III. The Empirical Estimates

A. Data Description

i. Market activities:

In the total transaction volumes, including futures and options, there were 59,146,376 lots in 2004 and 31,874,934 lots in 2003. The annual growth rate is 85.56%. The transaction volume was 546,968 lots on February 12 hitting the historical record, and the trading volume of TAIEX options also rose to 418,634 lots in its historical peaks. In addition, the outstanding contracts reached the historical high on March 12 with 1,167,262 lots. Among the financial products, the TAIEX Futures and Options are most actively traded. The TAIEX Options counts 74.10% of the total market transaction volume and had a growth rate of 101.77% in transaction volume in 2004. The TAIEX Futures counts 14.98% of the total market transaction volume and had a growth rate 101.77% in transaction volume in 2004. In addition, the growth rate of stock option was the fastest among all financial products. The transaction volume of stock option was 410,026 lots comparing to 201,733 lots in 2003 with a growth rate of 103.25%. Finance Sector Index Futures took the second place among all the financial products. The transaction volume of the Finance Sector Index futures was 2,255,478 lots in 2004 comparing to 1,126,895 lots in 2003 with the growth rate 100.15%. As to other financial products, including MiNi-TAIEX Futures, Taiwan 50 Futures, and Electronic Sector Index Futures, the transaction volume was 1,943,269 lots, 6,157 lots, and 1,568,391 lots, respectively with the growth rate of 47.59%, 51.35%, and 58.30% in 2003 respectively. Among the new financial products, the transaction volume of 10-year Government Bond Futures and 30-Day Commercial Paper Interest Rate Futures was 67,705 lots and 209,561 lots, respectively.
ii. Status of Market Participants

Because of the trading volume and the market liquidity increased dramatically, the incentive of the traders participating in the futures market increased significantly. Regarding to market participants, the major participant is natural persons in 2004, but the weight of corporates kept growing. In 2003, natural persons weighted 68.57% and the corporates weighted 31.43%. However, the weight of corporates increased dramatically to 33.98% in 2004. As shown in Table 1, the weight of the corporates increased year by year.

The sample period covers the 242 trading days from January 2 through December 31. We choose the most actively traded call and put options each day. We use two sources of data for the study of the TAIEX option which is an index option. The first one of data for this study comprises the quotation and volume for each trade in TAIEX options. The data were obtained from Taiwan Economic Journal Intraday Data Bank which contains a complete time-stamped history of quotes and volume of TAIEX option. Market bid and ask prices represent the best five buying and selling price quotation presented in the order book and imply the intraday trading behavior of market makers and other market participants. The second one of data for this study comprises a complete time-stamped history of the trade prices and trade volumes of TAIEX option and price quotation market makers respond to the request. In addition, we can identify the exact identity of traders including foreign institutional investors, futures proprietary merchants, market makers, public investors in the market. We obtain these data from Taiwan Futures Exchange. We exclude the data that are outside the 9:00~13:30 in order to avoid the overnight effect and manipulation in the last fifteen minutes.
B. Methodology

Following Corwin (1999), we examine whether performance differ across the major market participants. We define the four performance measures to evaluate the effects on different market participants. The four performance measures are quoted spread, percentage of quoted spread, percentage of effective spread, and percentage of trades that receive price improvement. We calculate the following statistics for put and call options, respectively.

The quoted spread and percentage quoted spread are calculated at the last outstanding quote of each half hour during the daily trading hours as follows:

\[
\text{Quoted Spread} = \text{Ask} - \text{Bid} \quad (1)
\]

\[
\% \text{ Quoted Spread} = 100 \times \frac{\text{Ask} - \text{Bid}}{(\text{Ask} + \text{Bid})/2}, \quad (2)
\]

where Ask and Bid are the ask quotes and bid quotes originated from provision of market makers and order book. The mean quoted spread is calculated by averaging across all intraday period and all trading days during the sample period. We shall present the means (medians) of percentage quoted spread coming from order book and market makers. For each transaction, the percentage effective spread was calculated as follows:

\[
\% \text{ Effective Spread} = 200 \times \frac{\text{Price} - \text{Midpoint}}{\text{Midpoint}} \quad (3)
\]

where Price is the transaction price and Midpoint\(^2\) is the average of the best market

\(^2\) Midpoint is the average of the lowest ask and highest bid in the order book.
bid and ask immediately prior to the time of transaction price. The mean percentage effective spread is calculated by averaging across all intraday period and all trading days during the sample period. We shall present the means (medians) of percentage effective spread in various market participants.

The percentage of price-improved trade is calculated on daily basis. The percentage of price-improved trade is defined as 100 times the proportion of trades executed inside the best bid and ask quotes.

\[
\% \text{ Price-Improved Trade} = \left( \frac{\text{The number of trades executed inside the best bid and ask quotes}}{\text{the number of total trades}} \right) \times 100, \quad (4)
\]

Each transaction price is compared with the immediately previous best bid and ask prices to obtain the frequencies in numerator. We shall present the means (medians) of percentage price-improve trades in various market participants.

C. Empirical Results

Bid-ask spreads are the cost of the immediacy. It is the price quotation responded by market makers willing to stand ready to immediately buy or sell a securities upon receipt of the request for price quotation.(Demsetz, 1968) Thereby, we would be very interested in price quotation market maker provided. Table 7 and Table 8 test for the equalities of mean (median) quoted spreads between order book and market makers. There are three interesting results emerged from two tables: (i) Quoted spreads from order book are significantly lower than that from market makers. For example, median quoted spreads decrease almost 900% from 10 index points to 1 index points. The huge quotation difference is because of the operational rule of market making. As shown in Table 3, the maximum spread limits for near-maturity
contract are very wide. Thereby, market makers in TAIEX option market use inefficient quotation (ex: 10 index point) to attain the monthly ratio of response to price quotation request (at least 70%). Namely, market makers provide inefficient quotation to circumvent any potential market positions and meet TAIEX requirements at the same time. (ii) The F-statistic tests the null hypothesis that means percentage quoted spreads are equal between order book and market makers. The $X^2$-statistics is for the Kruskal-Wallis test of the null hypothesis that medians percentage quoted spreads are equal between order book and market makers. The last column in table 7 and table 8 lists the results of F-test and $X^2$-test for call and put option. These tests strongly reject the null hypothesis that the percentage quoted spreads are equal (p-value = 0.0000). (iii) Quoted spreads for put options are greater than that for call options. In general, dealing in put options is more expensive than dealing in call option. Since the put market has not yet matured and public investors do not know the short-selling financial instrument well. Therefore, the put market is not highly liquid comparing to the call market. According to Baesel, Shows, and Throp (1983) also find liquidity cost for put is higher than for call.

Furthermore, there are two different ways of quotation or orders market makers can use to provide quotation and we divide the orders into two categories. One is R-order, and the other is Q-order. R-order is so-called limit order. R-orders from market makers have no restriction on time for the price quotations in the order book. Q-orders from market makers have 20 seconds restriction on time for the price quotations in the order book. Due to the observed wider price quotation from market makers, we are interested in investigating whether the R-order and Q-order play a role to affect market maker’s quotation. As shown in table 9 and table 10, mean quoted spreads from R-order are smaller than that from Q-order. This is because market makers have different intentions toward market. When they use R-order
similar to limit order, they have potential intentions to hold a position in market. Thereby, they will provide effective quotation and narrow their spreads. Unlike the R-order, market makers use Q-order to achieve request for price quotations under requirement of market making. Therefore, market makers do not have strong motives to provide efficient quotation and narrow down their spreads. The F-statistic tests the null hypothesis that means percentage quoted spreads are equal between Q-order and R-order. The $X^2$-statistics is for the Kruskal-Wallis test of the null hypothesis that medians percentage quoted spreads are equal between Q-order and R-order. The last column in table 9 and table 10 lists the results of F-test and $X^2$-test for call and put option. These tests strongly reject the null hypothesis that quoted spreads (%) are equal. We know different quotation ways indeed affect market makers’ quotation.

Before we apply the performance measures to evaluate the effects among those major market participants, we did some ex-ante analysis on total volume and weight in 2004. We summarize the result in Table 11. Among the numerous market participants, we will only focus on natural persons, futures proprietary merchants, market makers and QFIIs actively trading in TAIEX option market. We will conduct the following analysis based on the result in Table 11.

Differences in performance across those major market participants may be related to the observable trader characteristics. As the result shown in Panel A of Table 12, the result of F-test and $X^2$-test strongly reject the null hypothesis that percentage effective spreads for call are all equal. We conclude the execution costs are different across those traders. Because the mean percentage effective spreads is much greater than the median percentage effective spreads. We can detect there are many outliers in our research data and the standard deviations for futures proprietary merchants and natural persons are extremely high, so we focus our analysis on median categories. The median cost of execution for the different types of traders
from the highest to the lowest is foreign institutional investors (QFII), market makers, natural persons and futures proprietary merchants. Besides, the median cost of execution for futures proprietary merchants which is 1.6% compares higher with the total median cost of execution which is 1.5267%. Therefore, we infer the conclusion from the empirical result that futures proprietary merchants bear the expensive execution cost when they deal in call market. In Panel B of Table 12, we can conclude the similar result as Panel A, but the natural persons bear the highest cost of execution which is 1.6529% comparing to the other participants in the market. Meanwhile, we can not reject the restriction that median percentage effective spreads for put are all equal. We can discover that all traders bear the approximate cost of execution when they deal in put market. Finally, by comparing the mean and median of panel A to panel B, the percentage effective spread for put is higher than the percentage effective spread for call in all categories. Therefore, dealing in put is much more expensive than dealing in call.

The results of Panel A and Panel B in Table 13 indicates that the proportion of trades receiving price improvement differs significantly across major market participants (p-value=0.0000). The ratios displayed in Table 13 are small and therefore price improvement is not obvious in TAIEX option market. In addition, the results of proportion of price improvement is not consistent with our intuition because market participants with wider effective spreads are at the inside quote frequently, especially for put. Because we did not analyze our data further, we can not explain the result in detail.

Because the quality of data does not maintain well, we use two different methods to calculate the percentage effective spreads. The first method is our primary method. We calculate the percentage of effective spreads by replicating the quotation if we can not find applicable quotation between two transaction times. The result is
presented in Table 12 and Table 13.

The second method serves as a comparison method. We recalculate the percentage effective spreads by deleting those trades which cannot be found the applicable quotation. The result is presented in Table 12.1 and Table 13.1. Due to the irrationality of the figures in Table 12.1 and Table 13.1, we concentrate our analysis on Table 12 and Table 13.