreigners make huge profits in the KOSPI 200 index futures and options markets, while domestic individuals lose almost the same amount of money foreigners make. Domestic institutions only earn a small gain. The good performance of foreigners in the options market is still significant after risk adjustment, while it is not in the futures market. The main source of the profits for foreigners is not the compensation for liquidity provision, while informational edge over domestic investors in that foreigners in the options market have a predictive power for the future market return and realized market volatility.

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1. Introduction

It has been one of the important issues for both policy makers and researchers whether or not foreign investors make a profit when trading with domestic investors. If a long distance with different nationality makes it difficult to get the information of good quality, domestic investors may enjoy the information advantage over foreign investors and exploit foreign investors using the information asymmetry. On the other hand, if most foreign investors are institutional traders with superior trading skills and vast experience in sophisticated trading in addition to more resources, they can show better performance than domestic investors. Many studies have investigated which story fits the reality more closely by looking at the performance of foreign investors versus domestic investors, but the empirical results are inconclusive. Barber, Lee, Liu and Odean (2009) and Bauer, Cosemans and Eichholtz (2009) support the hypothesis that foreign investors have an advantage over domestic investors, while other studies including Choe, Kho and Stulz (2005) and Dvořák (2005) report foreign investors' loss or disadvantage. Though the previous studies fail to draw any conclusions on whether foreigners have an advantage over domestic investors and make more profits than domestic investors, there is one thing common in these studies: most of these studies focus on the possible information advantage of foreign or domestic investors regarding firm-specific information. The previous studies focus exclusively on a stock market or an individual equity options market. We believe that foreign investors may have better perspective on the market-wide information, even when they have disadvantageous access to firm-specific information relative to domestic investors. Since foreign investors invest globally, they are more willing to collect the information affecting the markets of various countries and may interpret the market-wide information better than domestic investors. Thus, we examine the performance of foreign investors versus domestic investors in an index derivatives market. Given the literature that options markets are a preferred habitat for informed investors (Easley, O'Hara and Srinivas, 1998), informed investors armed with better information on the market will trade in an index derivatives market rather than stock or individual equity options market.

We examine trading profits and losses in the KOSPI 200 index derivatives markets for three investor groups, domestic individuals, domestic institutions, and foreigners using the unique data that provide the complete trading history of KOSPI 200 index futures and options with the account information that can identify the encoded identity of each trading. The empirical results show that foreigners make a massive profit, while domestic individuals lose almost the same amount of money as the trading profit of foreigners on average. Domestic institutions only earn a small gain. Those profits cannot be the compensation for liquidity provision considering high trading aggressiveness of foreigners. This pattern of trading profits shows up consistently over

the whole sample period in both futures and options markets. However, there is a difference between the two markets when we divide the total profits into the profits unrelated to positions and those from positions. Most of the profits of foreign traders in the futures market come from trading activities during the trading section rather than price changes of positions, whereas foreign investors in the options market earn significant profits from both sources. Moreover, the great performance of foreigners in the options market is significant even after we control risk factors, while it is not in the futures market. The analysis on subgroups classified by trading frequency supports the hypothesis that foreign investors in the futures market rely a lot on their trading skills while foreigners in the options market exploit their information superiority. Furthermore, foreigners' demands on the market direction and volatility that are identified from the trading volume of index derivatives has a predictive power for the future market return and the future realized volatility of the index. Once again, this predictive power is more significant in the options market than in the futures market. The overall evidence consistently indicates that the information advantage of foreign investors over domestic investors, especially individual investors, is the main source of the trading profits of foreigners, specifically for options.

The remaining part of the paper is organized as follows. We briefly explain the KOSPI 200 index derivatives markets and the dataset in Section 2. Section 3 shows the trading performance of the investor groups. We investigate the predictive ability of the net buying for the market direction and volatility of foreign investors in Section 4. We conclude the research in Section 5.

2. The index derivatives markets in the Korea Exchange

2.1 Description of KOSPI 200 futures and options markets

The Korea Exchange (KRX) has launched equity index futures and options in May 1996 and July 1997, respectively. The index futures and options are based on the Korea Stock Price Index 200 (KOSPI 200), the leading equity index in Korea. The equity index derivatives market in Korea has rapidly grown during its relatively short history, and it is now one of the most active markets in terms of trading volume in the world. According to the Futures Industry Association (FIA) annual volume survey, total volume in KOSPI 200 options has been ranked top in the world for nearly a decade until 2012. After 2012, trading in KOSPI 200 options has

been hugely decreased as a result of a fivefold increase in the index multiplier by KRX.[1] Notwithstanding, the KOSPI 200 options market still holds the third place in the world as of 2013, and the KOSPI 200 futures market has been consistently ranked within top 20 in the world during the year 2010 to 2012.

The KOSPI 200 index derivatives market is an electronic order-driven market, devoid of designated market makers. The trading hours are 9:00 to 15:15, Monday through Friday, but the trading of matured contracts ends at 14:50 on the last trading day for each contract. The KRX introduces the overnight trading section for the KOSPI 200 futures that is linked with the CME Globex since November 16, 2009. For the KOSPI 200 options, it has been cooperating with EUREX from August 30, 2010. During the overnight section that is opened at 18:00 and stays open until 5:00 on the next day, investors can take a position on the KOSPI 200 futures and options as in the regular daytime trading section. The overnight section of the KOSPI 200 futures and options facilitates immediate risk management of foreign investors, thus it makes the KOSPI 200 index derivatives attractive to them. The last trading day of futures and options is the second Thursday of the contract month. The contract months of futures are March, June, September, and December. For options contracts, the contract months are the three nearest consecutive months and a month within six months among March, June, September, and December. The KOSPI 200 options contract is European, exercisable only at its expiration. In both futures and options markets, trading prices are determined by continuous auction except for the last ten minutes when orders are collected for the closing call auction. The minimum tick size is 0.05 index point, which corresponds to a value of 25,000 KRW, for futures and options with 3 points or higher of premiums, and 0.01 index point for options with premiums below 3 points.

2.2 Data

We use the unique dataset of complete history of trades in the KOSPI 200 futures and options markets provided by KRX. It includes all transactions on KOSPI 200 futures and options occurred during the period January 4, 2010 to June 30, 2014. Our sample period includes the period of the increased options multiplier since March 9, 2012, thus we can investigate the effect of the policy change by dividing the full sample period

[1] The change in the multiplier has begun taking effect on March 9 and ended on June 15 in 2012. The main purpose of the change is to discourage individual investors from speculating in the index options market, by making each contract five times as expensive to trade. It has been considered that one of key success factors of KOSPI 200 options is the relatively small size of the contract, which attracts many retail investors in the market. During the sample period, retail trading volume accounts for approximately one third of total volume in the market.

into sub-periods. The data include the encoded identifiers of trading participants and the information on their investor types. In addition, it provides the information about the initiator of a trade. The data allow us to construct the exact daily closing positions and cash flows during the day for each account in the derivatives market. An account is regarded as participating in the market if it trades at least once during a day or holds any positions at the market opening.

2.3 Summary of trading activities by investor types

Table 1 presents summarized information on trading activity by three types of investors. We first construct variables in daily frequency at the account level, and then aggregate them by types of investors. We report daily average values of variables in Table 1. ACNTN is the total number of accounts in which any transaction or position at the market opening exists for each investor group. TRDN is the total number of trades for each investor group. While foreigners trade almost as many times as domestic individuals in the futures market (83.73% of domestic individual investors) and even trade more than them in the options market (103.48% of domestic individual investors), the total number of accounts of foreigners are much smaller than those of domestic individuals in both markets. Each of foreign investors tends to trade much more frequently than domestic individuals and institutions, though this tendency is more significant in the options market than in the futures market. On average, foreign investors trade more than 3,000 times on a day, which means that they trade about 100 times more frequently than domestic individual investors in the options market. Thus, some of them might be often classified as high frequency traders (HFTs).

To take a closer look into trading activity in the KOSPI 200 index derivatives markets, we report the aggregate trading volume (VOL) and absolute value of open interests (AOI) for each investor group, represented in a billion KRW, as well as each group's share in the total trading volume (TVOL) and absolute open interests (TAOI) in the entire market. The aggregate trading volume for each investor group is the sum of the trading volume on the long and short positions, which indicates that the sum of the aggregate trading volume for investor groups is twice the actual trading volume in the market. The daily trading volumes in the futures and options markets are 33,426.19 and 1,263.93 billion KRW on average. The magnitude of trading volume of the KOSPI 200 index derivatives is about 2.57% of the annual GDP of Korea averaged over 2010 to 2013, and about 2.93% of the total market capitalization of stocks listed in KRX at the end of 2013. Though the trading volume of foreign investors takes the highest proportion of 36.45% in the futures market and 50.07% in the

options market, the participation of domestic individual investors is remarkably large compared to large derivatives markets in other countries. In terms of trading volume, each group of domestic individuals, domestic institutions, and foreign investors takes a considerable portion of the KOSPI 200 index derivatives markets.[2] This feature makes the KOSPI 200 index derivatives markets a good laboratory to compare trading profits among those investor groups. Each investor groups also hold substantial open interests, but foreigners occupy the larger portion relative to trading volume.

To examine how aggressively each group participates in the market, we also report the aggregate trading volume of aggressive trades of each investor group, denoted by AGVVOL. To determine whether a trade is aggressive or passive, we use the direct information on who initiates a trade. In other words, for each trade, we can identify one party who initiates the trade as an aggressive trader and the other party as a passive trader. For domestic individual investors, the aggressive trading volume makes up 42.60% and 33.98% of total trading for futures and options, respectively. Domestic institutions trade more aggressively than domestic individuals (43.15% in futures, and 40.12% in options), but there is not much difference. In contrast, the aggressive trades of foreign investors account for 61.37% and 63.87% of their total trades for futures and options. This indicates that foreign investors trade more aggressively than domestic investors in the KOSPI 200 index derivatives market. The difference in aggressiveness between domestic and foreign investors may result from different levels of information and trading skills, or just reflect how differently or actively each group trades without different level of information. If the reason behind the difference in aggressiveness among investors can be attributed to the former, foreign investors should show better performance than the other groups of investors. On the other hand, if the three investor groups have the same level of information and trading skills, foreigners should pay for demanding the liquidity in the markets and domestic investors should get the compensation for the liquidity provision, which result in better performance of domestic investors than foreign investors.

For each investor group, the aggregate trading volume is divided into three parts. In Table 1, INDVVOL, INSTVOL, and FRGNVOL for each investor group denote the volume of trades executed between the given investor group and domestic individuals, domestic institutions, and foreigners, respectively. The shares of the trading volume with investor groups for each investor group are not much different from the shares of the aggregate trading volume for each investor group except that the share of the trades between domestic

[2] During the early years of the KOSPI 200 index derivatives markets, trading volume of domestic individual investors has accounted for approximately two thirds of the total volume in the market, which is an exceptionally high level. Throughout the 2000s, however, participation of both domestic institutions and foreign investors has gradually increased, and the proportions of three investor groups have become similar.

institutions is relatively large and the one between foreign investors is small. Therefore, domestic individual investors trade more with foreign investors than with domestic institutions. This facet alludes to frequent opportunities for gains and losses between domestic individual and foreign traders.

The remarkably large number of trades of foreign investors implies that there exist HFTs in the index derivatives markets, and their trading aspects and purpose might be distinguishable from those of non-HFTs. Therefore, we divide all accounts into seven subgroups according to their number of trades and size of opening positions for every day. If an account trades more than 100 times in the futures market or 300 times in the options market a day, we classify it as a HFT. For domestic individual investors, the non-HFT group is divided into two subgroups once again, small and large individual traders, according to the criterion whether they trade more than 20 times for futures, 40 times for options, or the size of their opening positions are larger than 500 million KRW. The summary of trading activities of those investor subgroups is reported in Table 2. There are, on average, over 70 accounts per day that are categorized as HFTs for all investor types. Particularly, the proportions of the number of foreign HFTs to the total number of foreign investors are substantial, i.e., 31.74% in the futures market and 18.37% in the options market. They are also very aggressive traders who initiate trades more than 60% of their total trading volume even though the other HFTs have traded aggressively compared to the non-HFTs. It is noteworthy that domestic HFTs hold only small open positions relative to their contribution to trading volume, while foreign HFTs take a considerable portion of both trading volume and open interest. They take nearly half of the open interest in the options market. It implies that some foreign HFTs might jump into the Korean index derivatives markets with the purpose of hedging or betting on price movements.

3. Trading profits and performance of foreign investors

3.1 Trading profits of foreign investors

We calculate daily trading profits by tracking exact trading history of all accounts in the KOSPI 200 futures and options markets. At the market opening, we assume that an investor takes the same positions as the closing positions on the previous trading day. Then, he or she pays or gets the sum of the market value of the opening positions and cash flows incurred by today's trading for taking the closing positions. Similarly, we assume that investors square their closing positions at the closing price in the market. We can define daily trading profits as the difference between the cash flow from total short positions and that from total long positions (PRF). It is a

difference between the market value of the closing position and the gain/payment for taking the closing positions. We can handle total trading profits using this approach, but channels of profits can be various. If an investor wants to bet on the changes in the market index after the closing of the market, she will remain some positions rather than close positions. In contrast, an investor who intends to exploit his superior trading skills will trade much more than his actual closing positions. We consider the smaller of the sum of the short positions and that of the long positions during the trading sections as the trades unrelated to closing positions, thereby the difference between the larger and the number of contracts unrelated to closing positions affects closing positions. Assuming that long or short positions are traded at the daily average price which is the total long or short volume divided by the total number of long or short contracts, profits unrelated to positions (UPPRF) can be calculated by multiplying the difference between the average short price and the average long price and the number of contracts that is irrelevant to the closing positions. The difference between total trading profits and profits unrelated to positions indicates profits from positions (PPRF). As explained above, UPPRF can be interpreted as a gain from trading techniques or compensation for liquidity provision, while PPRF may come mainly from information advantage. The sum of total profits of all account should be zero because an index derivatives trade is a sort of zero sum game, whereas it cannot be zero for UPPRFs and PPRFs because a someone's trade which is not related to her positions can affect the closing positions of the counterpart of the trade. We define BNFP and CSTA as the weighted sum of absolute differences between the mid quote prices and actual trading prices with weights proportional to a contract size for passive trades and aggressive trades to examine the liquidity provision of each account. The difference between them represents the compensation for supplying liquidity.

Table 3 presents characteristics of average daily trading profits by three investor types. Regardless of the markets, foreign traders earn massive profits during the sample period (1.008 billion KRW for futures and 2.33 billion KRW for options per day), whereas domestic individual traders lose almost the same amount of money as foreign traders' profits (-1.097 billion KRW per day for futures and 2.334 billion KRW per day for options). The size of trading profits of domestic institutions in the derivatives markets is relatively small compared to the profits/losses of the other groups (0.089 billion KRW per day for futures and 0.004 billion KRW per day for options), which is not much different from zero considering their standard errors. Panel A of Figure 1 confirms this pattern of trading profits by investor types through the cumulative profits. Positive profits of foreign investors are not caused by some record-breaking days. Except for the sharp rises and/or falls in the options

market during the U.S. credit rating downgrade period from August 5 to August 9 in 2011,[3] foreign investors get profits and domestic individual investors suffer losses consistently over the whole sample period. We also find the similar pattern of investor types for profits unrelated to positions, UPPRFs, and those from positions, PPRFs, as shown Panel B and C of Figure 2, though profits unrelated to positions are positive and significant for domestic institutions and they lose some amounts of money from positions. One noticeable fact is that a large portion of domestic individuals' losses can be attributed to the losses from positions.

Although the overall pattern of cash flows that is not related with taking positions seems to be similar to that from positions, there is much difference in time-series variation between them. The profits that are not associated with positions are very stable, whereas trading profits related to positions fluctuate considerably over the sample period. Regardless of investor types, the standards errors of UPPRFs are definitely less than those of difference between PPRFs as reported in Table 3. In Panel B and Panel C of Figure 1, the cumulative profits verify this tendency again. In some periods, even the order of profits from positions among investor groups is reversed. For example, for the first one and a half years, institutional investors make large profits from their positions and foreign investors make considerable losses from positions in the futures market. In contrast, the foreign investor group maintains superiority in the cumulative profits unrelated to positions over the entire sample period. As we can see in Panel B of Figure 1, foreign investors make stable profits and domestic individual investors make stable losses very consistently from their trades that are irrelevant to positions in both markets over the sample period. This strong stability of UPPRFs compared to PPRFs might lend weight to our interpretation that trading skills is the main source of UPPRFs whereas PPRFs arise from information advantages, because information advantages are effective for a limited time and even disposable in the majority of cases.

The above stylized facts enable us to infer the source of foreign investors' profits. There are three possible sources for trading profits, i.e., liquidity provision for the index derivatives markets, information advantage over domestic investors, or superior trading skills. Among them, it is not likely that the main source of the profits comes from liquidity provision. Foreigners are net demanders for liquidity, considering that more than 60% of their trading volume is initiated by themselves in Table 1 and the difference between BNFP and CSTA is

[3] On August 5, 2011, Standard & Poor's downgraded the credit rating of the United States from AAA to AA+ for the first time. This downgrade in the credit rating induced a dramatic decrease in the Korean stock market. On the subsequent Monday, August 8, Korea Exchange temporarily halted program trading on stocks and the KOSPI 200 futures which is called a "sidecar". During this period, the closing KOSPI 200 index dropped -10.71% for three trading days from 261.54 points on August 4 to 233.52 points on August 9.

significantly negative in both markets in Table 3. On the other hand, domestic investors are passive traders providing liquidity as in Table 1 and their trading term is better than the quoted price as shown in the positive difference between BNFP and CSTA. The huge losses of domestic individual investors imply that the compensation for liquidity provision are swept away by the losses from subsequent trades at unfavorable prices or price movement opposite to the current positions. The large contribution of PPRFs on domestic individuals' losses supports that they are uninformed on the market index. Anyway, in the KOSPI 200 index derivatives markets, liquidity cannot explain the huge profits of foreigners and corresponding losses of domestic investors, in particular domestic individuals. Rather, foreign investors have to overcome the burden from aggressive trading, which means that foreign investors might be informed investors with information advantage or have superior trading skills. Given that the size of UPPRF and PPRF, foreign investors might be armed with both trading techniques and the market-wide information, domestic institutions are only equipped with skills, and domestic individual investors are lack of both. Actually, there is a distinction between PPRFs of foreigners in the futures and options markets. Foreigners in the futures market reap smaller PPRFs on average than foreign investors in the options market, and their PPRFs are significantly positive only in the options market, not in the futures market.

We verify that many of foreign investors are HFTs and they are distinct from other investor groups in trading activities. It is natural to infer that these foreign HFTs can be associated with the profitability of the foreign investor group given that they can improve market efficiency by aggressive trading (Brogaard, Hendershott and Riordan, 2014). Thus, we report trading profits of non-HFT and HFT subgroups in Table 4 following the classification used in Section 2. As expected, the foreign HFT is the only subgroup that is profitable in both futures and options markets. They enjoy huge profits particularly in the options market and, in fact, all other subgroups cannot earn significant profits or lose money. Most of profits of foreign investors seem to be attributable to foreign HFTs. Those profits come from both UPPRF and PPRF. Meanwhile, in the futures market, the foreign HFT's profits are rather smaller than the profits of foreign non-HFTs, and their profits are strongly reliant on UPPRF, not PPRF. The most profitable investor subgroup in the futures market is foreign non-HFTs and their major portion of profits is from positions. It shows that foreign HFTs in the options market are informed investors, whereas foreign non-HFTs are in the futures market. The better performance of non-HFTs than HFTs is also observed for domestic institution investors. Domestic non-HFTs are the only profitable investor subgroup except for foreign investors in the futures market. All three subgroups of domestic individuals suffer from significant losses in both markets. The small domestic individual investors take significantly

positive profits unrelated to positions which might be compensation for liquidity provision in that the size of profits is comparable to the difference between BNFP and CSTA. However, they lose a great amount from positions that indicate that they are uninformed investors. HFTs and large investors among domestic individual investors make significant losses unrelated to positions though they provide a large amount of liquidity. In particular, domestic individual HFTs might trade excessively in that they take huge losses irrelevant to positions.

We confirm the exceptional performance of foreign HFTs in the options market and foreign non-HFTs in the futures market, but the average size of profits does not tell us about time variation of profits for an investor group and effects of other investor groups. Table 5 shows the ratios of days that share the same sign of total profits of two investor subgroups to the total number of days in the sample and time-series correlations between total trading profits among investor subgroups. Given that futures and options are a zero-sum game, if one subgroup is the overall counterpart of the other subgroup, a correlation between profits of two subgroups will be likely to be negative, and, similarly, the ratios of days with the same sign might be small. When we consider three basic investor types, the variation of profits of foreign investors is extremely associated with domestic institutions for futures and domestic individuals for options. We also can see this tendency clearly in Figure 1. In the futures market, Panel A of the figure shows that foreigners gain (lose) when domestic institutional investors lose (gain) whereas domestic individual investors consistently lose over our sample period. This pattern reappears in the shapes of the cumulative PPRF, which contributes to most of the variation of total trading profits, while UPPRF does not show the pattern. On the other hands, for options, the same pattern is observed between foreigners and domestic individual investors. Foreigners gain (lose) when domestic individual investors lose (gain) in terms of total trading profits and PPRF. For the subgroups, the variation of trading profits of foreign HFTs in the options market is influenced by the performance of domestic individual HFTs, while in the futures market it is strongly related with domestic institutions. On the other hand, the variation of profits of foreign non-HFTs is closely associated with domestic individual non-HFTs (small and large) in the both markets.

To examine profitability of the investor subgroups for various options, we categorize call and put options into five subgroups according to their moneyness: Deep in-the-money (Deep ITM), in-the-money (ITM), at-the-money (ATM), out-of-the-money (OTM), and deep out-of-the-money (Deep OTM), where each subgroup is defined as the one with the ratio of the strike price over the spot price less than 0.93, equal to or larger than 0.93 and less than 0.97, equal to or larger than 0.97 and less than 1.03, equal to or larger than 1.03 and less than 1.07, equal to or larger than 1.07, respectively. Most of the profits of foreigners in the options market arise from ATM options as reported in Table 6 when we divide trading profits according to the moneyness of options. ATM

options are traded most actively and foreign investors make huge profits from both ATM call and ATM put options. Both profits from positions and unrelated to positions are considerable. They also obtain meaningful profits from OTM options. The interesting point is that they do not make a loss from trades unrelated to positions for all types of options, and it supports their superior trading skills once again. Though they make a loss from deep OTM options and deep ITM options trading, its magnitude is quite small relative to the size of profits from ATM options trading. They are insignificant taking into account their standard errors. Domestic institutions have the advantage of trading deep OTM options and OTM call options, and domestic individual investors take some profits from deep ITM options.

As mentioned before, our sample period contains the major policy change in the options market that the KRX increases the option multiplier from 100 thousand KRW to 500 thousand KRW. Following this, options with the small multiplier and the large multiplier are mixed during the period from March 9, 2012 to June 14, 2012, and the increased option multiplier is applied for all options after June 15, 2012. This increase in the multiplier may induce various changes in the investment environment such as trading volume, potential market participation, and frequent trading which can also affect the profits of investors. Therefore, we divide the whole sample period into three sub-periods, the Pre-period (January 4, 2010 to March 8, 2012), the Inter-period (March 9, 2012 to June 14, 2012), and the Post-period (June 15, 2012 to June 30, 2014), and report the summary of trading activities and trading profits for the three investor types in Table 7. We exclude the observations from August 5, 2011 to August 9, 2011 when foreign investors make exceptional profits from options, because the profits during this three trading days are abnormal due to an event as shown in Figure 1, and so may distort our sub-period analysis.

As expected, the overall trading volume in the options market has dropped sharply after the increase in the option multiplier. It is more obvious for domestic HFTs that their trading volume tumbled by over half after the policy change, while there is no noticeable change in the trading volume of domestic non-HFTs and foreign investors. Though foreigners decrease their trading slightly, the size of their open positions has declined significantly. It implies the possibility that the considerable number of foreign investors who have information advantage or hedging demands get out of the market. The result of trading profits also supports this interpretation. Far from the original intention to protect retail investors, the size of losses of domestic individual investors does not change before and after the increase in the multiplier, and, furthermore, the losses of domestic individual non-HFTs increase a small amount. For domestic institutions, non-HFTs' losses decline a little, whereas we cannot find any observable change in profits of HFTs. Surprisingly, the subgroup who gets the most

benefit from the policy change is the foreign non-HFT group. They suffer from 1.019 billion KRW of losses per day before the option multiplier goes up, and the size of losses dramatically reduces by 0.694 billion KRW which is equal to 68.11% of the losses in the Pre-period. On the other hand, the profits of foreign HFTs decrease from 2.796 billion KRW to 1.869 billion KRW. However, the increasing multiplier only affect their profits from positions (by 0.774 billion KRW), not much of the profits unrelated to positions (by 0.153 billion KRW). Overall, the policy change about the option multiplier constricts trading activities and induces an outflow of foreign informed investors, but it fails to protect individual investors from speculators. Nevertheless, inequality measures of profits and losses for domestic individual investors have dwindled. Thus, the policy change might improve the extreme profits and losses.

3.2 Risk-adjusted performance of foreign investors

We have documented that foreign investors have made huge profits in the KOSPI 200 index derivatives markets. In the finance literature, it is known that investors can make large returns if they take high risks. Thus, it is possible that the huge returns foreign investors enjoy may result from a fair reward for risk taking, not from their dominant information advantage over domestic investors or trading skills. This section examines whether the large returns of foreign investors can be accounted for by the risk factors known in the literature.

Fama and French (1993) document that their three factors, the market factor (MKT), the size factor (SMB), and the value factor (HML), can explain the returns on stocks and bonds successfully. Though there are anomalies that cannot be explained by the Fama-French three factor model, their three factors are widely used in the literature to measure the abnormal performance of a portfolio. Even in the international market including the Korean market, the Fama-French three factor model is accepted well as the standard asset pricing model.

The previous literature on option returns indicate that there are some unique factors to explain option returns, not explained by the asset pricing models developed in the stock market literature. Notably, the variance risk premium is known to be an important factor to explain option returns. For example, Coval and Shumway (2001) shows that the average return of zero-beta at-the-money straddle in the index options market is substantially negative, -3% for a week, even after taking the market beta into account, and the straddle factor seems to account for the cross-sectional differences in option returns. Carr and Wu (2009) provide evidence that the variance risk premium measured by a difference between a realized variance and a risk-neutral variance is significantly negative and the traditional Fama-French factors cannot explain it. Thus, we use the five factor

models to estimate the abnormal returns of portfolios in the KOSPI 200 index derivatives markets as in equation (1):

$$r_{i,t} - r_{f,t} = \text{Alpha} + \beta_{i,1}\text{MKT}_t + \beta_{i,2}\text{SMB}_t + \beta_{i,3}\text{HML}_t + \beta_{i,4}\text{ZSR-RF}_t + \beta_{i,5}\text{RV-IV}_t + \varepsilon_{i,t} \quad (1)$$

where $r_{f,t}$ is the 91-day CD rates, MKT, SMB, and HML are the Fama-French three factors, ZSR-RF and RV-IV are the excess returns of zero-beta straddles and the difference between the realized variance and the risk-neutral variance, respectively, and $\varepsilon_{i,t}$ is the error term.

Table 8 examines whether the factor model given in (1) can price well the options in the KOSPI 200 index options market. In this table, we consider the equal-weighted portfolios constructed by the moneyness. We test whether the alphas in Eq. (1) for these test assets are significantly different from zero. For robustness check, we also look at the alphas for the five subgroups restricted to nearest maturity options.

Table 8 confirms that the pricing model prices quite well the options returns in the KOSPI 200 index option market. All the estimated alphas are not significantly different from zero at the 5% significance level except for the cases of OTM and deep OTM put option returns with the nearest maturity. This result is consistent with Constantinides, Jackwerth and Savov (2013), who document that OTM put options with short maturity have the negatively significant alphas. We believe that it is unlikely to make a big problem in the following pricing tests because the share of OTM put options is small in the portfolios of our interest. Thus, we use the five factor model suggested in Eq. (1) to adjust the risk of portfolios in the KOSPI 200 index derivatives market.

To examine whether the performance is significant after controlling for the risk factors or not, we perform a regression of returns of the investment of each investor group in a similar way to Eq. (1). The return is calculated under the assumption that investors close their positions at the end of the trading section, but retake the opening position on the next day which is the same as the closing position on the previous day. In this manner, the return is the trading profit over the sum of cash flows from long positions. Table 9 presents the pricing test results by investor types.

After the risk adjustment, the performance of foreign investors is not significant any more for futures, but is still significant in the options market at any reasonable significance level. In Table 9, the estimate of alpha for the total trading profits of foreigners in the futures market is not statistically different from zero. Consistently with the previous results, the estimated alpha from the portfolio constructed from the changes in opening positions is not statistically significantly different from zero, while the one from the portfolio constructed from

the intraday position changes during the trading sections is significantly positive. On the other hand, the estimated alphas for domestic individual investors are negative and statistically significant for all the cases of total profits, opening positions, and changes in positions during the trading sections. Table 10 reports the risk-adjusted performance of investor groups for options. The estimated alphas for foreign investors are significantly positive, regardless of whether we look at the case of total profits, profits from opening positions, or profits from intra-day position changes during trading sections, while they are significantly negative for domestic individual investors. The returns of domestic institutions do not statistically differ from zero. Though we do not report in the table, the results remain qualitatively the same for the high stock market volatility sub-period (August 2011 to December 2012) and the other sub-period of the low market volatility.

Another interesting thing in Tables 9 and 10 is that the coefficients on factors for foreigners show the exact opposite signs to those for individual investors if they are statistically significant. These opposite signs imply that foreigners and domestic individual investors have very different risk characteristics and/or very different views on the market. One implication of these opposite signs is that both groups, foreigners and domestic individual investors, may be able to enjoy mutual benefit from the redistribution of risk, though domestic individual investors lose money to foreigners. If the derivatives markets expand the investment opportunity set for domestic individual investors (Bakshi, Cao and Chen 2000; Sim, Ryu and Yang, 2016), and if domestic individual investors want to shed some risk exposures by taking positions in the derivatives markets, then they may be willing to take some losses in the derivatives markets. Since we do not have data on the positions of domestic individual investors in the underlying or other markets, we cannot examine this interesting issue in this paper.

Given that foreigners enjoys huge profits and domestic individuals suffer large losses, it is a surprise that foreigners have positive coefficients on the variance premium factors (ZSR-RF and RV-IV) in the options market, while domestic individual investors have negative coefficients on them. Given the empirical evidence that the variance premium is negative and so returns on those two factors capturing the variance premium is negative (Coval and Shumway, 2001; Goyal and Saretto, 2009), foreigners make profits even with the positive exposure to these variance risk factors, which usually generates adverse effect on the option returns.

In summary, foreigners have positive abnormal returns and domestic individual investors have negative abnormal returns even after the risks of their respective portfolios are adjusted. Thus, the trading profits of foreigner investors are not an outcome from risk bearing. In addition, the risk exposure of foreign investors seems to be the opposite of that of domestic individual investors.

4. Information advantage of foreign investors

If an investor has information on the market return or market volatility, he or she will take positions in derivatives markets that generate a profit when his or her prediction on the market is correct. Therefore, his or her delta- and vega-weighted net demand should predict the future return and volatility of underlying index, respectively. From this point of view, Ni, Pan and Poteshman (2008) show that the vega-weighted net demand for stock volatility of non-market makers has a predictive power on the future realized volatility. Using the similar framework, Chang, Hsieh and Wang (2010) find that foreign institutional investors in the Taiwan index option market has direct information on the market volatility. Following the previous works, we estimate the regression of the market returns and realized market volatility on the delta- and vega-weighted net demand and other control variables. The delta- and vega-weighted net demands are calculated as daily changes in Black-Scholes delta and vega of the closing positions, respectively.

Table 11 presents the results of one-day to five-day market return predictability regressions. The following regression is estimated for j = 1,2,…,5 in the futures market as well as in the options market:

$$FRET = \alpha_j + \beta_{1,j} DWD(j) + \sum_{i=1}^{5} \beta_{2,i,j} RET(i) + \beta_{3,j} LVOL(j) + \beta_{4,j} LSVOL(j) + \varepsilon_j \quad (2)$$

where FRET is the return on the KOSPI 200 index, DWD(j) is the j-th lagged delta-weighted net demand of each group, RET(i) denotes the i-th lagged return of KOSPI 200 index for i = 1,2,…,5, and LVOL(j) and LSVOL(j) are the logarithm of trading volume of index derivatives and the logarithm of trading volume of KOSPI 200 index, respectively.

If you look at the results in the futures market, the coefficient of DWD(1) is only marginally significant and positive for foreigners at the 10% significance level, and the coefficients of DWD(j) for j = 2 to 5 are not significant. Those coefficients for domestic individual and institutional investors are not significant. These results show that there is only marginal evidence that foreign investors in the futures market have macro-level information predicting the future market return, while there is no evidence that domestic investors have the ability to predict the future market return.

Table 11 also shows that the delta-weighted net demand of foreigners in the options market significantly

predicts the market returns for the next trading day at the 1% significance level. Both the size of the estimate and its significance (i.e. *t*-value) in the options market is much larger than those in the futures market. This predictive power of the delta-weighted net demand gradually decreases as predictive horizon increases. On the contrary, domestic institutions have no information on the market returns, and even domestic individual investors forecast the market movement in the opposite direction. Interestingly, the wrong forecasting of domestic individuals in the options market is more apparent for the horizon of three days than for that of one day or two days.

Table 12 shows the results of one-day to five-day market volatility predictability regressions. The following regression is estimated for j = 1,2,…,5 in the options market:

$$FV = \alpha_j + \beta_{1,j} VWD + \sum_{i=1}^{5} \beta_{2,i,j} RV(i) + \beta_{3,j} ADWD(j) + \beta_{4,j} LVOL(j) + \beta_{5,j} LSVOL(j) + \varepsilon_j \quad (3)$$

where FV is the realized volatility of the KOSPI 200 index, VWD(j) and ADWD(j) are the j-th lagged vega-weighted net demand and the j-th lagged absolute value of the delta-weighted net demand of each group and RV(i) denotes the i-th lagged realized volatility of KOSPI 200 index for i = 1,2,…,5, and LVOL(j) and LSVOL(j) are the logarithm of trading volume of index derivatives and the logarithm of trading volume of KOSPI 200 index, respectively. The realized volatility is calculated using the 5-minute returns of the KOSPI 200 index every day.

The estimated results shown in Table 12 show that foreigners in the options market have information about the market volatility. Their vega-weighted net demand is significantly associated with the realized market volatility after two or three days, even though it does not contain the predictive power for the very next trading day volatility. On the other hand, domestic individual and institutional investors in the options market do not seem to possess any predictive power for the future realized volatility, judging from their option portfolio positions. In the case of domestic individual investors, their bets on the future volatility are significantly wrong: When they take a long (short) position in volatility, the future market volatility tends to go down (up).

In summary, foreign investors investing in the options market seem to have information about the future direction and volatility of the market returns, while domestic investors do not show any predictive power about those in the options market. This informational advantage of foreign investors seems to be the source of the profits foreign investors have enjoyed in the KOSPI 200 index options market. On the other hand, we have only marginal evidence that the foreign investors have the informational edge over domestic investors in the KOSPI

200 index futures market.

5. Conclusion

This study examines whether foreign investors have informational edge over domestic investors using the unique data on the complete trading history of the KOSPI 200 index futures and options. Unlike the previous research, we focus on the macro-level information by looking at the market index rather than firm-level prices. Moreover, since it is known that derivatives market is the habitat for informed investors, we expect that our experiment will have more power than the research using the stock market data.

Our empirical results show the followings.

(1) Foreigners make huge profits in the KOSPI 200 index futures and options markets, while domestic individuals lose almost the same amount of money foreigners make. Domestic institutions only earn a small gain. This pattern of trading profits shows up consistently over the whole sample period and is robust for outliers.

(2) Foreign investors who trade moderately are more profitable than foreigners who trade very frequently in the futures market, and most of the profits come from trading unrelated to closing positions rather than taking positions. In contrast, foreign high frequency traders dominate the options market and effectively exploit both channels.

(3) Foreigners tend to be aggressive traders consuming liquidity, while domestic investors tend to be passive traders providing liquidity in the KOSPI 200 index derivatives markets. This implies that the main source of the profits for foreigners is not likely to be the compensation for liquidity provision.

(4) The increase in the options multiplier cannot reduce the losses of domestic investors, though foreign investors' profits from closing positions have dropped sharply.

(5) The good performance of foreigners in the options market is still significant after risk adjustment, while it is not in the futures market.

(6) The risk exposure taken by individual investors seems to be opposite to the one taken by foreigners. This suggests that there may be potential gain from the risk sharing or risk redistribution for the two groups, even though domestic individual investors lose money in the KOSPI 200 index derivatives market.

(7) The delta-weighted net demand and the vega-weighted net demand of foreigners in the options market have a predictive power for the future market return and realized market volatility, respectively, while that of domestic investors, whether they are individuals or institutional investors, do not possess any predictive power

for the future market return or realized volatility. This suggests that foreigners investing in the options market are informed investors relative to others. In the case of the futures market, there is only marginal evidence that the net demand of foreigners have a predictive power for the future market return.

The evidence suggested in this paper is consistent with the hypothesis that foreigners have informational edge over domestic investors in terms of macro-level information. Because foreign investors are expected to invest in various countries as well as their own country, there is a possibility that they may have better access to macro-level information and digest and interpret the macro-level data more effectively and efficiently, which may result in better performance in the index derivatives market.

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Table 1. Summary of trading activities

This table shows summarized information of trading activities classified by three investor types of in the KOSPI 200 index futures and options markets. All variables are constructed in daily frequency, and the time-series mean of each variable is reported. ACNTN is the total number of accounts and TRDN is the total number of trades for each investor group. AOI indicates the aggregate absolute value of open interest, and TAOI is the total sum of AOIs in the market. VOL is the aggregate trading volume in value for each investor group, and TVOL is the total trading volume in the market. AGVVOL is the aggregate value of trades initiated by each investor group itself. The unit of trading volume and absolute open interest is a billion KRW, but that per account in the options market is a million KRW. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Domestic individuals	Domestic institutions	Foreigners	Total
Panel A. Futures				
ACNTN	6422.40	1589.44	411.04	8422.88
TRDN	102595.52	69854.42	85907.05	258356.99
TRDN/ACNTN	15.97	43.95	209.00	30.67
AOI	2488.26	5533.25	12742.22	20763.73
AOI / TAOI	11.98%	26.65%	61.37%	
AOI/ACNTN	387.43	3481.26	30999.95	2465.16
VOL	20644.81	21840.35	24367.22	66852.38
VOL / TVOL	30.88%	32.67%	36.45%	
VOL/ACNTN	3.21	13.74	59.28	7937.00
AGVVOL	8794.86	9424.84	15206.49	33426.19
AGVVOL / VOL	42.60%	43.15%	62.41%	50.00%
INDVVOL	6484.95	6522.02	7637.85	20644.81
INDVVOL / VOL	31.41%	29.86%	31.34%	30.88%
INSTVOL	6522.02	7646.62	7671.71	21840.35
INSTVOL / VOL	31.59%	35.01%	31.48%	32.67%
FRGNVOL	7637.85	7671.71	9057.66	24367.22
FRGNVOL / VOL	37.00%	35.13%	37.17%	36.45%
Panel B. Options				
ACNTN	23739.18	608.40	237.98	24585.56
TRDN	791143.35	337617.96	818686.78	1947448.09
TRDN/ACNTN	33.33	554.93	3440.15	79.21
AOI	340.67	154.02	759.80	1254.48
AOI/TAOI	27.16%	12.28%	60.57%	
AOI/ACNTN	14.35	253.16	3192.71	51.03
VOL	829.22	432.81	1265.82	2527.85
VOL / TVOL	32.80%	17.12%	50.07%	
VOL/ACNTN	34.93	711.39	5319.02	102.82
AGVVOL	281.78	173.65	808.49	1263.93
AGVVOL / VOL	33.98%	40.12%	63.87%	50.00%
INDVVOL	226.70	126.78	475.74	829.22
INDVVOL / VOL	27.34%	29.29%	37.58%	32.80%
INSTVOL	126.78	82.95	223.08	432.81
INSTVOL / VOL	15.29%	19.17%	17.62%	17.12%

FRGNVOL	475.74	223.08	567.00	1265.82
FRGNVOL / VOL	57.37%	51.54%	44.79%	50.07%

Table 2. Summary of trading activities of investor subgroups

This table shows summarized information of trading activities of seven investor subgroups in the KOSPI 200 index futures and options markets. All variables are constructed in daily frequency, and the time-series mean of each variable is reported. ACNTN is the total number of accounts and TRDN is the total number of trades for each investor group. AOI indicates the aggregate absolute value of open interest, and TAOI is the total sum of AOIs in the market. VOL is the aggregate trading volume in value for each investor group, and TVOL is the total trading volume in the market. AGVVOL is the aggregate value of trades initiated by each investor group itself. The unit of trading volume and absolute open interest is a billion KRW, but that per account in the options market is a million KRW. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Domestic individuals			Domestic institutions		Foreigners	
	Small	Large	HFT	Non-HFT	HFT	Non-HFT	HFT
Panel A. Futures							
ACNTN	5057.97	1241.66	122.77	1503.70	85.75	335.52	75.52
TRDN	21001.97	27646.51	53947.04	8861.64	60992.79	3183.75	82723.30
TRDN/ACNTN	4.15	22.27	439.42	5.89	711.29	9.49	1095.38
AOI	463.07	1630.62	394.57	4813.35	719.91	6840.66	5901.56
AOI / TAOI	2.23%	7.85%	1.90%	23.18%	3.47%	32.95%	28.42%
AOI/ACNTN	0.09	1.31	3.21	3.20	8.40	20.39	78.15
VOL	3144.31	5216.94	12283.56	2477.67	19362.68	1008.12	23359.09
VOL / TVOL	4.70%	7.80%	18.37%	3.71%	28.96%	1.51%	34.94%
VOL/ACNTN	0.62	4.20	100.05	1.65	225.80	3.00	309.31
AGVVOL	1180.86	2108.12	5505.88	1221.85	8202.99	554.90	14651.59
AGVVOL / VOL	37.56%	40.41%	44.82%	49.31%	42.36%	55.04%	62.72%
Panel B. Options							
ACNTN	19649.16	3739.91	350.11	461.09	147.31	162.45	75.53
TRDN	160581.98	354408.53	276152.83	22792.57	314825.38	5639.27	813047.51
TRDN/ACNTN	8.17	94.76	788.76	49.43	2137.16	34.71	10764.56
AOI	124.78	150.68	65.21	72.60	81.42	196.16	563.63
AOI/TAOI	9.95%	12.01%	5.20%	5.79%	6.49%	15.64%	44.93%
AOI/ACNTN	6.35	40.29	186.26	157.46	552.70	1207.51	7462.40
VOL	123.76	346.89	358.57	27.74	405.07	14.99	1250.83
VOL / TVOL	4.90%	13.72%	14.18%	1.10%	16.02%	0.59%	49.48%
VOL/ACNTN	6.30	92.75	1024.16	60.15	2749.80	92.28	16560.70
AGVVOL	34.15	93.02	99.53	6.88	119.91	3.88	471.86
AGVVOL / VOL	32.55%	32.61%	35.81%	36.53%	40.37%	44.06%	64.11%

Table 3. Trading profits in futures and options markets

This table reports the daily average profits earned by three investor groups in KOSPI 200 futures and options markets. All variables are constructed in daily frequency, and the mean of each variable is reported. PRF is the daily mark-to-market profit. UPPRF and PPRF are the profit unrelated to positions and the profit from positions. CSTA and BNFP are the sum of absolute differences between the mid quote prices and actual trading prices for aggressive trades and passive trades. Heteroscedasticity consistent standard errors are reported in parentheses. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days). The unit of profits is a billion KRW.

	Domestic individuals	Domestic institutions	Foreigners
Panel A. Futures			
PRF	-1.097	0.089	1.008
	(0.196)	(0.510)	(0.592)
UPPRF	-0.095	0.153	0.456
	(0.040)	(0.033)	(0.039)
PPRF	-1.002	-0.064	0.552
	(0.201)	(0.505)	(0.589)
BNFP	1.028	1.231	0.809
	(0.013)	(0.020)	(0.010)
CSTA	0.801	0.914	1.352
	(0.012)	(0.016)	(0.016)
BNFP - CSTA	0.226	0.317	-0.543
	(0.004)	(0.006)	(0.008)
Panel B. Options			
PRF	-2.334	0.004	2.330
	(0.590)	(0.340)	(0.506)
UPPRF	-0.286	0.173	1.337
	(0.047)	(0.043)	(0.045)
PPRF	-2.047	-0.169	0.993
	(0.598)	(0.330)	(0.489)
BNFP	2.650	2.121	2.154
	(0.045)	(0.045)	(0.034)
CSTA	1.674	1.441	3.809
	(0.030)	(0.042)	(0.053)
BNFP - CSTA	0.975	0.680	-1.655
	(0.017)	(0.022)	(0.033)

Table 4. Trading profits of investor subgroups

This table reports the daily average profits earned by seven investor subgroups in KOSPI 200 futures and options markets. All variables are constructed in daily frequency, and the mean of each variable is reported. PRF is the daily mark-to-market profit. UPPRF and PPRF are the profit unrelated to positions and the profit from positions. CSTA and BNFP are the sum of absolute differences between the mid quote prices and actual trading prices for aggressive trades and passive trades. Heteroscedasticity consistent standard errors are reported in parentheses. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days). The unit of profits is a billion KRW.

	Domestic individuals			Domestic institutions		Foreigners	
	Small	Large	HFT	Non-HFT	HFT	Non-HFT	HFT
Panel A. Futures							
PRF	-0.296	-0.289	-0.512	0.332	-0.243	0.632	0.376
	(0.049)	(0.141)	(0.072)	(0.422)	(0.144)	(0.523)	(0.508)
UPPRF	0.173	0.096	-0.364	0.094	0.058	0.063	0.393
	(0.007)	(0.015)	(0.031)	(0.014)	(0.032)	(0.006)	(0.038)
PPRF	-0.469	-0.385	-0.147	0.237	-0.301	0.569	-0.017
	(0.049)	(0.142)	(0.070)	(0.419)	(0.139)	(0.523)	(0.508)
BNFP - CSTA	0.067	0.081	0.079	-0.001	0.317	-0.012	-0.531
	(0.001)	(0.001)	(0.004)	(0.001)	(0.006)	(0.000)	(0.008)
Panel B. Options							
PRF	-0.993	-0.642	-0.698	-0.190	0.193	-0.515	2.845
	(0.204)	(0.240)	(0.231)	(0.119)	(0.281)	(0.280)	(0.417)
UPPRF	0.167	-0.125	-0.328	0.008	0.165	0.020	1.317
	(0.016)	(0.024)	(0.034)	(0.006)	(0.041)	(0.002)	(0.045)
PPRF	-1.160	-0.517	-0.370	-0.198	0.029	-0.536	1.528
	(0.203)	(0.244)	(0.233)	(0.119)	(0.271)	(0.280)	(0.401)
BNFP - CSTA	0.173	0.480	0.322	0.044	0.636	0.008	-1.663
	(0.002)	(0.007)	(0.010)	(0.001)	(0.022)	(0.001)	(0.033)

Table 5. Time-Series correlations between trading profits of investor subgroups

This table shows the ratios of days that share the same sign of total profits of investor subgroups to the total number of days and the time-series correlations between total trading profits in KOSPI 200 futures and options markets for each investor subgroups. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

		Domestic individuals			Domestic institutions		Foreigners	
		Small	Large	HFT	Non-HFT	HFT	Non-HFT	HFT
Panel A. Futures								
Domestic individuals	Large	66.91% 0.403			54.89%		31.66%	
	HFT	44.84% -0.004	55.16% 0.280		0.259		-0.555	
Domestic institutions	Non-HFT	62.33% 0.460	55.96% 0.108	42.87% -0.102			13.45%	
	HFT	67.89% 0.420	63.50% 0.413	43.23% 0.179	67.89% 0.508		-0.947	
Foreigners	Non-HFT	37.58% -0.539	28.16% -0.499	43.95% -0.143	35.25% -0.458	38.30% -0.349		
	HFT	38.66% -0.153	45.38% -0.048	52.56% -0.038	30.05% -0.562	34.53% -0.526	40.63% -0.340	
Panel B. Options								
Domestic individuals	Large	73.00% 0.81842			29.87%		26.64%	
	HFT	47.80% 0.41526	52.92% 0.68091		-0.517		-0.818	
Domestic institutions	Non-HFT	45.83% -0.32822	45.56% -0.25513	45.83% 0.0216			43.50%	
	HFT	31.57% -0.63888	32.92% -0.57344	50.76% -0.21108	48.25% 0.3374		-0.069	
Foreigners	Non-HFT	27.18% -0.63444	28.34% -0.66416	44.22% -0.49195	53.54% 0.29232	66.73% 0.28719		
	HFT	50.31% -0.24244	49.15% -0.45073	43.14% -0.68515	43.14% -0.41353	37.67% -0.20162	37.76% 0.01907	

Table 6. Trading profits in the options market by moneyness

This table reports the daily average profits earned by each investor group in the KOSPI 200 index options market. Trading profits in the options markets are reported according to moneyness of options. All variables are constructed in daily frequency, and the mean of each variable is reported. AOI indicates the aggregate absolute value of open interest, and VOL is the aggregate trading volume in value for each investor group. PRF is the daily mark-to-market profit. UPPRF and PPRF are the profit unrelated to positions and the profit from positions. Heteroscedasticity consistent standard errors are reported in parentheses. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days). The unit of VOL and AOI is a billion KRW, and that of profits is a million KRW.

	Domestic individuals		Domestic institutions		Foreigners	
	Call	Put	Call	Put	Call	Put
Panel A. Deep OTM						
VOL	2.207	2.933	0.687	0.560	3.952	4.364
	(1.991)	(2.785)	(1.267)	(2.230)	(2.624)	(4.851)
AOI	24.522	24.421	11.145	9.794	84.855	98.946
	(0.347)	(0.523)	(0.140)	(0.152)	(0.763)	(1.042)
PRF	-66.67	-69.29	65.77	91.50	0.90	-22.21
	(33.73)	(112.61)	(22.09)	(28.15)	(44.13)	(126.84)
UPPRF	7.70	6.52	-1.77	-1.28	26.19	63.93
	(9.41)	(10.78)	(6.75)	(7.66)	(5.51)	(9.56)
PPRF	-74.37	-75.81	67.54	92.77	-25.29	-86.14
	(52.00)	(122.58)	(19.89)	(131.26)	(61.55)	(128.78)
Panel B. OTM						
VOL	6.680	7.670	1.345	0.994	11.443	11.956
	(3.191)	(3.723)	(2.072)	(2.944)	(4.248)	(5.969)
AOI	23.865	22.989	12.720	9.085	84.093	69.778
	(0.372)	(0.609)	(0.149)	(0.186)	(0.651)	(1.042)
PRF	-271.86	-101.29	96.56	-52.87	175.30	154.16
	(73.59)	(160.19)	(34.16)	(46.63)	(88.26)	(167.91)
UPPRF	31.35	-4.28	13.13	-4.53	170.75	243.03
	(17.47)	(18.76)	(9.33)	(11.53)	(10.12)	(16.00)
PPRF	-303.21	-97.01	83.44	-48.34	4.55	-88.87
	(51.96)	(110.02)	(47.08)	(88.66)	(62.40)	(118.36)
Panel C. ATM						
VOL	300.034	266.834	146.904	121.580	422.128	419.723
	(5.045)	(4.887)	(4.001)	(3.542)	(5.941)	(6.006)
AOI	85.723	70.374	46.619	34.513	149.272	136.139
	(1.390)	(1.070)	(0.959)	(0.733)	(2.664)	(2.505)
PRF	-869.72	-922.85	-45.21	-152.06	914.94	1074.90
	(129.25)	(333.48)	(171.75)	(245.42)	(168.40)	(337.90)

UPPRF	-209.46	-123.67	143.39	49.48	404.81	383.87
	(59.05)	(53.88)	(29.78)	(23.25)	(23.93)	(29.54)
PPRF	-660.27	-799.18	-188.60	-201.54	510.13	691.03
	(150.13)	(348.22)	(179.54)	(248.99)	(163.06)	(324.44)
Panel D. ITM						
VOL	6.680	7.670	1.345	0.994	11.443	11.956
	(0.489)	(0.368)	(0.157)	(0.085)	(0.813)	(0.580)
AOI	23.865	22.989	12.720	9.085	84.093	69.778
	(0.865)	(0.755)	(0.759)	(0.546)	(2.665)	(2.580)
PRF	23.40	-158.41	18.50	-99.67	-41.89	258.09
	(51.78)	(109.97)	(47.29)	(88.74)	(62.48)	(119.79)
UPPRF	0.44	5.19	-2.81	-3.59	11.59	14.94
	(5.50)	(2.17)	(2.80)	(2.90)	(3.21)	(4.39)
PPRF	22.96	-163.60	21.31	-96.08	-53.48	243.15
	(81.27)	(170.41)	(32.58)	(47.07)	(85.84)	(164.54)
Panel E. Deep ITM						
VOL	2.207	2.933	0.687	0.560	3.952	4.364
	(0.088)	(0.782)	(0.093)	(0.093)	(0.227)	(0.904)
AOI	24.522	24.421	11.145	9.794	84.855	98.946
	(0.505)	(2.493)	(0.380)	(1.673)	(2.698)	(13.211)
PRF	6.91	96.11	-27.62	108.74	20.71	-204.85
	(51.98)	(123.38)	(26.64)	(132.56)	(63.47)	(128.37)
UPPRF	-0.72	0.53	-13.45	-5.81	10.50	7.81
	(0.87)	(2.40)	(13.96)	(7.93)	(9.69)	(6.13)
PPRF	7.63	95.58	-14.17	114.55	10.22	-212.66
	(31.89)	(118.28)	(19.28)	(25.32)	(43.88)	(125.80)

Table 7. Effects of increasing option multiplier

This table reports the trading activities, profits, and profits/losses inequality measures in the KOSPI 200 options market after increasing the option multiplier. We divide the whole sample period into three sub-periods according to the KOSPI 200 index option multiplier; the Pre-period (January 4, 2010 to March 8, 2012), the Inter-period (March 9, 2012 to June 14, 2012), and the Post-period (June 15, 2012 to June 30, 2014). We exclude observations from August 5, 2011 to August 9, 2011 (3 trading days). AOI indicates the aggregate absolute value of open interest, and VOL is the aggregate trading volume in value for each investor group. PRF is the daily mark-to-market profit. UPPRF and PPRF are the profit unrelated to positions and the profit from positions. The unit of AOI, VOL, and profits is a billion KRW.

	Small			Large			HFT		
	Pre	Inter	Post	Pre	Inter	Post	Pre	Inter	Post
Panel A. Domestic individuals									
VOL	122.68	106.67	126.28	393.96	310.22	295.97	495.60	323.29	206.92
AOI	118.47	127.84	130.63	162.38	129.93	137.88	79.53	56.91	48.42
PRF	-0.792	-0.591	-0.880	-0.296	0.102	-0.439	-0.433	-0.662	-0.308
UPPRF	0.154	0.108	0.178	-0.063	-0.124	-0.208	-0.345	-0.390	-0.293
PPRF	-0.946	-0.698	-1.058	-0.233	0.227	-0.231	-0.088	-0.272	-0.015
BNFP - CSTA	0.176	0.134	0.172	0.569	0.388	0.383	0.505	0.171	0.128
Gini (profits)	0.802	0.779	0.752	0.820	0.793	0.770	0.839	0.807	0.774
Theil (profits)	0.170	0.157	0.147	0.250	0.227	0.212	0.362	0.322	0.318
Gini (losses)	0.803	0.802	0.763	0.804	0.772	0.742	0.801	0.793	0.745
Theil (losses)	0.168	0.169	0.149	0.241	0.217	0.191	0.314	0.322	0.285

	Non-HFT			HFT		
	Pre-period	Inter-Period	Post-period	Pre-period	Inter-period	Post-period
Panel B. Domestic institutions						
VOL	25.07	25.41	30.57	548.87	384.56	243.43
AOI	75.60	69.16	69.24	74.30	47.00	91.99
PRF	-0.254	-1.132	0.026	-0.003	-0.105	0.057
UPPRF	0.005	0.000	0.013	0.232	0.119	0.082
PPRF	-0.259	-1.132	0.013	-0.235	-0.224	-0.024
BNFP - CSTA	0.031	0.039	0.057	0.741	0.653	0.504
Gini (profits)	0.850	0.851	0.839	0.815	0.822	0.867
Theil (profits)	0.351	0.359	0.352	0.367	0.418	0.509
Gini (losses)	0.880	0.897	0.856	0.826	0.823	0.863
Theil (losses)	0.408	0.451	0.401	0.403	0.432	0.534
Panel C. Foreigners						
VOL	14.53	15.20	15.33	1347.69	1299.13	1118.72
AOI	241.94	232.15	140.63	749.34	570.68	349.04
PRF	-1.019	-0.501	-0.325	2.796	2.890	1.869
UPPRF	0.022	0.021	0.020	1.371	1.068	1.218
PPRF	-1.041	-0.522	-0.345	1.425	1.822	0.651
BNFP - CSTA	0.008	0.002	0.008	-2.030	-1.388	-1.253
Gini (profits)	0.880	0.871	0.847	0.775	0.792	0.768
Theil (profits)	0.450	0.438	0.390	0.331	0.357	0.322
Gini (losses)	0.877	0.863	0.840	0.716	0.764	0.738
Theil (losses)	0.437	0.420	0.376	0.317	0.378	0.355

Table 8. Pricing test on excess option returns

This table presents the estimation result of regression of daily excess option returns on the risk factors. Call and put options are categorized into five moneyness groups according to their ratios of the strike price to the KOSPI 200 index on the last trading day. We consider all call options in Panel A, call options with the nearest maturity in Panel B, all put options in Panel C, and put options with the nearest maturity in Panel D. Deep ITM, ITM, ATM, OTM, Deep OTM indicate the ratios are less than 0.93, equal to or larger than 0.93 and less than 0.97, equal to or larger than 0.97 and less than 1.03, equal to or larger than 1.03 and less than 1.07, equal to or larger than 1.07, respectively. We take the average of daily excess returns of options that is the difference between option returns and 91-day CD rates for each moneyness group. MKT, SMB, HML are Fama-French's market, size, value factors in the Korean stock market, respectively. ZSR-RF is the difference between zero beta straddle returns and 91-day CD rates. RV-IV is the difference between the 5-min realized intraday volatility of the KOSPI 200 index and the VKOSPI which is the implied volatility index in the KOSPI 200 options market. *t*-values are calculated by Newey-West autocorrelation robust standard errors with 10-lag (2 weeks). The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Deep ITM		ITM		ATM		OTM		Deep OTM	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel A. All Call options										
Alpha	0.386	1.50	-0.098	-0.26	0.019	0.01	-1.267	-1.05	-0.616	-0.33
MKT	7.629	57.28	10.552	59.07	20.373	30.41	25.917	44.29	22.814	26.80
SMB	-0.558	-3.14	-1.644	-7.01	-4.494	-5.11	-6.339	-8.25	-7.730	-6.70
HML	0.010	0.06	-0.216	-0.89	-0.601	-0.66	-1.028	-1.28	-1.038	-0.85
ZSR-RF	0.066	3.69	0.111	4.39	0.924	9.74	1.629	19.66	2.112	16.99
RV-IV	-3.277	-0.49	10.549	1.36	5.422	0.19	50.961	2.00	29.285	0.83
Adjusted R^2		86.35%		85.85%		60.18%		76.24%		61.50%
Panel B. Call options with nearest maturity										
Alpha	0.284	1.00	-0.090	-0.19	1.327	0.33	-3.546	-1.31	-0.552	-0.16
MKT	9.133	61.10	15.014	64.39	38.248	19.37	43.100	32.77	23.959	15.59
SMB	-0.592	-2.99	-2.384	-7.69	-8.521	-3.29	-10.173	-5.89	-9.608	-4.54
HML	-0.082	-0.44	-0.424	-1.34	-1.139	-0.42	-1.260	-0.70	0.995	0.44
ZSR-RF	0.061	3.13	0.093	2.84	2.358	8.43	3.518	18.89	3.069	13.41
RV-IV	6.732	0.89	9.168	0.78	-15.384	-0.18	135.838	2.37	-13.314	-0.21
Adjusted R^2		88.38%		88.17%		37.34%		63.68%		39.47%
Panel C. All put options										
Alpha	0.354	0.94	-0.035	-0.09	0.440	0.41	-1.942	-1.39	-2.024	-1.51
MKT	-7.661	-44.49	-11.989	-62.52	-18.339	-35.68	-20.593	-30.43	-20.504	-29.42
SMB	1.281	5.49	1.417	5.63	3.050	4.52	2.883	3.24	1.109	1.19
HML	0.126	0.51	0.095	0.36	0.415	0.59	0.890	0.96	0.669	0.76
ZSR-RF	0.002	0.09	0.131	4.84	0.881	12.11	1.705	17.79	2.003	21.58
RV-IV	14.605	2.04	25.844	3.10	27.476	1.23	26.519	0.90	74.728	2.14
Adjusted R^2		82.47%		88.19%		75.81%		73.73%		76.78%
Panel D. Put options with nearest maturity										
Alpha	0.189	0.44	-0.266	-0.53	1.032	0.36	-5.327	-1.47	-8.277	-3.48
MKT	-8.802	-45.42	-16.264	-66.65	-30.894	-22.51	-33.096	-18.82	-23.642	-18.93
SMB	1.447	5.42	2.215	6.91	5.716	3.17	3.502	1.50	0.652	0.39
HML	0.061	0.21	0.492	1.47	0.831	0.44	0.699	0.29	0.847	0.54
ZSR-RF	0.016	0.57	0.192	5.54	1.974	10.15	3.546	14.35	2.977	18.18

RV-IV	5.905	0.73	5.318	0.50	33.362	0.56	433.658	4.88	88.659	1.41
Adjusted R^2		84.03%		89.53%		58.15%		56.55%		63.13%

Table 9. Risk-adjusted performance of investor subgroups in the futures market

This table shows the estimation result of regression of daily excess returns of investments of the three investor groups (domestic individuals, domestic institutions, and foreigners) on the risk factors. The risk-free rate is the 91-day CD rate, and the excess return is the difference between the pseudo return of investment and the 91-day CD rates. MKT, SMB, and HML are Fama-French's market, size and value factors in the Korean stock market, respectively. ZSR-RF is the difference between zero beta straddle returns and 91-day CD rates. RV-IV is the difference between the 5-min realized intraday volatility of the KOSPI 200 index and the VKOSPI which is the implied volatility index in the KOSPI 200 options market. *t*-values are calculated by Newey-West autocorrelation robust standard errors with 10-lag (2 weeks). The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Domestic individuals		Domestic institutions		Foreigners	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel A. Returns of total trading profits						
Alpha	-0.231	-6.74	0.032	0.37	0.042	0.75
MKT	0.185	11.15	0.248	6.03	-0.234	-8.72
SMB	-0.048	-2.21	-0.028	-0.52	0.034	0.97
HML	-0.037	-1.62	0.049	0.88	-0.020	-0.54
ZSR-RF	-0.007	-3.15	-0.026	-4.45	0.022	5.81
RV-IV	1.058	1.47	4.149	2.32	-2.894	-2.48
Adjusted R^2		22.85%		10.36%		18.94%
Panel B. Returns of profits unrelated to positions						
Alpha	-0.047	-4.80	0.043	5.29	0.072	9.40
MKT	-0.005	-1.03	0.013	3.33	-0.012	-3.26
SMB	0.000	-0.04	0.007	1.34	-0.019	-3.92
HML	0.000	-0.02	0.008	1.52	-0.008	-1.64
ZSR-RF	0.005	7.38	-0.002	-3.23	0.002	3.41
RV-IV	-0.944	-4.61	0.213	1.24	-0.267	-1.66
Adjusted R^2		6.48%		3.37%		3.60%
Panel C. Returns of profits from positions						
Alpha	-0.859	-6.19	-0.060	-0.31	0.072	0.71
MKT	0.831	12.38	0.590	6.25	-0.425	-8.68
SMB	-0.136	-1.55	-0.041	-0.33	0.072	1.12
HML	-0.087	-0.95	0.115	0.89	-0.029	-0.43
ZSR-RF	-0.049	-5.18	-0.074	-5.55	0.041	5.85
RV-IV	7.466	2.56	11.039	2.68	-4.865	-2.28
Adjusted R^2		27.70%		12.24%		19.10%

Table 10. Risk-adjusted performance of investor subgroups in the options market

This table shows the estimation result of regression of daily excess returns of investments of the three investor groups (domestic individuals, domestic institutions, and foreigners) on the risk factors. The risk-free rate is the 91-day CD rate, and the excess return is the difference between the pseudo return of investment and the 91-day CD rates. MKT, SMB, and HML are Fama-French's market, size and value factors in the Korean stock market, respectively. ZSR-RF is the difference between zero beta straddle returns and 91-day CD rates. RV-IV is the difference between the 5-min realized intraday volatility of the KOSPI 200 index and the VKOSPI which is the implied volatility index in the KOSPI 200 options market. *t*-values are calculated by Newey-West autocorrelation robust standard errors with 10-lag (2 weeks). The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Domestic individuals		Domestic institutions		Foreigners	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel A. Returns of total trading profits						
Alpha	-0.551	-8.53	-0.209	-1.73	0.303	7.51
MKT	0.515	16.47	-0.291	-4.96	-0.184	-9.41
SMB	0.159	3.87	-0.271	-3.52	0.022	0.86
HML	-0.035	-0.81	0.010	0.12	0.019	0.71
ZSR-RF	-0.090	-20.24	0.086	10.38	0.028	10.12
RV-IV	-5.766	-4.24	-5.775	-2.26	3.965	4.66
Adjusted R^2		58.23%		16.54%		32.50%
Panel B. Returns of profits unrelated to positions						
Alpha	-0.215	-8.96	0.113	2.42	0.550	42.20
MKT	0.050	4.28	0.069	3.08	0.012	1.92
SMB	-0.071	-4.68	0.059	1.99	0.016	1.91
HML	-0.011	-0.68	0.025	0.82	-0.001	-0.12
ZSR-RF	0.024	14.29	0.030	9.38	0.000	-0.39
RV-IV	-0.621	-1.23	-2.491	-2.55	1.223	4.45
Adjusted R^2		19.40%		7.21%		1.59%
Panel C. Returns of profits from positions						
Alpha	-0.829	-6.99	-0.363	-1.39	0.188	2.69
MKT	0.912	15.90	-0.722	-5.71	-0.301	-8.89
SMB	0.322	4.27	-0.592	-3.57	0.045	1.00
HML	-0.080	-1.02	-0.038	-0.22	0.060	1.30
ZSR-RF	-0.186	-22.90	0.151	8.46	0.053	11.09
RV-IV	-6.343	-2.54	-5.368	-0.98	4.865	3.30
Adjusted R^2		59.94%		14.54%		32.10%

Table 11. Information on futures market returns

This table reports the estimation results of predictive regressions of future returns of KOSPI 200 index on the delta-weighted net demand of each investor group (domestic individuals, domestic institutions, and foreigners) and other control variables. The predictive horizons are 1 day to 5 days following Ni, Pan, and Poteshman (2008). DWD(*j*) are the delta-weighted net demand of each investor group for *j* days before, respectively. RET(*j*), LVOL(*j*), and LSVOL(*j*) are the return of KOSPI 200 index, the logarithm of trading volume of index derivatives, and the logarithm of trading volume of KOSPI 200 index for *j* days before. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	Futures Market									
	j=1		*j*=2		*j*=3		*j*=4		*j*=5	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel A. Domestic individuals										
Constant	2.304	0.88	0.184	0.07	-0.195	-0.07	-0.917	-0.35	0.671	0.26
DWD(*j*)	-0.142	-1.52	-0.057	-0.61	-0.076	-0.82	0.109	1.17	-0.090	-0.99
RET(1)	0.007	0.21	0.013	0.42	0.013	0.44	0.013	0.42	0.013	0.43
RET(2)	-0.038	-1.21	-0.057	-1.80	-0.056	-1.86	-0.052	-1.75	-0.056	-1.85
RET(3)	-0.008	-0.28	-0.007	-0.22	-0.011	-0.35	-0.012	-0.40	-0.013	-0.42
RET(4)	-0.048	-1.60	-0.053	-1.74	-0.041	-1.33	-0.036	-1.15	-0.058	-1.92
RET(5)	-0.002	-0.07	-0.005	-0.18	-0.002	-0.08	-0.007	-0.24	-0.009	-0.29
LVOL(*j*)	0.306	0.91	0.050	0.15	0.461	1.39	0.501	1.52	0.351	1.07
LSVOL(*j*)	-0.636	-1.72	-0.075	-0.20	-0.519	-1.41	-0.480	-1.31	-0.492	-1.35
Panel B. Domestic institutions										
Constant	3.641	1.59	0.420	0.18	1.694	0.74	1.062	0.46	2.143	0.93
DWD(*j*)	-0.083	-1.50	-0.060	-1.09	-0.017	-0.32	0.022	0.40	-0.015	-0.28
RET(1)	0.001	0.02	0.012	0.41	0.014	0.46	0.013	0.43	0.013	0.43
RET(2)	-0.049	-1.62	-0.065	-2.03	-0.055	-1.81	-0.052	-1.73	-0.054	-1.81
RET(3)	-0.013	-0.43	-0.011	-0.36	-0.011	-0.35	-0.012	-0.41	-0.012	-0.39
RET(4)	-0.056	-1.86	-0.055	-1.83	-0.051	-1.68	-0.047	-1.45	-0.056	-1.86
RET(5)	-0.008	-0.26	-0.009	-0.31	-0.006	-0.20	-0.006	-0.19	-0.006	-0.18
LVOL(*j*)	0.181	0.83	-0.045	-0.20	0.233	1.06	0.158	0.72	0.258	1.18
LSVOL(*j*)	-0.648	-1.66	0.009	0.02	-0.475	-1.22	-0.309	-0.79	-0.558	-1.43
Panel C. Foreigners										
Constant	5.712	1.79	0.003	0.00	-0.192	-0.06	-2.642	-0.83	0.978	0.31
DWD(*j*)	0.085	1.89	0.054	1.19	0.028	0.62	-0.040	-0.88	0.030	0.67
RET(1)	-0.017	-0.51	0.012	0.39	0.013	0.43	0.013	0.43	0.013	0.45
RET(2)	-0.051	-1.65	-0.066	-1.99	-0.054	-1.79	-0.052	-1.74	-0.054	-1.80
RET(3)	-0.018	-0.61	-0.005	-0.16	-0.014	-0.42	-0.010	-0.32	-0.013	-0.42
RET(4)	-0.059	-1.95	-0.053	-1.76	-0.045	-1.46	-0.031	-0.94	-0.056	-1.85
RET(5)	-0.010	-0.34	-0.008	-0.25	-0.004	-0.13	0.001	0.02	-0.012	-0.36
LVOL(*j*)	-0.341	-0.97	0.069	0.20	0.279	0.80	0.563	1.64	0.166	0.50
LSVOL(*j*)	-0.268	-0.84	-0.077	-0.24	-0.308	-0.97	-0.358	-1.13	-0.312	-0.99

(*Continued*)

	Options market									
	j=1		*j*=2		*j*=3		*j*=4		*j*=5	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel D. Domestic individuals										
Constant	16.471	0.86	8.092	0.42	30.654	1.61	47.860	2.52	25.538	1.35
DWD(*j*)	-0.075	-1.16	-0.179	-2.79	-0.249	-3.92	0.022	0.34	0.012	0.19
RET(1)	-0.013	-0.33	0.011	0.35	0.004	0.12	0.012	0.39	0.011	0.36
RET(2)	-0.043	-1.39	-0.122	-3.08	-0.059	-1.98	-0.053	-1.76	-0.054	-1.78
RET(3)	-0.005	-0.16	0.007	0.22	-0.104	-2.64	-0.013	-0.44	-0.012	-0.40
RET(4)	-0.048	-1.59	-0.039	-1.28	-0.024	-0.80	-0.033	-0.83	-0.055	-1.83
RET(5)	0.000	-0.01	0.003	0.11	0.016	0.52	0.002	0.08	0.004	0.09
LVOL(*j*)	0.962	0.49	0.783	0.40	2.871	1.49	4.800	2.49	2.236	1.17
LSVOL(*j*)	-4.435	-1.43	-1.088	-0.35	-4.530	-1.48	-5.993	-1.95	-4.311	-1.41
Panel E. Domestic institutions										
Constant	10.698	0.78	2.524	0.19	18.235	1.34	27.971	2.06	17.159	1.27
DWD(*j*)	-0.069	-1.18	0.096	1.64	0.131	2.24	-0.086	-1.46	-0.019	-0.32
RET(1)	0.037	1.05	0.015	0.51	0.010	0.35	0.014	0.48	0.011	0.37
RET(2)	-0.058	-1.89	-0.083	-2.32	-0.052	-1.72	-0.051	-1.70	-0.054	-1.77
RET(3)	-0.014	-0.45	-0.002	-0.06	-0.049	-1.37	-0.014	-0.47	-0.012	-0.39
RET(4)	-0.054	-1.80	-0.050	-1.67	-0.037	-1.20	-0.019	-0.53	-0.055	-1.84
RET(5)	-0.009	-0.29	-0.005	-0.16	-0.001	-0.02	-0.007	-0.23	0.003	0.08
LVOL(*j*)	0.304	0.26	0.185	0.16	1.377	1.19	2.347	2.04	1.176	1.03
LSVOL(*j*)	-3.966	-1.31	-0.514	-0.17	-3.751	-1.24	-4.948	-1.64	-3.952	-1.31
Panel F. Foreigners										
Constant	5.593	0.34	5.689	0.35	21.247	1.33	26.446	1.67	21.565	1.39
DWD(*j*)	0.141	2.31	0.058	0.94	0.085	1.39	0.071	1.17	0.009	0.15
RET(1)	0.002	0.08	0.012	0.39	0.012	0.41	0.011	0.35	0.012	0.39
RET(2)	-0.053	-1.74	-0.055	-1.76	-0.057	-1.88	-0.055	-1.82	-0.055	-1.82
RET(3)	-0.006	-0.21	-0.010	-0.31	-0.010	-0.33	-0.015	-0.50	-0.013	-0.42
RET(4)	-0.049	-1.61	-0.049	-1.62	-0.046	-1.51	-0.049	-1.57	-0.056	-1.84
RET(5)	-0.003	-0.09	-0.004	-0.12	0.002	0.06	0.003	0.10	0.000	0.00
LVOL(*j*)	-0.215	-0.12	0.589	0.33	2.107	1.18	2.858	1.62	2.040	1.18
LSVOL(*j*)	-3.357	-1.32	-0.642	-0.25	-2.793	-1.10	-2.674	-1.06	-3.170	-1.26

Table 12. Information on futures market volatility

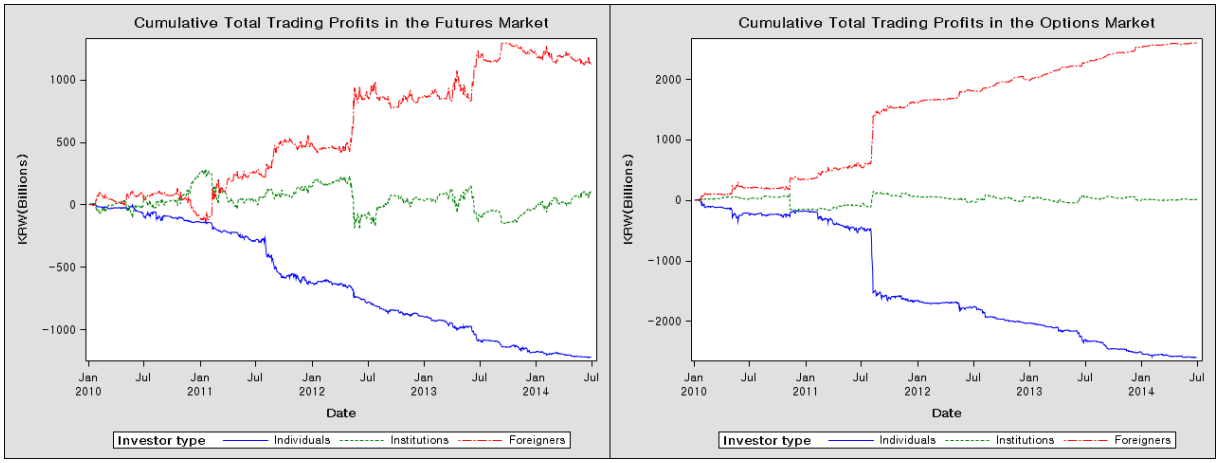
This table reports the estimation results of predictive regressions of future realized volatility of KOSPI 200 index on the vega-weighted net demand of each investor group in the KOSPI 200 options market (domestic individuals, domestic institutions, and foreigners) and other control variables. The predictive horizons are 1 day to 5 days following Ni, Pan and Poteshman (2008). VWD(*j*) and ADWD(*j*) are the vega-weighted net demand and the absolute value of the delta-weighted net demand of each investor group for *j* days before, respectively. RV(*j*), LVOL(*j*), and LSVOL(*j*) are the 5-minute realized volatility of KOSPI 200 index, the logarithm of trading volume of index derivatives, and the logarithm of trading volume of KOSPI 200 index for *j* days before. IV(1) is the square root of the VKOSPI which is the implied volatility index in the KOSPI 200 options market on the last trading day. The sample period is January 4, 2010 to June 30, 2014 (1,115 trading days).

	j=1		*j*=2		*j*=3		*j*=4		*j*=5	
	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Panel A. Domestic individuals										
Constant	5.131	0.63	5.441	0.67	-6.751	-0.84	-9.238	-1.16	-6.015	-0.76
VWD(*j*)	0.441	0.64	-1.611	-2.33	-1.812	-2.61	0.002	0.00	-0.457	-0.67
RV(1)	0.027	0.81	0.049	1.58	0.045	1.45	0.051	1.62	0.053	1.69
RV(2)	0.202	6.49	0.157	4.71	0.202	6.52	0.197	6.35	0.199	6.42
RV(3)	-0.006	-0.18	0.002	0.07	-0.030	-0.89	-0.007	-0.21	-0.007	-0.23
RV(4)	0.098	3.24	0.106	3.47	0.104	3.42	0.082	2.51	0.098	3.20
RV(5)	0.026	0.88	0.027	0.91	0.034	1.12	0.025	0.82	0.009	0.27
IV(1)	3.739	7.69	3.967	8.24	4.195	8.74	4.120	8.56	3.971	8.25
ADWD(*j*)	0.040	1.34	0.051	1.74	0.042	1.43	0.051	1.73	0.022	0.76
LVOL(*j*)	1.530	1.78	1.366	1.60	-0.115	-0.13	-0.217	-0.26	0.260	0.31
LSVOL(*j*)	-0.073	-0.06	-1.018	-0.85	-0.611	-0.51	0.294	0.24	0.578	0.48
Panel B. Domestic institutions										
Constant	-10.046	-1.66	-6.618	-1.11	-10.868	-1.83	-9.100	-1.55	-17.431	-3.00
VWD(*j*)	0.718	0.60	-2.378	-1.99	-1.320	-1.10	-0.999	-0.83	0.615	0.51
RV(1)	0.037	1.14	0.053	1.70	0.050	1.59	0.054	1.73	0.053	1.71
RV(2)	0.204	6.55	0.196	6.12	0.199	6.41	0.200	6.45	0.198	6.42
RV(3)	-0.003	-0.09	0.003	0.08	-0.005	-0.16	-0.004	-0.12	-0.006	-0.21
RV(4)	0.099	3.26	0.099	3.27	0.100	3.29	0.100	3.17	0.095	3.14
RV(5)	0.025	0.83	0.022	0.72	0.024	0.80	0.025	0.82	0.009	0.30
IV(1)	3.969	7.99	3.944	7.99	4.195	8.50	3.944	8.03	4.286	8.83
ADWD(*j*)	0.043	1.57	0.029	1.04	0.033	1.20	-0.005	-0.18	0.079	2.90
LVOL(*j*)	-0.075	-0.14	0.063	0.12	-0.457	-0.88	-0.159	-0.31	-0.830	-1.62
LSVOL(*j*)	1.304	1.08	0.189	0.16	0.124	0.10	0.596	0.49	1.826	1.51
Panel C. Foreigners										
Constant	13.772	2.04	5.811	0.87	-5.083	-0.76	-5.245	-0.79	-6.488	-0.98
VWD(*j*)	-0.454	-0.73	2.105	3.37	1.962	3.11	0.340	0.54	0.277	0.44
RV(1)	0.008	0.24	0.046	1.49	0.045	1.44	0.053	1.69	0.054	1.75
RV(2)	0.197	6.39	0.154	4.65	0.205	6.58	0.198	6.36	0.201	6.48
RV(3)	-0.001	-0.02	0.005	0.16	-0.016	-0.48	-0.006	-0.20	-0.006	-0.19
RV(4)	0.100	3.31	0.112	3.68	0.107	3.53	0.089	2.71	0.098	3.17
RV(5)	0.030	0.99	0.025	0.84	0.036	1.20	0.027	0.88	0.016	0.48
IV(1)	3.508	7.34	3.881	8.18	4.020	8.47	3.973	8.31	3.886	8.07
ADWD(*j*)	0.048	1.45	0.053	1.58	0.001	0.03	0.013	0.38	-0.001	-0.02
LVOL(*j*)	2.826	3.50	1.576	1.95	0.076	0.09	0.272	0.34	0.254	0.31
LSVOL(*j*)	0.488	0.47	-0.421	-0.41	-0.570	-0.55	0.245	0.23	0.859	0.81

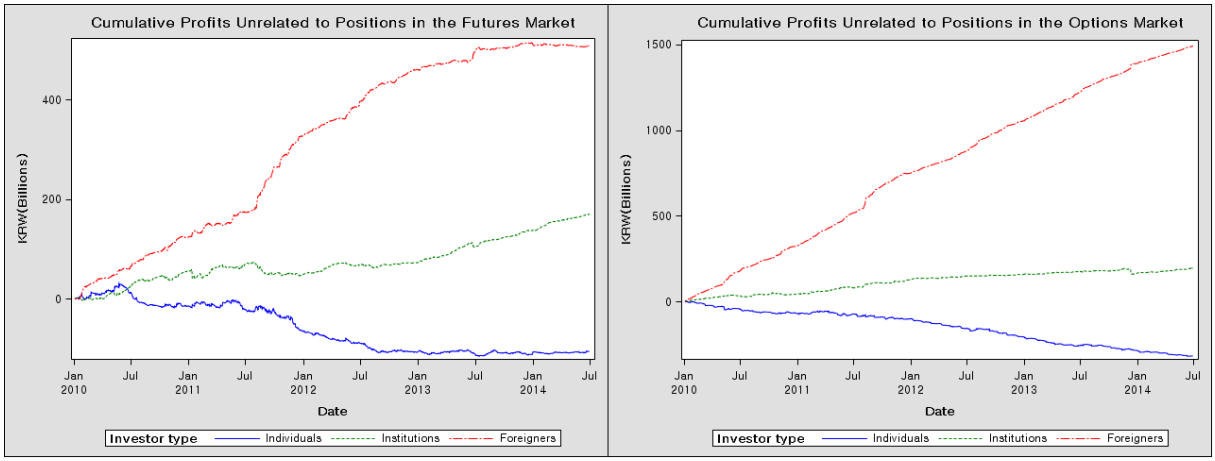
Figure 1. Time trend of cumulative trading profits

This figure shows the time trend of the cumulative trading profits in the KOSPI 200 index derivatives markets over the sample period from January 4, 2010 to June 30, 2014 (1,115 trading days). The unit of the trading profits is a billion Korean Won (KRW). The solid, dashed, dash-dot lines indicate the cumulative trading profits of domestic individuals, domestic institutions, and foreigners, respectively.

Panel A. Total trading profits



Panel B. Profits unrelated to positions



Panel C. Profits from positions