# A NOTE ON RATIONAL CALL OPTION EXERCISE

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Using Swedish equity option data, the rationality in the exercise of American call options is analyzed to see how well it complies with the theoretical exercise rules. Although the exercise behavior appears to be rational overall, several cases of both faulty exercise and failure to exercise are found. Almost a third of the early exercised calls are exercised at other times than predicted by theory. Several of these exercise decisions could potentially be explained by transaction costs, indicating that market frictions do affect the exercise behavior. However, over two thirds of the faulty exercises cannot be explained at all. © 2002 Wiley Periodicals, Inc. Jrl Fut Mark 22:471–482, 2002

## INTRODUCTION

Assuming frictionless markets, Merton (1973) showed that American call options written on dividend-paying stocks should be exercised early only at the last cum-dividend instant and only if the underlying stock pays a sufficiently large dividend. In practice, transaction costs and other market frictions may also induce early exercise as shown by, for example,

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Diz and Finucane (1993), Dawson (1996), and Finucane (1997). Early exercise of a call written on a nondividend paying stock may, for example, be optimal if the holder wants to convert the position into cash and faces high bid/ask spreads. The spread could be avoided by exercising instead of selling the call, but the gain will be reduced by transaction costs for the underlying stock.

Pricing models for American options build on the notion that contracts are exercised according to the early exercise rules. It is therefore interesting to examine whether this notion is true. Knowledge about the actual exercise pattern can also help option writers to assess the probability of being assigned. The studies mentioned above, as well as Overdahl and Martin (1994), all found largely rational exercise behavior although cases of both failures to exercise and faulty exercise were also found. However, the studies were performed on different markets and the varying results suggest that institutional differences influence the exercise behavior.

Engström, Nordén, and Strömberg (2000) found mainly rational exercises of equity put options on the Swedish market, but they also found several failures to exercise. Lack of data prevented a corresponding analysis for calls, but theoretically call option holders have an easier decision whether to exercise or not. Moreover, if a put eligible for early exercise is left unexercised, the optimal decision might be made later, but for a call there is no second chance. The loss incurred by nonexercise could also be higher for calls than for puts. It is thus expected that the exercise practice for calls conforms more closely to the theoretical behavior than for puts.

The purpose of this study is to analyze the exercise behavior for equity call options on the Swedish option market, OM. By comparing actual exercise decisions to theoretical rules, the hypothesis of rational behavior is tested. Possible effects on expiration day exercise of information arriving in the interval between the close of trading and the latest possible exercise time are also investigated, as are the effects of the exchange's automatic exercise system. In addition, possible reasons for the decisions to exercise early are analyzed, and care has been taken to account for both direct and indirect transaction costs.

The results of the study are expected to differ from the results of the mainly U.S.-based previous studies. The Swedish and U.S. markets differ in certain aspects that influence exercise decisions: liquidity, taxation, and size and frequency of dividends. With its lower liquidity, the Swedish market is expected to exhibit relatively more contracts exercised in order to avoid the option spread. Dividends and capital gains are taxed equally for most investors, meaning that there are no clear tax incentives in the exercise decision. However, under certain circumstances some institutional investors do not pay taxes on dividend income, whereas

some others pay taxes on dividends but not on capital gains. Dividends are usually paid only once a year in Sweden, compared to four times a year in the United States. This means that the U.S. market exhibits a higher percentage of last cum-dividend days when calls may be eligible for early exercise. This should, in turn, increase the percentage of early exercised calls in the United States, but the quarterly dividend payments imply that the dividend paid at each instant may be too small to trigger rational early exercise. The average dividend yield in Sweden is around 2% on a yearly basis during the sample period, which is up to 50% higher than in the United States. Hence each dividend event in the United States is, on average, down to one-sixth of the average Swedish event. This is, in turn, expected to increase the percentage of early exercised calls in Sweden compared to the United States.

## THE EX-DIVIDEND STOCK PRICE DROP AND ITS EFFECT ON CALL EXERCISE

Early call exercise may be optimal at the last cum-dividend instant. The holder then receives $S_{cum} - X$, where $S_{cum}$ is the cum-dividend stock price and $X$ is the exercise price. If an exercisable call is left unexercised, its value should drop since the stock price will drop to $S_{cum} - \alpha Div$, where $Div$ is the dividend payment and $\alpha$ is the stock price drop in the cum-ex interval as a proportion of the dividend. Early exercise will *not* be optimal if the arbitrage free lower boundary call price on the ex-dividend day is higher than the exercise value, that is, if

$$S_{cum} - \alpha Div - Xe^{-r(T-t)} \geq S_{cum} - X \tag{1}$$

Rearranging (1), this means that the option should be left unexercised until expiration if

$$\alpha Div \leq X(1 - e^{-r(T-t)}) \tag{2}$$

Early call exercise should be decided upon before the ex-dividend day, and ex ante estimates of the drop is therefore of interest. Kaplanis (1986) shows how to estimate the expected price drop using cum- and ex-dividend day prices of the call and the underlying stock. It is reasoned that if the market properly includes the ex-dividend stock price drop when pricing options, the market estimate of $\alpha$ could be deduced from the option prices.

One reason the price drop might deviate from the dividend is tax differences between dividends and capital gains. In Sweden, $\alpha$ should thus be approximately 1, but it may be affected by, for example, selling or buying pressures caused by parties with differential taxation trading to

capture the dividend or to avoid receiving it. Using the Kaplanis (1986) method, the expected price drop in Sweden is found to be only 48% of the dividend. The estimated value of $\alpha$ is assumed to be a fair approximation, but for comparison an $\alpha$ equal to 1 is also used.

## INSTITUTIONAL SETTING, DATA, AND METHODOLOGY

During 1998, the number of equity put and call options traded on OM was 20.589 million (around 82,000 contracts per trading day). For comparison, the CBOE equity option trading volume during 1998 amounted to 138.5 million contracts (around 550,000 contracts per day). Normal hours for option and stock trading are between 9:30 a.m. and 5:30 p.m. CET, but a call may be exercised until one hour after the closing time on any trading day and until two hours after the close at expiration. After receipt of exercise notices, OM assigns exercises randomly among the option writers. At expiration, automatic exercise is applied for contracts with a minimum intrinsic value, unless an objection is received from the option holder.

All exercised calls in Sweden during the period January 1, 1997 through July 31, 1999 are analyzed. OM's exercise records contain the exercised volume of each contract and the day during which the exercise occurred. No information about when during the day the contracts are exercised is available, but since the exercise decision should be made as late as possible, daily aggregates are sufficient. OM also provided stock and option prices, whereas rates of the Treasury bill with maturity closest to the option expiration are used as a proxy for the riskless interest rate. Dividends are paid only once a year except for two of the underlying stocks listed abroad where dividends are paid quarterly. A few of the stocks pay dividends in other currencies than SEK, and these are converted to SEK using that day's exchange rate.[1]

Table I summarizes the exercised calls. A total of 3,089,060 contracts are exercised, and these exercises occur on 3,414 contract days. As in Gay, Kolb, and Yung (1989), a contract day is a trading day for a call with a specific exercise price and expiration. Around 10% of the exercised contracts are exercised early, whereas Overdahl and Martin (1994) and Finucane (1997) both find that around 30% of the equity calls exercised on the CBOE are exercised early. The lower percentage of early call exercise in Sweden might be explained by the fact that during most of

[1]NOKIA pays a dividend in FIM (Finnish marks), whereas Autoliv and Pharmacia & Upjohn pay in USD. For 1999, Stora Enso also paid a dividend in FIM.

**TABLE I**
Summary of Exercised Contracts

| Year | *Total # of Exercised Contracts* | *# Exercised at Expiration (%)* | *# Contract Days* | *# Exercised Before Expiration (%)* | *# Contract Days* |
|---|---|---|---|---|---|
| 1997 | 1,116,125 | 1,030,977 (92.38) | 872 | 85,028 (07.62) | 386 |
| 1998 | 1,047,980 | 927,384 (88.49) | 791 | 120,596 (11.51) | 480 |
| 1999 | 924,955 | 836,237 (90.41) | 541 | 88,718 (09.59) | 344 |
| Total | 3,089,060 | 2,794,718 (90.47) | 2,204 | 294,342 (09.53) | 1,210 |

Note. The table summarizes all the exercised contracts. The number and percentage of options exercised at and before expiration, as well as the number of contract days exhibiting exercise, are presented for each year.

the year no dividends are paid, and there are hence no theoretical early exercise opportunities. However, Swedish option holders may also for some reason be less inclined to exercise early.

For calls exercised at the last cum-dividend day, it is tested whether $\alpha Div > X(1 - e^{-r(T-t)})$. To estimate the loss incurred by an incorrect exercise decision, the cash flows received if the option was sold are compared to the cash flow received through exercise. Direct and indirect transaction costs affect these cash flows. OM charges an exercise fee of 0.075% of the exercise amount, and there are also the usual brokerage fees. Because of minimum and maximum absolute costs, it is impossible to assess the actual cost for every position, but the used transaction costs—2.5% for options and 0.5% for stocks—are assumed to be representative. Since the exercise decision should be made at the last possible instant, the closing option bid price, $C_{bid}$, is considered the most accurate measure of the price at which an exercised option could have been sold. The exercise value of the call, $C_{exercise}$, is mostly computed as the difference between the closing bid stock price and the exercise price. A stock received through exercise may be kept or directly sold, and the price received for the stock if sold is the bid price. However, if the alternative to exercise the option is to buy the stock in the market, the ask price is appropriate. Hence, for faulty exercise on the last cum-dividend day, the loss is computed using the ask price. Discarding taxes, which for most investors are the same for dividends and capital gains, the loss can be computed as:

$$L = C_{bid}(1 - t_c) - (S_{bid}(1 - t_s) - X(1 + t_{ex})) \tag{3}$$

where $t_c$ is the cost for the sale of the option, $t_s$ is the cost for selling the received stock, and $t_{ex}$ is the exercise costs. The condition for rational early exercise is that $L \leq 0$.

If a call is *not* exercised when it should be, the holder can expect a lower value due to the ex-dividend stock price decline. For a call to be considered a failure to exercise it has to be in-the-money, $0.48Div > X(1 - e^{-r(T-t)})$, and the stock could be acquired at a lower cost via exercise than via selling the option and buying the stock. An indication of the loss incurred by a failure is computed as the difference between the expected option value and the expected exercise value on the ex-dividend day. In this computation, the expected ex-dividend stock price, using both $\alpha = 1$ and $\alpha = 0.48$, the Black–Scholes (1973) European model and the implied at-the-money volatility are employed to compute the expected option value.

## EMPIRICAL RESULTS

### Exercise at Expiration

At expiration, the decision whether or not to exercise should not be a problem. Nevertheless, as shown in Table II, over 19,000 out-of-the-money options are exercised on 37 expiration contract days. Including transaction costs these exercise decisions cause a loss of, on average, SEK 160 per contract. The table also reports on the number of contracts not exercised during these contract days; as can be seen, most contracts are left unexercised.

Since the exercise decision at expiration may be postponed until two hours after the close of trading, the option holder has something that resembles the wildcard option associated with cash settled options. If

**TABLE II**
Summary of Exercise Behavior at Expiration

| | *Faulty Exercise* | | | | *Failures to Exercise* | | | |
|---|---|---|---|---|---|---|---|---|
| | *Total # of Contracts* | *Contract Days* | *Remaining Contracts* | *Average Loss* | *Total # of Contracts* | *Contract Days* | *Exercised Contracts* | *Average Loss* |
| Closing prices | 19,260 | 37 | 138,314 | 159.40 | 53,746 | 66 | 87,907 | 209.49 |
| Opening prices | 6,530 | 14 | 85,201 | 85.69 | 38,864 | 42 | 66,041 | 241.81 |

Note. The table summarizes the exercise behavior at expiration. The first half of the table contains the faulty exercised contracts, the contract days exhibiting faulty exercise, the contracts that remain unexercised during these contract days, and the average loss in SEK per contract incurred by the exercise decision. In the row below, exercises that might be explained by information arriving during the "wildcard interval" are removed. The second half of the table contains the failures to exercise, the contract days exhibiting failures, the contracts actually exercised during these contract days, and the average loss in SEK caused by a failure to exercise.

information arriving in this interval led the option holder to believe that the stock price would rise, the option might have been exercised in order to acquire the stock before the rise. To examine this possibility, the closing stock price is compared to the opening price on the following trading day during all days exhibiting faulty exercise. If the opening price is lower than the closing price, the exercise decision is considered an actual mistake, whereas if it is higher, the decision might be explained by new information. Allowing for the wildcard possibility, the number of faulty exercises is reduced 6,500.

There are also cases of failures to exercise at expiration. Table II shows 54,000 contracts not being exercised despite being sufficiently in-the-money. Here the wildcard interval may be an explanation. If the option holder due to information arriving in this interval suspect that the stock price will fall, the choice might be not to exercise. After allowing for this possibility, the number of contracts considered failures to exercise is reduced to 39,000.

The automatic exercise system on OM might also explain the exercise behavior. A call will be subject to automatic exercise if the average transaction stock price on that day is more than 1% above the exercise price. Options written on a stock with a sharp price drop at the end of the day may thus be automatically exercised although the option at the close of trading is out-of-the-money.[2] If this happens, the holder may object to automatic exercise. Otherwise, the exercise is considered faulty since the stock could have been bought in the market at a lower price. To examine the effect of automatic exercise, the decisions given the average prices are compared to the decisions given the closing prices. However, since records of the average prices are available only for a part of the sample, the results are not presented in Table II.

Only around 3,500 of 11,000 faulty exercised contracts where average prices are available have been exercised automatically, whereas the rest have been actively exercised. However, the exercise of the 3,500 contracts may be explained by new information arriving during the wildcard interval. Moreover, around 13,000 of 19,000 failures to exercise may be explained by not being automatically exercised. The remaining 6,000 contracts have not been exercised despite being on the automatic exercise list, and the option holders have thus objected to exercise the contracts. Only 900 of these failures may be explained by the possible

[2]OM's argument for basing the automatic exercise on volume-weighted average prices rather than closing prices is that the average price better reflects the value of the stock that day.

arrival of unfavorable information, and for the remaining failures no explanation can be found.[3]

## Exercise Before Expiration

As in Finucane (1997), all cases of early exercise are divided into three mutually exclusive groups to assess the relative importance of dividends and transaction costs as explanations for the exercise. In Groups 2 and 3 both direct and indirect transactions costs are accounted for.

Group 1: $Div > 0$

Group 2: $Div = 0 \cap C_{bid} \leq C_{exercise}$

Group 3: $Div = 0 \cap C_{bid} > C_{exercise}$

Group 1 includes all calls exercised on the last cum-dividend day regardless of the size of the dividend. The dividend may be too small to trigger rational early exercise, but here an exercise decision is considered dividend induced whenever it occurs on the last cum-dividend day. Group 2 includes all exercises at other times than on the last cum-dividend day where the exercise value of the option exceeds its market bid price. If the option could not be sold at a reasonable price, it might have been exercised in order to convert the position into cash. The exercises are considered transaction costs consistent. Exercises in Group 3 are unexplained, that is, inconsistent with both dividends and transaction costs. The contracts are exercised even though the holder would have been better off to sell the options rather than exercising them.

Table III displays the early exercised contracts according to the group they belong to. Although occurring on only 25% of the contract days exhibiting early exercise, almost 70% of the early exercised calls may be explained by dividends. For comparison, Finucane (1997) found that 80% of the early exercised calls on the CBOE are consistent with dividends. Transaction costs could potentially explain around 10% of the early exercised contracts, but over 20% cannot be explained at all and are therefore considered faulty exercised. The average relative bid/ask spread is higher for the group with transaction-cost-induced early exercise than for the other groups. However, even though the liquidity on OM is expected to be lower than on the CBOE, transaction costs explain a slightly lower percentage of early exercised contracts than the 12% reported in Finucane (1997). Unexplained early exercise, on the other

[3]The cases of irrational exercise behavior at expiration are very few compared to the entire sample of exercised calls, and the total loss incurred is also very low. This suggests that the exercise behavior at expiration is predominantly rational.

**TABLE III**

Early Exercised Call Options According to the Potential Reason

| *Potential Reason* | *Number of Exercised Contracts* | *% of All Early Exercised Contracts* | *Number of Contract Days* | *Average Time to Expiration in Days* | *Average Moneyness* | *Average Relative Bid/Ask Spread* |
|---|---|---|---|---|---|---|
| Dividends | 201,122 | 68.33 | 304 | 27 | 1.16 | 0.17 |
| Transaction costs | 28,108 | 9.55 | 298 | 28 | 1.35 | 0.29 |
| Unexplained | 65,112 | 22.12 | 608 | 30 | 1.19 | 0.22 |
| Total | 294,342 | 100.00 | 1,210 | 28 | 1.18 | 0.19 |

Note. The table shows the numbers and percentages of early exercised calls divided into groups according to the potential reason for early exercise. The number of contract days exhibiting each group of exercised contracts is also presented, along with the average number of days to expiration and the average moneyness (defined as the ratio of the closing stock price to the exercise price). The last column presents the average bid/ask spread divided by the bid/ask midpoint. All averages are weighted by the number of contracts exercised each day.

hand, occurs much more frequently on the Swedish market than on the U.S. markets, and the risk of unanticipated assignment for the option writer should thus not be neglected.

The number of rationally exercised calls does not appear to be very sensitive to the value of $\alpha$. When it is tested whether the inequality $\alpha Div > X(1 - e^{-r(T-t)})$ is satisfied, 200,962 contracts are considered rationally exercised using $\alpha = 1$, whereas 199,892 contracts appear rational if instead $\alpha = 0.48$ is used.[4] In addition to the cases of early exercise at the last cum-dividend day, around 28,000 contracts are exercised cum-dividend but one or a few days too early. The loss of interest on the exercise amount over these few days may not have been very high, but nothing is gained by exercising this early. Instead, the option holder is exposed to unfavorable price movements in the underlying stock up to the last cum-dividend instant.[5]

Panel A of Table IV displays all early exercised contracts according to the difference between market value and exercise value. Although $L$

[4]To get an indication of the effect of the size of the dividend on the number of early exercised calls, it is tested how many contracts that may be considered rationally exercised using a lower value of $\alpha Div$. Since the average yearly dividend yield during the sample period is up to 50% higher in Sweden than in the United States, each dividend event in the United States should be around one-sixth of the Swedish event. If $\alpha = 0.1667$ is used in the rationality test, around 142,000 exercised contracts dispersed over 149 contract days may still be considered rational. Thus the fact that several option series have no dividend payments during their maturity appears, at least to some extent, to explain the much lower percentage of early exercised calls in Sweden.

[5]As an option trader pointed out, if the option holder is short in the underlying stock, institutional rules force the trader to reassign the contract shares to the lender a few days before the ex-dividend day. If at that time the delta of the option is 1, it may be optimal to exercise it a few days before the last cum-dividend day. However, since it is impossible to assess how many cases are affected by this, they are all considered irrational.

**TABLE IV**

Early Exercised Options According to the Difference Between Market Value and Exercise Value of the Option

| *Loss (L)* | *Exercised Contracts* | *Contract Days* | *Average Moneyness* | *Average T − t* |
|---|---|---|---|---|
| *Panel A: All Early Exercised Options* | | | | |
| $4.00 \leq L$ | 12,679 | 73 | 1.01 | 19 |
| $3.00 \leq L < 4.00$ | 6,080 | 46 | 1.16 | 33 |
| $2.00 \leq L < 3.00$ | 13,716 | 99 | 1.21 | 54 |
| $1.00 \leq L < 2.00$ | 59,444 | 211 | 1.19 | 39 |
| $0.00 \leq L < 1.00$ | 96,026 | 403 | 1.18 | 22 |
| $-1.00 \leq L < 0.00$ | 60,128 | 199 | 1.19 | 23 |
| $-2.00 \leq L < -1.00$ | 24,023 | 71 | 1.16 | 24 |
| $-3.00 \leq L < -2.00$ | 10,933 | 49 | 1.24 | 22 |
| $-4.00 \leq L < -3.00$ | 2,550 | 19 | 1.35 | 41 |
| $L < -4.00$ | 8,763 | 40 | 1.41 | 36 |
| Totals | 294,342 | 1,210 | Average *L*: 0.48 | |
| *Panel B: Faulty Early Exercise* | | | | |
| $4.00 \leq L$ | 9,121 | 54 | 0.96 | 12 |
| $3.00 \leq L < 4.00$ | 1,632 | 34 | 1.19 | 62 |
| $2.00 \leq L < 3.00$ | 4,561 | 76 | 1.25 | 54 |
| $1.00 \leq L < 2.00$ | 23,921 | 153 | 1.20 | 44 |
| $0.00 \leq L < 1.00$ | 37,195 | 335 | 1.22 | 26 |
| Totals | 76,430 | 652 | Average *L*: 2.33 | |
| *Panel C: Failures to Exercise When* $E(\alpha) = 1$ | | | | |
| $-1.00 \leq L < 0.00$ | 45,186 | 48 | 1.11 | 47 |
| $-2.00 \leq L < -1.00$ | 19,379 | 36 | 1.16 | 46 |
| $-3.00 \leq L < -2.00$ | 19,205 | 31 | 1.16 | 32 |
| $-4.00 \leq L < -3.00$ | 21,545 | 15 | 1.19 | 33 |
| $L < -4.00$ | 8,081 | 52 | 1.19 | 46 |
| Totals | 113,396 | 182 | Average *L*: −1.90 | |
| *Panel D: Failures to Exercise When* $E(\alpha) = 0.48$ | | | | |
| $-1.00 \leq L < 0.00$ | 44,472 | 46 | 1.11 | 47 |
| $-2.00 \leq L < -1.00$ | 26,330 | 42 | 1.13 | 41 |
| $-3.00 \leq L < -2.00$ | 15,211 | 23 | 1.18 | 36 |
| $-4.00 \leq L < -3.00$ | 28,859 | 21 | 1.15 | 32 |
| $L < -4.00$ | 10,091 | 56 | 1.16 | 44 |
| Totals | 124,963 | 188 | Average *L*: −2.25 | |

Note. The table displays early exercised contracts, and contract days exhibiting early exercise, according to the difference between the market price of the option and the exercise value. If the difference, $L$, is positive, the option holder would have been better off to sell the option rather than exercise it, and $L$ therefore represent the direct loss per option incurred by the incorrect exercise decision (for the loss per contract, $L$ should be multiplied by 100). For the failures to exercise, $L$ stands for the difference between the expected ex-dividend day option value and the expected exercise value. The negative $L$ value represents the gain from exercise that is lost by not exercising. The average moneyness and number of days left to expiration are both weighted by the number of contracts exercised each contract day.

should be negative for the exercise to be considered rational, over 60% of the exercised calls, which can be compared to the less than 17% found in Finucane (1997), have positive $L$ values. If these calls could have been sold at the market bid price, the exercise decisions are inefficient. Measurement errors, market imperfections, nonsynchronous prices, etc., might explain exercises with slightly positive $L$ values, but exercises corresponding to high values of $L$ are not so easily explained.

Panel B of Table IV displays the faulty exercised contracts. Most of these contracts belong to the group of unexplained exercises, but around 11,000 belong to Group 1. These options are exercised at the last cum-dividend day although selling the call and buying the stock should have been a more profitable strategy. The faulty exercised options are on average deep in-the-money, except for the group with the highest $L$ values, where the average moneyness is even below 1.0.[6] One possible explanation for faulty exercise is taxation. If a call is exercised, capital gains taxes will be deferred until the stock acquired via option exercise is sold, and a holder of an in-the-money call wanting to postpone the realization of capital gains may thus choose to exercise rather than sell the option. However, nonsufficient monitoring may also be an explanation. Overall, at least some of the exercise decisions appear to be irrational.

Panels C and D of Table IV display the expected loss due to failures to exercise on the last cum-dividend day using $\alpha = 1$ and $\alpha = 0.48$, respectively, to compute the expected ex-dividend stock price. Regardless of $\alpha$, over 100,000 exercisable calls remain unexercised at the last cum-dividend days, and it appears that the option holders have not monitored their positions carefully enough. The average probability of assignment for the option writer on the last cum-dividend day is thus less than 64% for options that should be exercised. The average loss for failures to exercise is of the same magnitude as for faulty exercise. However, the total loss incurred by irrational exercise behavior is not very high.

## CONCLUSION

This study examines the exercise rationality for Swedish equity call options, and finds that 3% of the exercised calls are exercised at other times than at expiration or at the last cum-dividend day. Almost a third of these exercises may be explained by transaction costs, indicating that

[6]An examination of the exercises belonging to this group reveals that most of the options are written on the stock Balder. Around that time, Balder was going to be distributed to the stockholders of SHB as a tax-exempt stock dividend, and the special circumstances around this could possibly explain the detected behavior.

market frictions do affect the exercise behavior. Some option holders exercise cum-dividend but a day or two too early, and the option writer who would not like to be assigned should hence consider closing out the position several days before the last cum-dividend day. There are also cases when contracts are not exercised even though it would have been rational to do so, but compared to the results for put options reported in Engström et al. (2000), failures to exercise are much less common for calls than for puts. Unexplained early call exercises are about as common as for puts, though. However, the results imply that the exercise behavior to a large extent follows the early exercise rules, and the deviations that do exist represent a very small part of the total trading volume at OM.

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