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RESEARCH ARTICLE

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Analysis of the clientele effect and the information content of short-term index option returns in Taiwan

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We compare and contrast the clientele effect, information content and the buy-and-hold returns of options with weekly and monthly expiration periods (Weeklys and Monthlys) traded on the Taiwan Stock Exchange Capitalization-weighted Stock Index (TAIEX). No significant clientele effect is discernible in either market. Furthermore, Weeklys has the wider bid-ask spread and lower depth clearly implies greater information asymmetry than Monthlys. Unlike Weeklys, Monthlys are found to play a leading informational role in TAIEX returns. We further observe that both types of options have significantly negative returns.

KEYWORDS
investor sentiment, shortest-term options, weekly options

JEL CLASSIFICATION
G13

1 | INTRODUCTION

We set out in this study to compare and contrast the clientele effect, information content and return rates of TAIEX options with weekly and monthly expiration periods (hereafter, Weeklys and Monthlys). In specific terms, we aim to determine any differences between Weeklys and Monthlys in terms of the participants, volume patterns, price discovery, and return rates. The shortest-term options referred to in this study are those contracts with 1 week or less to maturity. The Taiwan Futures Exchange (TAIFEX) launched monthly TAIEX options in December 2001, with the underlying assets being provided by the Taiwan Stock Exchange (TWSE) Capitalization-weighted Stock Index. Weekly TAIEX options were subsequently launched in November 2012 for the purpose of accommodating the needs of the shortest-term traders.[1]

TAIEX options are traded as European-style options based upon expiration months (the spot month, the next two calendar months and the next 2 quarterly months), with the last trading Day for these Monthlys being the third Wednesday of the expiration month. Weeklys on the TAIEX, which have a shelf life of just 1 week, are newly issued each Wednesday and expire on the subsequent Wednesday (with the exception of the third Wednesday). As the expiration Day approaches, Monthlys with 1 week or less to maturity are virtually the same as Weeklys: thus, there are no new issues of Weeklys on the second Wednesday of the month.

[1]According to 2008–2012 statistics compiled by the Taiwan Futures Exchange (TAIFEX), the average daily trading volume for nearest-month options during the last week prior to expiration was about 1.37 times the average during all preceding weeks, thereby clearly indicating that investors have a preference for trading in options contracts with 1 week or less to maturity.

According to the World Federation of Exchanges (2015), in terms of their trading volume (notional value), TAIEX options were ranked the sixth (seventh) most frequently traded index options in the world in 2014. It is also important to note that after the introduction of Weeklys, the trading volume in TAIEX options increased from 108.46 million contracts in 2012, to 191.51 million contracts in 2015, and indeed, according to a 2015 TAIFEX news release, TAIEX Weeklys had risen to first place on a global scale, in terms of trading volume.

As our empirical results show, the implied volatility levels of the shortest-term options are more unstable than those of options with a minimum of 1 week to maturity. Although options contracts with 1 week or less to maturity have been excluded from the samples in many of the prior related studies, these contracts were not removed from our sample.[2] The dataset examined in this study reveals that during the 2013–2015 period, trading volume in TAIEX options reached 452.5 million contracts, of which Weeklys and Monthlys with 1 week or less to maturity accounted for 289.8 million (64.05% of the total).

S&P 500 index options with 1 week or less to maturity accounted for about 12% of the total trading volume in S&P 500 index options in 2010: however, this had increased steadily to 25% by 2014 (Andersen, Fusari, & Todorov, 2015). Given the high proportions of the shortest-term options in both the US and Taiwan markets, this clearly highlights the importance of carrying our research into Weeklys, and indeed, also suggests that the exclusion from a study sample of all shortest-term options may well result in the loss of important market information.

From a comparison between the participants in Weeklys and Monthlys on the S&P 500 index, Chatrath, Christie-David, Miao, and Ramchander (2015) found that Weeklys had smaller trade sizes than Monthlys, but higher implied volatility: their results therefore inferred that Weeklys were mainly traded for speculative purposes, thereby leading to an increasingly segmented options market over time. Yan and Zhang (2009) had previously suggested that short-term investors were generally better informed than long-term investors, and as such, investors in possession of superior information would tend to trade more frequently than those who were not engaging in trading to exploit an informational advantage.

Based upon their further comparison of the information content of Weeklys and Monthlys, Chatrath et al. (2015) provided evidence to show that Weeklys contributed more to price discovery than Monthlys. However, they also noted that short-term investors in options may simple be "noisy" traders, since they are generally thought to be overconfident investors who tend to make less-informed investment decisions and overreact to both good and bad market news. If this really is the case, then the contribution to price discovery made by Weeklys should be found to be inferior to that made by Monthlys.

To the best of our knowledge, with the one recent exception of Pan, Shiu, and Wu (2016), no other prior related study has yet examined and compared the returns on Weeklys and Monthlys. In the Pan et al. (2016) study, the returns on index options were generally found to be negative, probably because the primary motives for trading in options were either for speculative purposes (Lakonishok, Pearson, & Poteshman, 2007) or gambling/entertainment (Bauer, Cosemans, & Eichholtz, 2009). Pan et al. (2016) provided further evidence to show that investment in Weekly calls (puts) was superior (inferior) to similar investment in Monthly calls (puts).

Our results show that Weeklys tend to exhibit smaller trade size and lower implied volatility levels than Monthlys, while the relative bid-ask spread (depth) is found to be wider (lower) for Weeklys, as compared to Monthlys, thereby implying that Weeklys suffer from greater information asymmetry. Furthermore Monthlys are found to play an informational leadership role in TAIEX returns, a role which is not associated with Weeklys.

We also confirm the finding of Pan et al. (2016) that the shortest-term options are associated with negative returns: our study extends the work carried out in the prior related studies and makes an important contribution to the literature on the shortest-term options. As previously stated, although most options trades are found to involve the shortest-term options, these samples have typically been excluded from almost all of the prior related studies. In the present study, we aim to fill the current gap in the literature by comparing the clientele effect and information content of Weeklys and Monthlys on the TAIEX.

Although our study is closely connected to the work of Chatrath et al. (2015), a major difference between the two studies is that the Chatrath et al. (2015) study used data on S&P 500 index options, whereas our study examines data relating to TAIEX options. TAIEX Weeklys are European-style options with a shelf life of just 1 week: in contrast, Weeklys on the S&P 500 index are European-style options, and while they also had a 1-week shelf life when they were first introduced in early 2010, longer shelf lives were subsequently introduced in June 2012.

Despite this, in a majority of the tests in Chatrath et al. (2015), the data employed covered the period from January 2011 to May 2012, a period when S&P 500 Weeklys still had a shelf life of just 1 week. This arguably makes our findings comparable with the results of Chatrath et al. (2015): however, it is clearly worth pointing out that these two index options markets are actually quite different, with the TAIEX being characterized by very high levels of individual participation (Pan et al., 2016).

[2]Examples include: Jiang and Tian (2005), Shiu, Pan, Lin and Wu (2010) and Pan, Shiu and Wu (2014, 2015).

According to TAIFEX statistics on TAIEX options traded in December 2014, the respective shares of trading volume attributable to individuals, institutional investors, and proprietary traders were 45.02%, 5.70%, and 49.28%. Thus, individual investors are clearly important participants in the TAIEX options market, with a preference for trading in Weeklys, and indeed, most of these investors have very little investment experience and also limited access to information.

It was clearly demonstrated in Chatrath et al. (2015) that Weeklys have higher implied volatility and contribute more to price discovery, while they also noted that Weeklys are more expensive than Monthlys: nevertheless, our findings are quite the reverse. These contradictory results are at least partly explained by differences in the contract specifications, which are due to different motivations for launching these option products. According to the TAIFEX, one of the most important reasons for launching TAIEX Weeklys was the preference for short-term trading among many market participants. In contrast, Weeklys on the S&P 500 index were launched to help investors implement a variety of trading strategies and take advantage of market events. This, in part, explains why S&P 500 Weeklys contribute more to price discovery than TAIEX Weeklys.

The remainder of this paper is organized as follows. The institutional background and the data adopted for this study are described in section 2, followed in section 3 by the results of our analyses on the volume patterns, trader identity, price discovery, and return rates of weekly and monthly options. Section 4 provides a description of the ways in which investor sentiment can contribute to the differences in the return rates between weekly and monthly options. Finally, the conclusions drawn from this study are presented in section 5.

2 | DATA

The sample period for this study runs from January 2013 to December 2015, with the cut-off date being selected on the basis of the exponential rise in the quantity of intraday data and the capacity of computers. The intraday data on the options, which were obtained from the Taiwan Economic Journal (TEJ), provide several variables of interest, including the date and time of the trade (to the nearest second), the trade price, trade size, bid price, bid size, ask price, ask size, class symbol ("W" for Weeklys), put/call indicator, expiration date, and strike price.

The final settlement price for each contract was downloaded from the TAIFEX website. We also employed intraday data on the TAIEX, downloaded from the TWSE website, since this provides the index values every 15 s over the same time period. Transactions in the TEJ are recorded under at least two different records, using a second as the minimum time unit. We also adopted one second as the minimum time unit for the calculation of the trading volume and average price in order to avoid trading noise and any potential misjudgment (Pan et al., 2016).

Given that the operating hours in the TAIFEX run from 8:45 am to 1:45 pm, they do not provide an exact match with the TWSE operating hours, which run from 9:00 am to 1:30 pm: we therefore matched the options opening data between 8:45 am and 9:00 am with the closing index from the previous trading day. The options closing data between 1:30 pm and 1:45 pm were then matched with the closing index on the current day.

According to the statistics obtained for this study, the volume ratio for Weeklys and the nearest-to-expiration Monthlys over the 2013–2015 period accounted for 92% of the total TAIEX options volume. Since this clearly implies that investors have a preference for trading in short-term options over long-term options, and that the non-nearest-to-expiration Monthlys are traded infrequently, all of the non-nearest-to-expiration Monthlys were removed from our sample, with the exception of when calculating the risk-neutral moments (the proxy for investor sentiment).

The total volume of TAIEX options stood at around 108 million contracts in 2012, with Weeklys having been launched on 21 November of that year. As shown in Table 1, the respective volume share for the shortest-term options in 2013, 2014, and 2015 accounted for 58.33%, 62.1%, and 68.87% of the total volume of TAIEX options. The total volume of options rose only slightly to 109 million contracts in 2013, while the volume share for Weeklys increased dramatically from virtually zero in 2012 to 35.45%

TABLE 1 Volume statistics for TAIEX options

Year	Total	Weeklys	Share of total (%)	Monthlys	Share of total (%)
2013	109,311,515	38,748,282	35.45	25,009,709	22.88
2014	151,620,546	60,020,214	39.59	34,123,380	22.51
2015	191,513,144	88,810,140	46.37	43,086,956	22.50

This table reports the total volume (by number of contracts) in TAIEX options for 2013–2015 for both Weeklys and Monthlys with 1 week or less to maturity.

in 2013. The volume share for Weeklys increased further to 39.59% in 2014, with a subsequent sharp increase to 46.37% in 2015. Over the 2013–2015 period, the volume share for Monthlys with 1 week or less to maturity remained at around 22.5%. All of this clearly indicates a move by short-term traders away from transactions in Monthlys to transactions in Weeklys.

Given our focus on short-term options in the present study, options contracts with less than 8 days to maturity were not removed from our sample, in contrast to the prior studies.[3] Since there are no new issues of Weeklys on the second Wednesday, it would be impossible to compare Weeklys and Monthlys with the same time-to- maturity at a given point in time: thus, we follow Chatrath et al. (2015) to compare Weeklys and Monthlys in terms of days to expiration and moneyness. Moneyness is defined as K/S_t, where K is the strike price, and S_t is the current index level. We also analyze Weeklys and Monthlys at a given point in time, but with different maturities. Thus, our study sample comprises of 92% of the total volume in TAIEX options.

In order to confirm the popularity of weekly options, we carry out real-time comparisons between the daily volume (trades) in Weeklys and the nearest- to-expiration Monthlys over the January 2013 to December 2015 period, and calculate the average daily volume (trades) for each week, that is, from the Thursday to the following Wednesday: the results are illustrated in Figures 1 and 2).

In 2013, the average daily volume for Weeklys is found to be lower than that for Monthlys in the first, second, and third week, while Weeklys volume is found to be higher than that for Monthlys in other weeks. In 2014, the average daily volume of Weeklys is found to be lower than that for Monthlys in the second and third week, while the volume for Weeklys is higher than that for Monthlys in the other weeks. Finally, in 2015, the average daily volume for Weeklys is consistently found to be higher than that for Monthlys, with the exception of the third week.

As for average daily trades, in 2013, the average daily trades for Weeklys is found to be lower than that for Monthlys in the second and third week, while the average daily trades for Weeklys is found to be higher than that for Monthlys in the other weeks. In 2014 and 2015, with the exception of the third week, average daily trades of Weeklys are all higher than that of Monthlys. It is, therefore, clear that over time, trading in Weeklys has become more popular than trading in Monthlys.

3 | EMPIRICAL RESULTS

3.1 | Volume patterns

The volume statistics on near-the-money (NTM) Weekly and Monthly options are presented in Table 2. In order to compare these statistics with those of Chatrath et al. (2015), we define near-the-money as $0.97 < K/S_t \leq 1.03$, and find that the bulk of the trading volume is in NTM options, which account for around 95.24% (91.94%) of the total volume for Weeklys (Monthlys). The statistics are reported by proximity to the final 6 trading days (days 5, 4, 3, 2, 1, and 0), where Day 5 is the initiation Day for Weeklys (Wednesday) and Day 0 is the final trading Day (Wednesday). In the case of Monthlys, Day 5 represents the sixth final trading day, and Day 0 represents the final trading day. Trading in the two instruments ceases at 1:30 pm, with their settlements being based upon the average value of the TAIEX within the final 30 min on the third Wednesday.

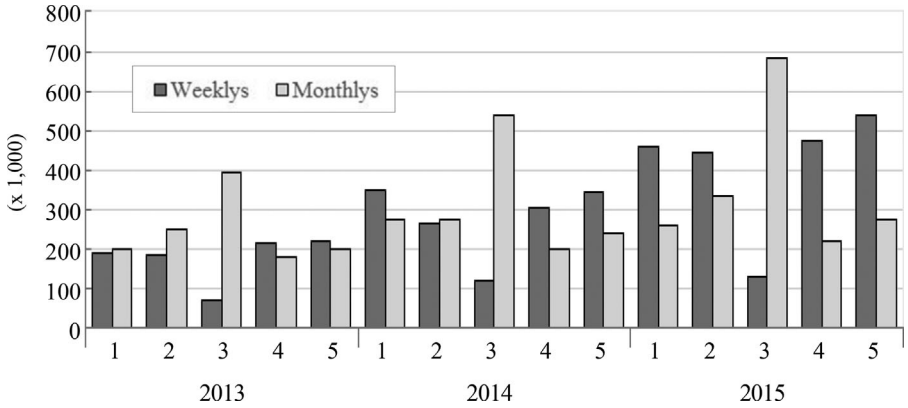

FIGURE 1 Average daily volume of Weeklys and Monthlys. This figure illustrates average daily volume in Weeklys and Monthlys for the first, second, third, fourth, and fifth weeks of each month during the 2013–2015 sample period

[3]Examples include Jiang and Tian (2005), Shiu et al. (2010) and Pan et al. (2014, 2015).

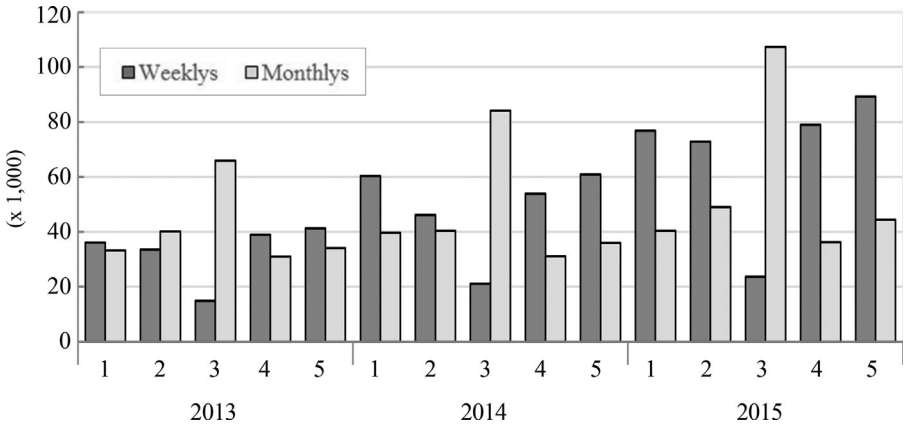

FIGURE 2 Average daily Trades of Weeklys and Monthlys. The figure illustrates average daily trades in Weeklys and Monthlys for the first, second, third, fourth and fifth weeks of each month during the 2013–2015 sample period

Three key statistics, the mean, total daily volume and the share of the total volume, are provided in Table 2, from which we can see that for both Weeklys and Monthlys, the volume for puts is slightly lower than that for calls, a finding which runs contrary to the case of S&P 500 index options, where greater volume is found for puts than calls. Furthermore, the put/call ratio for well-established stock index option markets are typically much higher than 1 (Chatrath et al., 2015). The total volume for Weeklys (Monthlys) is above 178.65 (93.98) million contracts, clearly revealing that volume in Weeklys is about twice that in Monthlys.

TABLE 2 Volume statistics for weekly and monthly options

		Weeklys		Monthlys	
Day	**Statistics**	**Calls**	**Puts**	**Calls**	**Puts**
0	Mean of daily volume	193,112	184,819	269,306	257,869
	Sum of volume	23,173,470	22,178,261	9,695,007	9,283,287
	Share of total (%)	25.270	25.508	19.765	20.664
1	Mean of daily volume	160,002	154,943	255,793	237,058
	Sum of volume	19,040,224	18,438,197	9,208,539	8,534,104
	Share of total (%)	20.763	21.206	18.773	18.996
2	Mean of daily volume	140,634	136,289	231,067	219,452
	Sum of volume	16,454,150	15,945,863	8,087,360	7,680,816
	Share of total (%)	17.943	18.340	16.488	17.097
3	Mean of daily volume	128,786	120,649	238,357	219,281
	Sum of volume	15,196,716	14,236,600	8,342,483	7,674,848
	Share of total (%)	16.571	16.374	17.008	17.084
4	Mean of daily volume	116,841	106,942	240,590	209,766
	Sum of volume	13,203,041	12,084,399	8,180,059	7,132,036
	Share of total (%)	14.397	13.899	16.677	15.875
5	Mean of daily volume	46,840	41,049	178,632	149,042
	Sum of volume	4,637,150	4,063,879	5,537,585	4,620,288
	Share of total (%)	5.057	4.674	11.289	10.284
	Total volume	91,704,751	86,947,199	49,051,033	44,925,379

This table reports the volume statistics for near-the-money (NTM) weekly and monthly calls and puts ($0.97 < m \leq 1.03$, where m = strike price/underlying asset price) for a sample period running from January 2013 to December 2015. The statistics are presented by proximity to the final six trading days (days 5, 4, 3, 2, 1, 0), where Day 5 is the initiation day (Wednesday) and Day 0 is the final trading day (Wednesday) for Weeklys. In the case of Monthlys, Day 5 represents the sixth final trading day, and Day 0 represents the final trading day.

However, the daily volume in Weeklys is about a half of that in Monthlys, simply because the total number of trading days in the former is three to four times that of the latter. The average volume for Weeklys on Day 5 is found to be approximately a quarter of that for Monthlys: however, on Days 4–0, we find that the average volume for Weeklys is approximately half of that for Monthlys. Since no new Weeklys are issued on the second Wednesday of the month, which is Day 5 for Monthlys, this comparison is not in real time.

There is a discernible increase in volume for Weeklys with the approach of the expiration date. Volume on Day 5 is found to be only 5.06% (4.67%) of the total volume for calls (puts): however, this rises to 14.40% (13.90%) on Day 4, finally reaching its peak of 25.27% (25.51%) on Day 0. This clearly reflects the preference among investors in Weeklys for trading in options with the shortest possible maturities. The changes in volume for Monthlys are not as dramatic as those for Weeklys: volume on Day 5 is 11.29% (10.28 cent) of the total call (put) volume, rising to 16.68% (15.88%) on Day 4, and then settling at around 18% (18%) for the remaining trading days.

The second Wednesday of the month, which is the final trading day for expiring Weeklys, is also the sixth final trading day for Monthlys. Since investors in Weeklys clearly have a preference for trading options with the shortest possible maturities, the volume patterns for Monthlys may imply that investors in Weeklys do not enter the Monthlys market until Day 4 (Thursday), when no Weeklys are tradable.

3.2 | Trader identity

In this sub-section, we analyze the final 6 days of trading and also provide "real time" sampling. As a result of trading motivations and preferences in trade sizes, different clientele groups emerge at certain junctures;[4] trade size may therefore serve to identity these market participants. A comparison between the implied volatility for Weeklys and Monthlys enables us to assess whether Weeklys are cheaper than Monthlys, essentially because investors in Weeklys have no choice but to switch to the Monthlys market, leading to an expected growth in demand pressure on Monthlys. We also go on to examine the extent to which the two markets are integrated.

3.2.1 | Trade size

As shown in Panel A of Table 3, the difference between the average trade size for Weeklys and Monthlys is around one contract, with statistical significance at the 1% level. As regards the results by percentiles, we find that trade sizes for the 25th and 50th percentiles are very similar, while the difference for the 75th (95th) percentile is found to be around 0–3 (4–9) contracts.

Trade sizes, compared in real time, are shown in Panel B of Table 3, where trading in Weeklys on Days 0–5 is compared with trading in Monthlys with at least 1 week to maturity: here, the differences are found to be even smaller, thereby confirming once again that there are no substantial differences between trade sizes in the two markets. Given that individual investors are the dominant traders in the TAIEX options market, and the fact that there is clear potential for the disguising of trading by informed traders through the use of smaller trade sizes, no significant differences in trade size are discernible between the two markets.

3.2.2 | Option values

Lower prices create lower thresholds for options trading, thereby attracting greater numbers of less wealthy individual investors into the market (Pan et al., 2016). A comparison between the option prices for Weeklys and Monthlys is provided in Panel A of Table 4, which reveals a clear reduction in the price with the approach of the expiration day: the table also shows that for both calls and puts, Weeklys are cheaper than Monthlys through the final 6 days, with statistical significance.

In addition to the usual investors in Monthlys, investors in Weeklys will tend to enter the Monthlys market during the third week, thereby leading to a rise in demand pressure on Monthlys. As regards the results by percentiles, with the exceptions of the 95th percentiles for calls on Day 2, we find that Weeklys for all percentiles are generally cheaper than Monthlys. As regards our real-time comparison, reported in Panel B of Table 4, Monthlys are clearly more expensive than Weeklys, essentially because the former have a longer maturity period than the latter.

[4]See Barclay and Warner (1993), Chakravarty (2001), Alexander and Peterson (2007) and Chatrath et al. (2015), among others.

TABLE 3 Summary statistics on trade size

	Days		Mean			P25		P50		P75		P95	
Type	W	M	W	M	Diff	W	M	W	M	W	M	W	M
Panel A: Final 6 days													
Calls	0	0	7.471	8.025	−0.555***	1	1	3	2	9	10	25	30
	1	1	7.230	8.296	−1.066***	1	1	2	2	9	10	24	30
	2	2	7.046	7.944	−0.898***	1	1	2	2	8	10	23	28
	3	3	6.942	7.785	−0.844***	1	1	2	2	8	10	22	27
	4	4	6.847	7.742	−0.895***	1	1	2	2	8	10	22	28
	5	5	6.224	8.037	−1.813***	1	1	2	2	7	10	20	29
Puts	0	0	7.337	7.966	−0.628***	1	1	3	2	9	10	25	29
	1	1	7.130	7.995	−0.865***	1	1	2	2	8	10	24	29
	2	2	6.798	7.586	−0.788***	1	1	2	2	8	10	22	27
	3	3	6.626	7.477	−0.852***	1	1	2	2	8	9	21	27
	4	4	6.540	7.352	−0.813***	1	1	2	2	8	8	20	26
	5	5	5.837	7.503	−1.666***	1	1	2	2	6	9	20	27
Panel B: Real time sampling													
Calls	0∼5	Nearest	7.092	7.210	−0.118***	1	1	2	2	8	8	23	25
Puts	0∼5	Nearest	6.879	6.616	0.263***	1	1	2	2	8	6	22	23

This table reports the trade size statistics for near-the-money (NTM) Weekly (W) and Monthly (M) calls and puts ($0.97 < m \leq 1.03$, where m = strike price/underlying asset price), for a sample period running from January 2013 to December 2015. ***indicates significance at the 1% level.

TABLE 4 Summary statistics on option prices

	Days		Mean			P25		P50		P75		P95	
Type	W	M	W	M	Diff	W	M	W	M	W	M	W	M
Panel A: Final 6 days													
Calls	0	0	29	32	−2.960***	20	23	27	30	35	38	51	55
	1	1	33	37	−4.032***	25	29	31	36	38	43	52	56
	2	2	37	38	−0.773***	29	31	35	37	43	44	58	56
	3	3	39	42	−2.662***	31	34	38	41	46	48	61	63
	4	4	42	46	−4.055***	33	37	40	44	48	53	66	70
	5	5	43	48	−5.928***	33	39	41	47	50	55	70	73
Puts	0	0	24	28	−3.051***	17	19	22	25	30	33	47	50
	1	1	30	32	−1.898***	22	24	28	31	36	39	51	52
	2	2	35	41	−5.149***	26	31	33	39	41	48	62	65
	3	3	39	44	−5.238***	29	34	36	41	45	50	66	76
	4	4	42	48	−5.628***	33	36	40	44	49	55	67	86
	5	5	46	50	−4.215***	34	38	42	47	53	59	79	84
Panel B: Real time sampling													
Calls	0∼5	Nearest	37	77	−39.616***	28	58	35	72	44	89	61	128
Puts	0∼5	Nearest	36	87	−50.796***	25	61	34	78	43	101	64	165

This table reports the option price statistics for near-the-money (NTM) Weekly (W) and Monthly (M), calls and puts ($0.97 < m \leq 1.03$, where m = strike price/underlying asset price), for a sample period running from January 2013 to December 2015. *** indicates significance at the 1% level.

There is one-to-one correspondence between implied volatility and option prices: thus, in order to explore arbitrage opportunities as early as possible, the conventional method is to use implied volatility as the proxy for option prices. For our examination of implied volatilities in the two instruments, we employ the risk- neutral-volatility approach proposed by Bakshi, Kapadia, and Madan (2003), while also following Pan et al. (2015) to exclude from the sample all options with prices of less than 0.3 points in order to avoid potential microstructure-related bias: any options violating the arbitrage boundary were also removed from the sample.

We use put-call parity to derive the implied underlying asset ex-dividend price, which is generally referred to as the "implied index," and adopt this index as the means of identifying all out-of-the-money options: this index is also employed as an input in the Black-Scholes model to back out implied volatility. Prior to calculating the risk-neutral volatility for each minute, there is a requirement to fit a smoothing implied volatility curve. The approach in this study follows the method used in the prior studies to fit the curve by applying cubic splines (Jiang & Tian, 2005, 2007).

Based on the fitted implied volatility curve, the implied volatility levels obtained for all strike prices were then plugged into the Black-Scholes model to determine the out-of-the-money option prices: finally, we plugged the requisite out-of-the-money option prices into the risk-neutral volatility formula. The risk-neutral volatilities for the two contracts, to their last trading day, are reported in Panel A of Table 5, with Panel B reporting the corresponding measures for the real-time sampling.

Several patterns emerge from Table 5. First, for each contract, there is an initial reduction in risk-neutral volatility, followed by an increase with the approach of the expiration date, with the lowest level occurring on Day 3 (Friday), and the highest level occurring on Day 0. Wednesday is the initiation day (Day 5) for a newly-issued Weekly and also the final day (Day 0) for an expiring contract. The trading activity on Day 0 is also found to dominate that on Day 5 (see Table 2), with the risk-neutral volatility being at its highest on Day 0. Consequently, based upon arbitrage pricing theory and taking the implied volatility of the expiring options into consideration, it would seem that traders price the newly-issued options on the Wednesday, and that on the following 2 days (Thursday and Friday), there is a gradual reduction in the influence of the expired-option implied volatility: hence, the risk-neutral volatility ultimately reaches its lowest level on Friday.

Second, the risk-neutral volatilities of Weeklys are found to be lower than those of Monthlys, which implies that on the final 6 days, Monthlys are more expensive, relative to Weeklys. The results by percentiles are found to be the same as those for the mean: these results do, however, run contrary to those of Chatrath et al. (2015) on S&P 500 index options, where Weeklys were found to more expensive. Panel B of Table 5 shows that the average volatility for Weeklys is higher than that for Monthlys with at least 1 week to maturity, by 0.003.[5]

The daily averages of the risk-neutral volatilities for Weeklys and Monthlys over the period from January 2013 to December 2015 are illustrated in Figure 3, from which several patterns emerge. First, risk-neutral volatility falls to its lowest level on Day 3 (Friday) and then rises to its highest level on Day 0 (Wednesday) in every week. Second, those Weeklys with an

TABLE 5 Summary statistics for risk-neutral volatility levels

Days		Mean			P25		P50		P75		P95	
W	M	W	M	Diff	W	M	W	M	W	M	W	M
Panel A: Final 6 days												
0	0	0.287	0.338	−0.051***	0.194	0.231	0.249	0.300	0.337	0.401	0.575	0.648
1	1	0.178	0.229	−0.050***	0.125	0.147	0.157	0.193	0.203	0.271	0.322	0.472
2	2	0.170	0.227	−0.058***	0.124	0.145	0.151	0.183	0.191	0.270	0.288	0.484
3	3	0.131	0.179	−0.048***	0.101	0.116	0.121	0.147	0.148	0.214	0.217	0.355
4	4	0.139	0.191	−0.053***	0.109	0.125	0.130	0.160	0.156	0.224	0.229	0.384
5	5	0.152	0.196	−0.044***	0.118	0.131	0.142	0.159	0.174	0.228	0.246	0.407
Panel B: Real time sampling												
0~5	Nearest	0.173	0.170	0.003	0.118	0.127	0.147	0.151	0.196	0.188	0.342	0.311

This table reports the risk-neutral volatility statistics for Weeklys (W) and the nearest-to-expiration Monthlys (M) for a sample period running from January 2013 to December 2015, with the Bakshi et al. (2003) theory being used to calculate risk-neutral volatility. *** indicates significance at the 1% level.

[5]As stated previously, the time to maturity for Weeklys is less than 8 calendar days, whereas it for Monthlys is strictly more than 8 days: thus, Weeklys suffer from microstructural problems.

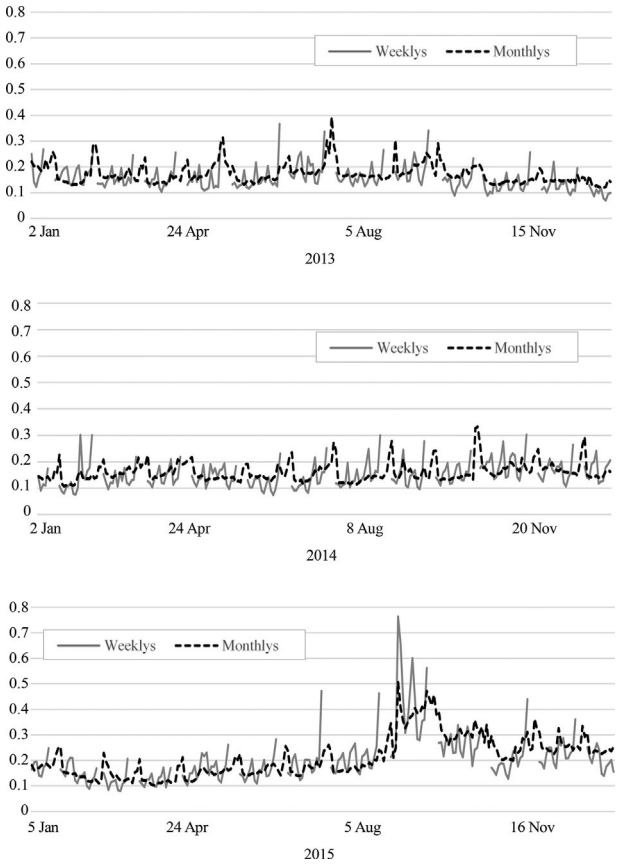

FIGURE 3 Daily average risk-neutral volatility. This figure illustrates the daily average risk-neutral volatility for Weeklys and Monthlys, with the three panels respectively reporting the data for the years 2013, 2014, and 2015. The Bakshi et al. (2003) theory is used to calculate risk-neutral volatility

expiration day falling on the second Wednesday of the month have the highest level on Day 0. Third, during the non-third weeks, Monthlys are found to have a lower and smoother volatility level than Weeklys. The expiration effect on implied volatility is clearly obvious, and since the expiration effect may lead to incorrect conclusions, this explains why options with 1 week or less to maturity were removed from the samples in the prior studies.

In summary, our adoption of prices and implied volatility as the measures of the value of TAIEX options shows that Monthlys are more expensive than Weeklys on the final 6 days. This may be attributable to investors in Weeklys entering the Monthly market and pushing up the prices of Monthlys. Taken together, the evidence provided here, which is consistent with the earlier evidence on trade size, shows that the two markets appear to have similar participants, a finding which differs from the results reported by Chatrath et al. (2015) on S&P 500 index options due to differences in the contract specifications.

3.2.3 | Market integration

Given the evidence on similar participants in the Weeklys and Monthlys markets, we go on to assess the extent to which these two markets are integrated. Since there are no Weeklys and Monthlys with the same time to maturity traded on the same dates, we match the Weeklys with the Monthlys which have at least 1 week to maturity. We follow Kapadia and Pu (2012) and Chatrath et al. (2015) to define the market integration measure as:

$$\hat{\kappa} = \sum_{j=1}^{n-1} \sum_{i=1}^{n-j} 1_{\left[\Delta S^j_{i,W} \Delta S^j_{i,M} < 0\right]}$$

where S_W and S_M denote the respective implied index levels for Weeklys and Monthlys.

We follow Pan et al. (2016) to derive the implied TAIEX by first of all calculating the average prices of all calls and puts based upon 1-min periods, and then selecting the option pairs (those with the smallest difference in their average prices among all option pairs) and applied put-call parity to derive the implied TAIEX. The put-call parity calculation is expressed as follows:

$$S_t = P_t + Ke^{-r(T-t)} - C_t$$

where C_t (P_t) denotes the average price per minute of call (put) options: r is the risk-free interest rate: and T–t is the time to maturity. We used the average of the demand deposit interest rates of the five major banks in Taiwan as the proxy for the risk-free interest rate, with the data on interest rates being obtained from the website of the Central Bank of Taiwan.[6]

We assume that on a given date, we have $i = 1,\ldots, n$ observations for S_W and S_M, and define the respective Weeklys and Monthlys, $\Delta S^j_{i,W} = S_{i+j,W} - S_{i,W}$ and $\Delta S^j_{i,M} = S_{i+j,M} - S_{i,M}$, for $1 \leq j \leq n-1$ and $i \leq n - j$. If $\Delta S^j_{i,W}\Delta S^j_{i,M} < 0$, then a pair of implied prices presents a possible arbitrage opportunity. This measure, $\hat{\kappa}$, takes into account all pairings of S_W and S_M on a given date.

We can then define:

$$\kappa = \frac{4\hat{\kappa}}{n(n-1)} - 1$$

where κ is a value bounded by -1 and 1 (in the absence of mispricing, $\kappa = -1$).

Table 6 presents the results for κ and the t-statistics for the t-test of H_0: $\kappa = -1$. The κ value is found to have a minimum of -0.974, a maximum of -0.385 and an average of -0.859, with a t-statistic of 36.91. Our results indicate that although the two markets have similar participants, they are still not fully integrated.

3.3 | Price discovery

In this sub-section, we examine the relative spread and depth to assess the level of information asymmetry between Weeklys and Monthlys. We then carry out a regression analysis comparing the relative information leadership on TAIEX returns.

3.3.1 | Spread and depth

A positive relationship is discernible between the bid-ask spread and information asymmetry, whereas a negative relationship is found between depth and information asymmetry.[7] The TAIFEX is an order-driven market which operates under a fully electronic trading system and displays the five best bid and ask prices. In this study, we use the best bid and ask price along with size to calculate the relative bid-ask spread and depth. The relative bid-ask spread for each intraday observation is given by the difference in the best bid price and ask price, standardized by the average of these prices, while the depth is the sum of the best bid size and ask size.

Details of the relative bid-ask spread and depth for NTM options are provided in Table 7, with the results in Panel A showing a higher relative spread for Weeklys across the 6 days: nevertheless, these differences do not appear to be substantial, with the

TABLE 6 Market integration

H_0	Mean	S.D.	Max.	Min.	t-value
$\kappa = -1$	−0.859	0.0908	−0.385	−0.974	36.91

This table reports the implied index levels, based upon one-minute observations, for Weeklys and nearest-to-expiration Monthlys that are used to calculate κ, where κ is a value bounded by -1 and 1: in the absence of mispricing, $\kappa = -1$.

[6]Go to: http://www.cbc.gov.tw/mp2.html.

[7]See, for example, Copeland and Galai (1983), Amihud and Mendelson (1986), Lee, Mucklow, and Ready (1993) and Brennan and Subrahmanyam (1995).

TABLE 7 Summary statistics on relative spread and depth

	Days		Relative spread			Depth		
Type	**W**	**M**	**W**	**M**	**Diff**	**W**	**M**	**Diff**
Panel A: Final 6 days								
Calls	0	0	0.065	0.064	0.001***	112.744	141.315	−28.571***
	1	1	0.052	0.047	0.004***	119.286	165.509	−46.223***
	2	2	0.042	0.035	0.007***	127.159	175.476	−48.318***
	3	3	0.036	0.028	0.008***	134.241	195.856	−61.615***
	4	4	0.031	0.025	0.007***	130.980	208.043	−77.063***
	5	5	0.039	0.024	0.015***	101.940	202.281	−100.341***
Puts	0	0	0.069	0.067	0.002***	100.098	130.326	−30.228***
	1	1	0.046	0.036	0.010***	117.257	157.687	−40.430***
	2	2	0.036	0.028	0.008***	124.216	164.289	−40.073***
	3	3	0.030	0.024	0.006***	130.957	182.521	−51.564***
	4	4	0.028	0.022	0.007***	130.495	199.431	−68.935***
	5	5	0.038	0.021	0.017***	101.626	194.292	−92.666***
Panel B: Real time sampling								
Calls	0∼5	Nearest	0.044	0.016	0.028***	122.954	216.031	−93.078***
Puts	0∼5	Nearest	0.040	0.015	0.026***	119.495	200.509	−81.013***

The table reports the relative spread and depth statistics for near-the-money (NTM) Weekly (W) and Monthly (M) calls and puts for a sample period running from January 2013 to December 2015. *** indicates significance at the 1% level.

greatest difference of 0.015 (0.017) for calls (puts) being found on Day 5. Panel A of Table 7 also reports the statistics on depth for Weeklys and Monthlys, from which we find that the difference between the two is substantial, with the greatest difference being on Day 5, at −100.341 for calls, and −92.666 for puts.

A summary of the spread and depth figures obtained through real time sampling of Weeklys and Monthlys is provided in Panel B of Table 7, where the difference between the relative spreads is found to be wider than that reported in Panel A, at 0.028 for calls, and 0.026 for puts. Turning to the results on depth, the difference between Weeklys and Monthlys is also found to be much larger in Panel B than in Panel A, at −93.078 for calls, and −81.013 for puts.

In summary, the relative bid-ask spread for Weeklys is found to be larger than that for Monthlys, while the depth for Weeklys is found to be smaller than that for Monthlys: hence, these results clearly imply that information asymmetry is more severe for

TABLE 8 Information leadership

Days	$R_{W,t}$	$R_{W,t-1}$	$R_{M,t}$	$R_{M,t-1}$	**Adj.** R^2	**DW**
0	0.4799***(24.53)	−0.0217 (−1.14)	0.3034*** (15.63)	0.1710***(8.94)	0.6511	2.0285
1	0.5541*** (17.87)	−0.0573* (−1.92)	0.1867*** (6.04)	0.2515*** (8.42)	0.6260	2.0226
2	0.5323*** (17.80)	0.0861*** (3.01)	0.2191*** (7.35)	0.1112*** (3.92)	0.6423	2.0209
3	0.4164*** (11.52)	−0.0348 (−1.00)	0.2793*** (7.73)	0.2227*** (6.37)	0.5491	1.9919
4	0.4015*** (11.83)	0.0437 (1.31)	0.3393*** (10.01)	0.1417*** (4.25)	0.6269	2.0299
5	0.4199*** (14.02)	0.0069 (0.23)	0.3191*** (10.69)	0.1587*** (5.20)	0.5917	2.0128
Total	0.4455*** (37.96)	0.0050 (0.43)	0.2939*** (25.11)	0.1763*** (15.36)	0.6120	2.0174

This table reports the results of the following lead-lag regression:

$$R_{S,t} = \beta_0 + \beta_1 \times R_{W,t} + \beta_2 \times R_{W,t-1} + \beta_3 \times R_{M,t} + \beta_4 \times R_{M,t-1} + \varepsilon_t + \gamma_1 \times \varepsilon_{t-1} + \gamma_2 \times \varepsilon_{t-2}$$

where $R_{S,t}$ is the 5-min return rate of the TAIEX, and $R_{W,t}$ ($R_{M,t}$) is the 5-min return rate of the TAIEX implied from Weeklys (nearest-to-expiration Monthlys) for a sample period running from January 2013 to December 2015. $R_{W,t-1}$ ($R_{M,t-1}$) is used to determine whether Weeklys (Monthlys) play an information leadership role, with two lagged residual terms being included in the regression in order to deal with the potential problem of serial correlation. The figures in parentheses are *t*-statistics. * indicates significance at the 10% level; and *** indicates significance at the 1% level.

TABLE 9 Summary statistics on loss ratio and daily return rate

	Days		Loss ratio			Daily returns		
Type	**W**	**M**	**W**	**M**	**Diff**	**W**	**M**	**Diff**
Panel A: Final 6 days								
Calls	0	0	0.67	0.70	−0.036***	−0.198***	−0.144***	−0.054***
	1	1	0.67	0.68	−0.014***	−0.357***	−0.407***	0.051***
	2	2	0.68	0.65	0.026***	−0.440***	−0.433***	−0.008
	3	3	0.73	0.75	−0.016***	−0.534***	−0.564***	0.030***
	4	4	0.69	0.82	−0.129***	−0.524***	−0.638***	0.114***
	5	5	0.68	0.75	−0.071***	−0.533***	−0.584***	0.050***
Puts	0	0	0.72	0.62	0.104***	−0.229***	0.143***	−0.372***
	1	1	0.75	0.72	0.027***	−0.468***	−0.424***	−0.044***
	2	2	0.77	0.81	−0.036***	−0.564***	−0.632***	0.067***
	3	3	0.77	0.76	0.013***	−0.601***	−0.572***	−0.029***
	4	4	0.76	0.77	−0.002	−0.628***	−0.585***	−0.043***
	5	5	0.79	0.78	0.008**	−0.668***	−0.641***	−0.026***
Panel B: Real time sampling								
Calls	0∼5	Nearest	0.69	0.70	−0.012	−0.429***	−0.580***	0.151***
Puts	0∼5	Nearest	0.76	0.66	0.098	−0.523***	−0.544***	0.021***

This table reports the loss-ratio and excess-winning-ratio statistics for near-the-money (NTM) Weekly (W) and Monthly (M) calls and puts for a sample period running from January 2013 to December 2015. The loss ratio is defined as the loss frequency divided by the sample size for 1 min, while the daily return rate is defined as: $\text{Daily Rate of Return} = \sqrt[Days+1]{1 + \text{Profit}/\text{Option Price}} - 1$

*indicates significance at the 10% level; **indicates significance at the 5% level; and ***indicates significance at the 1% level.

Weeklys than Monthlys. Given that individual investors are assumed to be noisy traders, if such individual investors are the dominant participants in the Weeklys market, then the price-discovery contribution of Weeklys is clearly going to be inferior to that of Monthlys.

3.3.2 | Information leadership

In this sub-section, we examine the informational roles of the two instruments with regard to price discovery based upon the following regression model:

$$R_{S,t} = \beta_0 + \beta_1 \times R_{W,t} + \beta_2 \times R_{W,t-1} + \beta_3 \times R_{M,t} + \beta_4 \times R_{M,t-1} + \varepsilon_t + \gamma_1 \times \varepsilon_{t-1} + \gamma_2 \times \varepsilon_{t-2}$$

where $R_{S,t}$ is the five-minute return rate of the TAIEX, and $R_{W,t}$ ($R_{M,t}$) is the 5-min return rate of the TAIEX implied from Weeklys (Monthlys): we also use $R_{W,t-1}$ ($R_{M,t-1}$) to examine the leadership role of Weeklys (Monthlys).

We include two lagged residual terms in the regression in order to address the potential issue of serial correlation, while also standardizing all of the variables to facilitate a comparison of the explanatory power of the independent variables: the results of the regression analysis are reported in Table 8.

Although $\hat{\beta}_1$ is larger than $\hat{\beta}_3$, $\hat{\beta}_2$ is found to be even smaller than $\hat{\beta}_4$, and indeed, negative, which implies that Weeklys reflect more synchronous information relating to the underlying asset price than Monthlys. However, unlike Weeklys, Monthlys are found to play an information leadership role with regard to the value of the underlying asset.

3.4 | Returns analysis

In this sub-section, we employ the average trading price per second to calculate the profit and return rate using a buy-and-hold strategy (Pan et al., 2016). The formulae are expressed as follows:

TABLE 10 Summary Statistics on Daily TAIEX Returns

Days		Calls			Puts		
W	M	W	M	Diff	W	M	Diff
0	0	0.0001**	−0.0010***	0.0011***	0.000***	−0.0010***	0.0011***
1	1	0.0002***	−0.0004***	0.0006***	0.0002***	−0.0004***	0.0006***
2	2	0.0002***	0.0004***	−0.0002***	0.0002***	0.0004***	−0.0002***
3	3	−0.0001***	−0.0004***	0.0003***	−0.0001***	−0.0004***	0.0003***
4	4	0.0000***	−0.0007***	0.0007***	0.0001***	−0.0007***	0.0007***
5	5	0.0002***	−0.0002***	0.0005***	0.0002***	−0.0002***	0.0005***

This table reports the daily TAIEX return statistics for near-the-money (NTM) Weekly (W) and Monthly (M) calls and puts for a sample period running from January 2013 to December 2015. The daily return rate is defined as:
Daily Rate of Return $= \sqrt[Days+1]{S_T/S_t} - 1$

** indicates significance at the 5% level; and *** indicates significance at the 1% level.

$$\text{Profit for a call} = \text{Max}(S_T - K,\ 0) - C_t$$

$$\text{Profit for a put} = \text{Max}(K - S_T,\ 0) - P_t$$

where C_t (P_t) denotes the average price per second for call (put) options. For simplicity, interest payments, relevant service charges, and taxation are not taken into consideration in our analysis. For comparative purposes, the daily return rate is defined as:

$$\text{Daily Rate of Return} = \sqrt[Days+1]{1 + \frac{\text{Profit}}{\text{Option Price}}} - 1$$

The loss ratio reported in Table 9 is defined as the loss frequency divided by the sample size for 1 min, with the average loss ratio for each category exceeding 62%. As shown in Panel A, across the final 6 days, with the exception of Day 2

TABLE 11 Summary statistics on the changes of risk-neutral volatility and skewness

	Days		Volatility			Skewness		
Type	W	M	W	M	Diff	W	M	Diff
Calls	0	0	−0.0004***	0.0009***	−0.001***	−0.0061***	−0.0111***	0.005***
	1	1	−0.0002***	0.0028***	−0.003***	0.0719***	−0.0345***	0.106***
	2	2	−0.0033***	0.0010***	−0.004***	0.0421***	−0.0616***	0.104***
	3	3	0.0026***	0.0057***	−0.003***	0.0280***	−0.0656***	0.094***
	4	4	0.0007***	0.0061***	−0.005***	0.0237***	−0.0759***	0.100***
	5	5	−0.0023***	0.0069***	−0.009***	−0.0053***	−0.0906***	0.085***
Puts	0	0	−0.0004***	0.0009***	−0.001***	−0.0061***	−0.0111***	0.005***
	1	1	−0.0002***	0.0028***	−0.003***	0.0719***	−0.0345***	0.106***
	2	2	−0.0033***	0.0010***	−0.004***	0.0421***	−0.0616***	0.104***
	3	3	0.0026***	0.0057***	−0.003***	0.0279***	−0.0656***	0.094***
	4	4	0.0007***	0.0061***	−0.005***	0.0237***	−0.0759***	0.100***
	5	5	−0.0023***	0.0069***	−0.009***	−0.0052***	−0.0906***	0.085***

This table reports the statistics on the changes in risk-neutral volatility and skewness for near-the- money (NTM) Weekly (W) and Monthly (M) calls and puts for a sample period running from January 2013 to December 2015. The risk-neutral volatility and skewness values are calculated based upon the Bakshi et al. (2003) theory and the selection of transaction prices of the nearest-month options with at least eight days until maturity. ***indicates significance at the 1% level.

(Monday), weekly calls have a lower loss ratio than monthly calls, while weekly puts have a higher loss ratio than monthly puts, with the pattern remaining the same for the real-time sampling (Panel B). The daily returns of both instruments are found to be significantly negative across all final 6 days: in general, the longer the time to maturity, the poorer the daily returns.

A comparison between the results for the two instruments reveals that they are very similar to the results reported on the loss ratio. Weekly calls are found to have less negative returns than monthly calls, with the exception of Day 0, while weekly puts tend to have more negative returns than monthly puts, with the exception of Day 2 (Monday). In our real time sampling, Weeklys are found to have less negative returns than Monthlys, thereby providing support in the present study for the argument of Barberis and Huang (2008).[8]

4 | INVESTOR SENTIMENT

In this section, we make an attempt to determine whether the significant differences that are identified between the returns of Weeklys and Monthlys across the final 6 days may be attributable to investor sentiment. There are two key variables which have direct effects on option prices: these are the underlying asset price and volatility. As stated in virtually any standard textbook on options, the higher the volatility of the underlying asset prices, then the higher the prices of the associated call and put options. We can therefore infer that the differences found between the returns of Weeklys and Monthlys observed in the previous section may be attributable to changes in the underlying asset prices: if this is indeed a valid inference, then the TAIEX would exhibit inferior performance in the third week of each month, as compared to other weeks.

We match the TAIEX with the transaction data on the two instruments and then calculate the TAIEX daily returns with those of the Weeklys and Monthlys. The TAIEX return rates are reported in Table 10, which reveals that in most cases, the average returns for the third week are significantly lower than those for the non-third weeks: this clearly raises the question as to why the TAIEX should exhibit such poorer relative performance during the third week of each month.

Furthermore, investors tend to have a pessimistic opinion with regard to the performance of the stock market based upon the existence of a negative relationship between index returns and volatility (Black, 1976; Christie, 1982). If this inference is correct, then higher market uncertainty and pessimism should be discernible during the third week of each month, as compared to all other weeks. In order to measure investor belief about uncertainty and their pessimism with regard to the performance of the stock market, we follow the approach developed by Pan et al. (2015) to calculate risk-neutral volatility and skewness on a 1-min basis.

We match the transaction prices of Weeklys and Monthlys on a 1-s basis with the proxies for investor sentiment on a 1-min basis, which enables us to collect the changes from the initial value to the final value of risk-neutral volatility and skewness for each transaction: the results are reported in Table 11, which shows that the final values of risk-neutral volatility for Weeklys are significantly lower than their initial values, with the exceptions of Day 3 and Day 4, while the final values for Monthlys are significantly higher than their initial values. This implies that market fear is often reduced as Weeklys approach their expiration date, whereas it is increased as Monthlys approach their expiration date.

A comparison between the changes in risk-neutral volatility for Weeklys and Monthlys shows that most of the changes for Weeklys are negative, while almost all of the changes for Monthlys are positive. Since the stock index decreases (increases) as market fear increases (decreases), the changes in market fear help to explain the difference between the returns of the two instruments across the final 6 trading days. Table 11 also shows that the final values of risk-neutral skewness for Weeklys are found to be significantly less negative than their initial values with the exceptions of Day 5 and Day 0, while the final values for Monthlys are found to be significantly more negative than their initial values. This implies that investors are less pessimistic as Weeklys approach their expiration date, but more pessimistic as Monthlys approach their expiration date.

A comparison between the changes in risk-neutral skewness for Weeklys and Monthlys shows that most of the changes for Weeklys are positive, whereas all of the changes for Monthlys are negative. Since the stock index decreases (increases) with greater (lesser) market pessimism, the changes in market pessimism help to explain the difference between Weekly and Monthly returns across the final 6 trading days.

[8]Barberis and Huang (2008) argued that there was a tendency among investors to overvalue assets with a right-skewed returns distribution, thereby leading to a negative excess return rate.

5 | CONCLUSIONS

We compare and contrast the clientele effect, information content and buy-and-hold returns of weekly and monthly options traded in an order-driven market characterized by high participation by individual investors. Using a sample of TAIEX options covering the period from January 2013 to December 2015, contrary to the findings on S&P 500 index options (Chatrath et al., 2015), we find that TAIEX options with weekly and monthly expiration periods do not cater to two different types of clients, a finding which may be caused by two factors. First, Weeklys are not written in the week when Monthlys expire: thus, investors in Weeklys are compelled to trade in Monthlys. Second, since individual investors are major contributors to TAIEX options market participation, institutional investors, and proprietary traders are sufficiently motivated to disguise their trading.

We examine the informational roles of Weeklys and Monthlys in the price discovery of the underlying index using a lead-lag regression. Prior to carrying out the regression analysis, the relative bid-ask spread and depth are found to reveal greater information asymmetry for Weeklys than Monthlys: thus, Monthlys are found to play a leadership role with regard to TAIEX returns, whereas Weeklys do not.

Individual investors are said to prefer Weeklys to Monthlys, and vice versa for institutional investors. Furthermore, most individual investors are noise traders often trading in options for gambling and entertainment purposes. As such, our finding of Weeklys having no leadership role with regard to TAIEX returns is not unexpected. We also find that monthly call options have lower returns than weekly call options, whereas monthly put options have higher returns than weekly put options.

Chatrath et al. (2015) carried out similar analysis in a quote-driven market where they documented remarkably different results. While we have found that Weeklys have lower implied volatility and have less effect on price discovery than Monthlys, they found that Weeklys had higher implied volatility and contributed more to price discovery than Monthlys. These diverse findings are possibly attributable to differences in market trading mechanisms and characteristics.

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