THE PRICE AND VOLATILITY EFFECTS OF STOCK OPTION INTRODUCTIONS: A REEXAMINATION

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Abstract

This paper adds to the literature dealing with the effect of derivatives trading on underlying securities by examining option listings from the Netherlands. The effects on both stock returns and volatility are investigated using three types of samples, namely, listing of call options alone, simultaneous listings of both call and put options, and listings of put options alone. A significant decline in stock price is observed with the introduction of option trading. But, no significant effect takes place on the volatility of underlying stocks. Although the evidence is in sharp contrast to the so-called “established view”, it is consistent with recent studies.

1. INTRODUCTION

With the opening of the European Options Exchange in Amsterdam in 1978, options have become an important financial instrument in the Netherlands. Since then, there exists a controversy concerning the interaction between the option and the stock market. Especially, after the stock market crash of October 1987 questions were raised by diverse parties on this interaction including the effect of options on underlying stocks' volatility. Empirical studies examining the impact of options trading on underlying securities mainly come from the United States. Damodaran and Subrahmanyam (1992), after surveying the literature, conclude that the listing of call options increases stock returns while the listing of put options decreases stock returns. Evidence also exists that stock volatility is reduced with the introduction of option listing. The observed empirical effects are surprisingly in contrast to some theoretical arguments. Damodaran and Subrahmanyam stress the need to gather more evidence from other markets before drawing a general conclusion.

The U.S. option market has some distinct features. For example, more than 80% of all equity option introductions in the United States during 1973-87 involve only call options. As argued by Conrad (1989), with call options only, dealers supply calls to investors and simultaneously buy underlying stocks. This may explain the positive price effect found in earlier studies. There are multiple stock and options exchanges in the United States, and many options are introduced on different exchanges at the same time. Factors related to institutional and time-zone differences among different exchanges in the U.S., therefore, necessitate very careful sample selection process. In addition, many of the earlier studies do not cover a long time period in order to adequately control for market-wide movements.

Interestingly, two recent papers contradict prior documented results. Sorescu (1998) reports that the previously found positive price effect of stock option introduction is due to manipulative trading in underlying stocks by option dealers in the United States. With the stringent enforcement of margin trading regulation in 1981, the average price effect of option listings is found to be *significantly negative*. In another study, Bollen (1998) examines option listings over a longer time-period and finds that the introduction of stock options has *no significant effect* on underlying stock volatility. Since the results of these two studies are inconsistent with previous studies from the United States, there is a greater need to gather more evidence from other markets.

In this paper, the effect of option introductions on the Dutch stock market is investigated. Both stock price and stock volatility effects are examined using various samples of option introductions. Some noteworthy Dutch features include a relatively large number of simultaneous introductions of call and put options, the introduction of options for stocks on larger and established firms, the presence of competing market makers for more liquid options, and the availability of very short-term (one month) as well as long-term (3 - 5 years) options for larger firms. The study also covers option listings that took place during a relatively long time period (16 years). These features would also allow us to have more confidence on the validity of our results.

The findings of this study show that there is a significant average stock price decline after the introduction of options. The study also finds that there is no statistically significant change in stock volatility after such introductions. All three volatility measures: total risk, systematic risk and non-systematic risk fail to show any significant change. This evidence of declining stock price and unchanged stock volatility associated with equity option introductions represents a striking departure from the so-called "established view". It is also consistent with recent studies of Sorescu (1998) and Bollen (1998).

The rest of the paper is organized as follows. In section 2 the literature on the effect of stock option listings is very briefly discussed. The description of data analysed in this study is outlined in section 3. The research methodology used to investigate the effect on stock returns and the obtained results are elaborated in section 4. The methodology on the measurement of the volatility effect and the results are reported in section 5. The final section provides a summary and conclusion.

2. LITERATURE

2.1 Price effect

According to the derivatives pricing theory, an option is a redundant security because it can be synthetically replicated by a combination of assets already available in the market. With the assumptions of a perfect capital market, options can be replicated by combining the underlying stock and riskless borrowing-lending opportunities. Hence, it is unlikely that an option listing can have any direct effect on the underlying stock.

As the assumptions of perfect capital market do not hold true in practice, one can expect to observe numerous effects. Options trading, like any other financial instrument, contributes towards a more complete, efficient and perfect security market. More complete because the opportunity set faced by an investor is expanded as more trading alternatives are created; more efficient because additional information may now be released and quickly impounded in the underlying stock prices; and more perfect because transaction costs could be lower due to increased competition between market makers. Due to these factors, one can expect an increase in stock prices with the introduction of options.

But, there also exist arguments which predict a decline in stock price once options are listed. According to Figlewski and Webb (1993), options trading allows investors to circumvent constraints on short-selling that usually exists on the stock market. Investors who could not take a short position previously can now easily trade in equity options and thus benefit from using negative information. Another explanation is that option introductions can lead to a diversion of trading from the stock market to the option market. For many short-term traders the existence of an option market provides a new investment opportunity with lower transaction costs. Shareholders might also sell their stakes if they believe that option introduction would work as a destabilizing factor for the underlying stock. Therefore, we observe that a theoretical ambiguity exists regarding the precise stock price effect of option introductions.

2.2 Volatility effect

Options trading reveals information about future trading intentions of investors. With the increased incentive to acquire new information, a stock can become less volatile. A decline of stock volatility after option listing might also occur if trading volume of the underlying stock increases because of increased interest from institutional investors and analysts, greater media coverage and hedging activities by market makers. On the other hand, an opposite view is that options introduction increases stock return volatility. Investors may find it more attractive to engage in trade in an option market that may cause increased volatility in underlying stock prices. The existence of options trading may also divert trading from the stock market to the option market. As a result of decreased trading volume an increased price volatility might occur.

2.3 Empirical evidence

Several studies empirically examine the impact of option listings by looking at the announcement date as well as the listing date. Conrad (1989) and DeTemple and Jorion (1990) find no significant stock price effect after the announcement of option introductions. But, they observe an increase in the price of underlying stocks after the listing of call options. DeTemple and Jorion (1990) also reports a reduction in the magnitude of price effect during the later period of option listing. There are two non-U.S. studies that provide evidence on the stock price effect. Watt, Yadav and Draper (1992) analyze 39 option introductions in the United Kingdom and observe a steady price decline after option listing. The evidence from the U.K. is, therefore, in contrast to that reported from the U.S. Stucki and Wasserfallen (1994) analyze the effect of options trading on 11 stocks in Switzerland. Although they report positive price reaction, their sample includes options introduced on one single day.

Most studies investigating the impact of option listing on the volatility of underlying stocks usually report a decline in the volatility. Damodaran and Subrahmanyam (1992) review these studies. The results reported by Watt, Yadav and Draper (1992) for the

United Kingdom and Stucki and Wasserfallen (1994) for Switzerland also support the U.S. evidence. However, Chamberlain, Cheung and Kwan (1993) and Elfakhani and Chaudhury (1995) provide conflicting evidence using Canadian data. The former study does not find any statistically significant change in volatility while the later study documents a reduction in stock volatility.

Studies also investigate the effect of option introductions on other stock characteristics like trading volume, speed of price adjustment and the bid-ask spread. The trading volume results are mixed. An increase in trading volume is reported by Kumar, Sarin and Shastri (1998), a decrease in volume is reported by Damodaran and Lim (1991) and no change in trading volume is documented by Chamberlain, Cheung and Kwan (1993). Investigating the speed with which new information is compounded in stock prices, Damodaran and Lim (1991) and Watt, Yadav and Draper (1992) show that prices of option listed stocks adjust more quickly. Fedenia and Grammatikos (1992) report that the bid-ask spread declines for New York Stock Exchange-traded stocks, but increases for the Over-The-Counter traded stocks.

3. DATA

Option trading in the Netherlands first started on April 4, 1978. The Options Exchange was the first in continental Europe, and has recently attained even the top position in Europe with respect to equity options trading. Both annual reports of the Exchange and the Dutch financial daily newspaper 'Het Financieele Dagblad' were searched to collect all option listing dates during the period 1978-1993. Information is collected from these sources on the listing of call options, the listing of put options and the simultaneous listing of call and put options. An overview of all listing dates and the underlying stocks is provided in Table 1.

During the sample period, data on a total of 56 option listings on 47 different stocks were collected.[1] It should be mentioned that during the first year of the European Options Exchange (1978) only call options were introduced on nine different stocks. Put options were introduced on the same nine stocks during 1979-82. Both call and put options were introduced simultaneously on the remaining 38 stocks (see Table 1). Such introductions first took place in 1980 and then continued over the fourteen-year period. On two occasions, a few options were introduced together.[2] Three stocks had to be dropped from the analysis because of insufficient data on either side of option listing.[3] Daily adjusted stock prices are collected from Datastream. In order to compute stock returns, information on cash dividends is collected from the financial newspapers 'Het Financieele Dagblad' and 'Beursplein 5'. The CBS-Total Return Index, an index for the Dutch stock market, is used to compute market returns.[4]

4. THE EFFECT ON STOCK RETURN

Methodology

A standard event study is performed in order to examine the effect of option listing on the underlying stock returns. The Market Model is used to estimate daily excess stock returns[5]. A period of 20 trading days around the option listing date is considered as the

[1] Options introduced following the merger between two companies which already had separate listed options are excluded from the sample (e.g. ABN-AMRO and Bols-Wessanen).

[2] Because of the same listing date these stocks are analyzed after forming two portfolios.

[3] Options trading on these stocks (DSM, DAF and Polygram) started within half a year of listing of the stocks on the Amsterdam Stock Exchange.

[4] The CBS-Total Return Index is available only from January 1980. Therefore, for the period before 1980 the Datastream Total Market Index is used.

[5] The sensitivity of the results generated by the Market Model is checked by computing abnormal returns using the Market Adjusted Method and the Mean Adjusted Method. According to the first method, the expected return of a particular stock is equal to the market return in the same period ($R_{it} = R_{mt}$). According to the second method, the

test period. The Market Model parameters are estimated over a period of 125 trading days preceding the start of the event period (-145, -21).[6] The estimations are made using the ordinary least squares regression method. Both average and cumulative average abnormal returns are calculated over the test period. A test is also carried out to check whether abnormal returns are significantly different from zero. This is done by performing a t-test under the assumption that the abnormal returns are cross-sectionally independent.[7] This methodology is well known in the literature. However, a brief explanation is provided in Appendix A.

Results

The average abnormal returns (AAR) and the cumulative average abnormal returns (CAAR) together with the t-statistics for each day in the test period for the sample of 35 simultaneous call and put option listings is reported in table 2. The cumulative abnormal return in the 20-day pre-listing period is negative (-2.34%) and statistically significant (t = -2.12). A majority of the stocks also shows negative abnormal returns. This price decline could be mainly attributed to the *announcement* of option introductions which is usually made one to two weeks before the start of option trading. The day of listing itself does not show any statistically significant stock price movement, but the day after the listing exhibits a significant abnormal return of -0.46% (t = -2.12). This is followed by another few days with negative abnormal returns. On the day after listing, 79% of the stocks in the sample show negative returns. Analyzing the six day post-listing period, I observe that the cumulative abnormal return is -1.74% which is also statistically signifi-

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expected return is equal to the average return of a stock during a particular period ($R_{it} = R_{i,avg}$). In order to compute this average return a period of 125 trading days (-145, -21) is used.

[6] For control purpose, an estimation period of 250 trading days preceding the event period (-270, -21) is also used.

[7] Brown and Warner (1985) argue that even if the cross-sectional independence assumption is approximately true, the t-test will be efficient. With the clustering of event-dates, the t-test will be more powerful under the assumption of cross-sectional independent abnormal returns.

cant (t = -3.31). The cumulative abnormal return in the 21 day period after option listing increases to -4.40% and is statistically significant too (t = -4.33).

Similar results are obtained when the robustness of previous results using the two other models of estimating excess returns is checked. During the 20-day pre-listing period, the mean-adjusted cumulative excess return is -4.39% (t = -3.96) and the market-adjusted cumulative excess return is -0.59% (t = -0.28). The post-listing excess returns estimated from these two models continue to be negative and are equal to -6.61% (t = 6.03) and -2.66% (t = 2.52), respectively.

Multiple call/put stock options were introduced on two occasions (August 31, 1990 and July 2, 1992). Two equally-weighted portfolios are formed with stocks having the same introduction date. Sample excess returns are recomputed treating each portfolio as one stock. The cumulative average excess return over the pre-introduction period is found to be insignificantly positive (0.55%). But, the result for the 21 day post-listing period remains significantly negative (-5.57%).

In addition to the simultaneous call and put option introductions, there are nine cases of only call and only put option introductions in the full sample. Once again, consistent results are obtained from analyzing these two sub-samples separately. The 21-day post-listing period shows a change of stock returns by -2.26% for the call option sample and by -1.45% for the put option sample.

The above mentioned results, therefore, suggest that equity option introductions lead to a decline in stock price. The finding is consistent with Sorescu (1998) who analyze option introductions in the United States, and Watt, Yadav and Draper (1992) who analyze option introductions in the United Kingdom. The evidence is in sharp contrast to prior studies (Conrad, 1989; DeTemple and Jorion, 1990) which document stock price increase after option listings. As suggested by Sorescu (1998), specific characteristics of the U.S. market prevailing during the earlier years appear to have caused this unique result.

5. THE EFFECT ON VOLATILITY

Methodology

To investigate if option introduction leads to a change in the volatility of stock returns, the following analysis is conducted using the same data. Three alternate measures of volatility are first defined: the total risk, the non-systematic risk and the systematic risk. In order to control for changes in overall market volatility, standardized total risk measure is calculated by dividing the total volatility of each stock by that of the market. Risk measures are estimated for four different periods on either side of option listing date. Each period consists of 125 trading days and is defined as follows:

period T1	day -270 to day -146
period T2	day -145 to day -21
period T3	day +21 to day +145
period T4	day +146 to day +270.

All these days are calculated relative to the option introduction date. The change in volatility in period T3 with respect to T2 will reveal if that occurred specifically due to option introduction or not. By comparing the change in period T4 from period T3 one can determine if the previous change in volatility is of permanent nature or not. The period T1 is examined to test the hypothesis that options are introduced only for those stocks which showed an increase in volatility. The 40 days period immediately surrounding the listing date is ignored to avoid any influence of the listing itself. An analysis is performed separately for each sample consisting of introduction of simultaneous call and put options, only call options, and only put options. A further description of the methodology is provided in Appendix B.

Results

The average ratio's of standardized total risk and non-systematic risk and the average values of systematic risk are analyzed to see if option introduction leads to a change in the volatility of the underlying stocks. The results of total, non-systematic and systematic risks for the sample of simultaneous call and put option introductions are presented in panels A, B and C, respectively, in table 3. In each panel besides reporting the mean and the median, the percentage of stocks exhibiting a higher value relative to the previous period is also reported. Overall, the results show that no statistically significant change takes place in stock volatility in the period immediately after the introduction of options trading (T3/T2). The average ratio of standardized total risk remains almost same. The average ratio of non-systematic risk increases by 12%, but it is not statistically significant. The change in systematic risk immediately after options listing is also negligible.

Similar analysis is performed with samples of those stocks on which call options and put options were introduced separately. Even though the sample size is small, the analysis enables us to check the robustness of previously obtained results. The results are reported in tables 4 and 5, respectively. Once again, I find that there is no significant change in total risk associated with separate listings of call and put options. Although a majority of stocks show an increase in non-systematic risk after option introductions, none of the changes in volatility is statistically significant. Comparing the effect on systematic risk, we see that eight out of nine stocks had a higher beta after call option listing (see Table 4), while five out of nine stocks had a decrease in beta after the introduction of put options (see Table 5). Overall, these results support the previous finding that option listing as a whole has no overwhelming effect on the volatility of the underlying stocks.

A few studies document that the magnitude of the effects of option introduction is different in recent years compared to that observed in the early years (DeTemple and Jorion, 1990; Elfakhani and Chaudhury, 1995). Therefore, I analyze separately two sub-samples: the first sample contains option introductions until 1989 and the second one includes introductions after 1989. The results are reported in Table 6. The results show that there is a significant decline of standardized total risk in the first period, but no significant change in the second period. On the other hand, there is a significant increase in non-systematic risk for the second group of stocks, but no significant change for the first group. Average systematic risks of two periods do not exhibit a different behaviour.

The long-term change in stock volatility after option introduction is also investigated. Comparing the three different risk measures calculated from period T4 with those from period T3, no significant change in volatility is observed for the sample of simultaneous call and put option listings (see Table 3). The results from call options sub-sample (see Table 4) indicate that the non-systematic risk declines significantly in period T4. But, there is no significant change in the other two risk measures. The results from put options (see Table 5) sample show a significant decline only in total risk. Non-systematic risk, on the other hand, does not exhibit any significant change.

It has been argued that options are introduced for those stocks which exhibit relatively higher volatility (Damodaran and Lim, 1991; Watt, Yadav and Draper, 1992). In order to test this hypothesis, stock volatility measures are estimated using returns from period T1 (day -270 to day -146), and compared with those estimated from the period immediately before option introductions (T2 consisting of day -145 to day -21). The results from the sample involving simultaneous call and put option introductions (see Table 3) show that there is a significant increase in total risk before the introduction of options. The average (median) ratio of standardized total risk increased by 21% (14%). But, no statistically significant change takes place in non-systematic risk, and only 40% of stocks show an increase in systematic risk. The results are insignificant for the sample of call and put options introduced separately.

6. CONCLUSIONS

There is no theoretical unanimity on the precise direction of stock price and stock volatility effects of equity option introductions. Price and volatility may increase, decrease or remain unchanged. It is, therefore, an empirical issue to determine which effect dominates. Since prior studies, especially from the United States, provide conflicting results, this paper reexamines the issue using data from the Netherlands. Three different samples covering simultaneous listings of call and put options, call options alone, and put options alone are analyzed. In addition, the study covers options listings during a relatively long time period. The results indicate that the listing of options is associated with, on average, a decline in stock prices. The finding is robust to different methodologies and samples. Although the evidence is at odd with that reported in earlier studies, it is consistent with recent findings. The negative price effect is also consistent with theoretical arguments, i.e. the relatively easy possibility of getting around with restrictions on short sales and the faster incorporation of negative information into stock prices.

The study also investigates the change in stock return volatility associated with option introductions. Three different risk measures: market-adjusted total risk, non-systematic risk and systematic risks are examined. In addition, both short- and long-term risk changes are investigated. The overall results lead us to conclude that no significant change in risk takes place after the introduction of option listing. Once again, the evidence provided here is different from earlier studies, but consistent with recent ones.

Appendix A: Methodology for stock return analysis

According to the Market Model, the return of a stock is linearly related to the return of the market. Mathematically, it can be written as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}$$

where R_{it} is calculated as the continuously compounded return of stock i in period t, R_{mt} the continuously compounded return of the market index, α_i and $ß_i$ the time-independent parameters, and ϵ_{it} the random disturbance term for stock i in period t with a zero expected value and constant variance. The expected stock return is written as follows:

$$E(R_{it}) = \alpha_i + \beta_i E(R_{mt})$$

In order to investigate if option listing induces any abnormal returns for each stock on each day in the event period, the actual returns are compared with the Market Model predicted returns. The difference between these two returns is interpreted as the abnormal return of a stock:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) = \epsilon_{it}$$

where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are least-squares estimations of model parameters α_i and $ß_i$. The estimation is made over a period of 125 trading days preceding the start of the event period.

Average and cumulative average abnormal returns are then calculated as follows:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \qquad i = 1, 2, ..., N \text{ and } t = -20, ..., +20$$

$$CAAR_k = \sum_{t=s}^{s+k-1} AAR_t \qquad 2 \leq k \leq 41 \qquad \text{and} \qquad t,s = -20, ..., +20$$

The t-test of statistical significance is performed as follows. First, all abnormal returns in the event period for each stock are standardized as follows resulting in standardized abnormal returns (SAR_{it}):

$$SAR_{it} = \frac{AR_{it}}{s_i(AR)}$$

where $s_i(AR)$ is the standard deviation of the abnormal returns of stock i in the estimation period. The cumulative abnormal returns are also standardized:

$$SCAR_{ik} = \left(\sum_{t=s}^{s+k-1} SAR_{it} \right) \cdot \frac{1}{\sqrt{k}}$$

The t-value for the total sample of N stocks for each day t in the event period is then calculated in the following way:

$$t(SAR) = \left(\sum_{i=1}^{N} SAR_{it} \right) \cdot \frac{1}{\sqrt{N}}$$

$$t(SCAR) = \left(\sum_{i=1}^{N} SCAR_{ik} \right) \cdot \frac{1}{\sqrt{N}}$$

Appendix B: Methodology for volatility analysis

For each period T, the total risk for each stock i is estimated from the standard deviation of daily stock returns:

$$\sigma(R_i)_T = \sqrt{\frac{\sum_{t=1}^{125} (R_{it} - \overline{R_i})^2}{(125-1)} * 255} \qquad i = 1, 2, ..., N; t = 1, 2, ..., 125$$

T = 1, 2, 3, 4

where: $R_{it} = \ln\left[\frac{P_{it} + D_{it}}{P_{i,t-1}}\right]$ and $\overline{R_i} = \frac{1}{125}\sum_{t=1}^{125} R_{it}$

The daily standard deviation is multiplied by 255 to express in terms of year. In order to properly evaluate the results we also need an estimate of total market risk. The CBS-Total Return Index is used in a similar way to calculate the market standard deviation. The estimated total risk for each stock is then divided by that of the market to compute the following standardized total risk measure (STR):

$$STR_{i,T} = \frac{\sigma(R_i)_T}{\sigma(R_m)_T}$$

The standardized total risk for each stock calculated from one period is divided by that from another period. A ratio of greater (less) than one would suggest an increase (decrease) in volatility.

In order to estimate the non-systematic risk and the systematic risk for each stock, least squares regression analysis is performed using data from the four periods. The regression coefficient gives an estimate of the systematic risk of the stock, while the standard deviation of the error term is used to estimate non-systematic risk. Like the total risk measure, the ratio of non-systematic risk is calculated for each stock by dividing the standard deviation from one period by that of the other.

In order to test if the change in either total risk or non-systematic risk from one period to the other is statistically significant or not, a two-sided 'paired-sample t-test' is performed. For each stock, first the difference (d_i) between two period's ratios, and then the cross-sectional average difference over all stocks are calculated.

$$\bar{d} = \frac{1}{N}\sum_{i=1}^{N} d_i$$

The 'paired-sample t-statistic' (t_p) is then computed as follows:

$$t_p = \frac{\bar{d}}{s_d} * \sqrt{N}$$

where,

$$s_d = \sqrt{\left(\sum_{i=1}^{N}(d_i - \bar{d})^2\right) \Big/ (N-1)}$$

For each measure of volatility, three changes are calculated: the change in period T2 from period T1, the change in period T3 from period T2, and the change in period T4 from period T3.

References

Bollen, N.P.B. (1998), A note on the impact of options on stock return volatility, *Journal of Banking and Finance* 22, 1181-1191.

Brown, S.J. and J.B. Warner (1985), Using daily stock returns: the case of event studies, *Journal of Financial Economics* 14, 3-31.

Chamberlain, T.W., C.S. Cheung and C.C.Y. Kwan (1993), Options listing, market liquidity and stock behaviour: some Canadian evidence, *Journal of Business Finance & Accounting* 20, 687-698.

Conrad, J. (1989), The price effect of option introduction, *Journal of Finance* 44, 487-498.

Damodaran, A. and J. Lim (1991), The effects of option listing on the underlying stocks' return processes, *Journal of Banking and Finance* 15, 647-664.

Damodaran, A. and M.G. Subrahmanyam (1992), The effects of derivative securities on the markets for the underlying assets in the United States: a survey, *Financial Markets, Institutions and Instruments* 1, No. 5, 1-22.

DeTemple, J. and D. Jorion (1990), Option listing and stock returns, *Journal of Banking and Finance* 14, 781-802.

Elfakhani, S. and M. Chaudhury (1995), The volatility effect of option listing: some Canadian evidence, *Quarterly Review of Economics and Finance* 35, 97-116.

Fedenia, M. and T. Grammatikos (1992), Options trading and the bid-ask spread of the underlying stocks, *Journal of Business* 65, 335-351.

Figlewski, S. and G. Webb (1993), Options, short sales, and market completeness, *Journal of Finance* 48, 761-777.

Kumar, R., A. Sarin and K. Shastri, (1998), The impact of options trading on the market quality of the underlying security: an empirical analysis, *Journal of Finance* 53, 717-732.

Skinner, D. (1989), Option markets and stock return volatility, *Journal of Financial Economics* 24, 61-78.

Sorescu, S.M. (1998), The effect of options on stock prices: 1973-1995, Working Paper, University of Houston.

Stucki, T. and W. Wasserfallen (1994), Stock and option markets: the Swiss evidence, *Journal of Banking and Finance* 18, 881-893.

Watt, W.H., P.K. Yadav and P. Draper (1992), The impact of option listing on underlying stock returns: the UK evidence, *Journal of Business Finance & Accounting* 19, 485-503.

Table 1

Option listings in the Netherlands

	Date of listing	Underlying stock	Type of listing		Date of listing	Underlying stock	Type of listing
1	05-04-1978	Philips	call	29	22-06-1988	Wessanen	call/put
2	same	Royal Dutch Shell	call	30	15-09-1988	Van Ommeren Ceteco	call/put
3	same	Unilever	call	31	28-02-1989	DSM	call/put
4	02-05-1978	Algemene Bank Nederland	call	32	27-06-1989	DAF	call/put
5	same	Amro Bank	call	33	21-08-1989	NMB	call/put
6	same	Nationale Nederlanden	call	34	20-06-1990	Polygram	call/put
7	22-05-1978	KLM	call	35	31-08-1990	CSM	call/put
8	26-06-1978	AKZO	call	36	same	Pakhoed	call/put
9	04-07-1978	Hoogovens	call	37	same	VMF Stork	call/put
10	01-03-1979	AKZO	put	38	23-10-1990	Fokker	call/put
11	same	Royal Dutch Shell	put	39	27-11-1990	Internatio-Müller	call/put
12	same	KLM	put	40	25-06-1991	VNU	call/put
13	same	Philips	put	41	02-07-1992	ACF Holding	call/put
14	28-01-1980	Nationale Nederlanden	put	42	same	Begemann Groep	call/put
15	same	Unilever	put	43	same	DEL Bols	call/put
16	same	Heineken	call/put	44	same	Borsumij Wehry	call/put
17	20-07-1981	Hoogovens	put	45	same	Getronics	call/put
18	same	Nedlloyd	call/put	46	same	Hagemeyer	call/put
19	19-04-1982	Algemene Bank Nederland	put	47	same	Hunter Douglas	call/put
20	same	Amro Bank	put	48	same	KBB	call/put
21	08-11-1982	Gist-Brocades	call/put	49	same	Nutricia	call/put
22	18-07-1983	Ahold	call/put	50	same	Stad Rotterdam	call/put
23	29-05-1984	Aegon	call/put	51	same	Volmac	call/put
24	31-01-1985	Robeco	call/put	52	same	VRG	call/put
25	21-01-1986	Amev	call/put	53	same	Wolters Kluwer	call/put
26	08-09-1986	Elsevier	call/put	54	22-09-1992	Océ van der Grinten	call/put
27	27-04-1987	KNP	call/put	55	07-07-1993	IHC Caland	call/put
28	13-05-1987	Bührmann-Tetterode	call/put	56	same	Nijverdal Ten-Cate	call/put

Source: 'Het Financieele Dagblad' and annual reports of the European Options Exchange.

Table 2

Abnormal returns surrounding simultaneous call and put option introductions

Day	AAR_t	t_i	$CAAR_k$	t_i	% positive
-20	-0.236	-1.24	-0.236	-1.24	45
-15	-0.067	-0.41	-1.393	-2.52**	36
-10	-0.324	-1.27	-1.717	-2.09**	45
-5	0.079	0.95	-2.550	-2.53**	45
-4	0.301	1.65*	-2.248	-2.06**	48
-3	0.059	-0.28	-2.190	-2.06**	42
-2	0.231	0.48	-1.959	-1.90*	48
-1	-0.377	-1.20	-2.336	-2.12**	42
0	0.047	0.15	-2.290	-2.04**	58
1	-0.459	-2.12**	-2.749	-2.44**	21
2	-0.235	-1.21	-2.984	-2.64**	45
3	-0.755	-3.31**	-3.739	-3.26**	27
4	-0.230	-1.10	-3.969	-3.41**	42
5	-0.106	-0.51	-4.075	-3.45**	42
10	0.014	0.68	-4.384	-3.17**	61
15	-0.125	-0.68	-5.545	-3.89**	39
20	-0.300	-1.58	-6.733	-4.58**	39

* = statistically significant at the 10% level
** = statistically significant at the 5% level

Table 3

Change in stock volatility around simultaneous call and put option introductions

Panel A: Average ratio of standardized total risk:

	T2/T1	T3/T2	T4/T3[1]
Mean (t-value):	1.215 (3.604**)	0.990 (-0.136)	1.166 (1.305)
Median:	1.139	0.951	1.093
% higher:	68.6%	42.8%	54.8%

Panel B: Average ratio of non-systematic risk:

	T2/T1	T3/T2	T4/T3[1]
Mean (t-value):	1.060 (0.366)	1.119 (1.461)	1.012 (0.221)
Median:	1.047	1.098	0.878
% higher:	57.1%	65.7%	32.2%

Panel C: Average systematic risk:

Period:	T1	T2	T3	T4[1]
Mean:	0.850	0.827	0.936	0.872
Median:	0.802	0.864	0.879	0.845
% higher:	-	40.0%	71.4%	48.4%

** = statistically significant at the 5% level

[1] Four stocks had to be excluded for this period because sufficient price data were not available.

Notes: Period T1: day -270 to day -146, Period T2: day -145 to day -21, Period T3: day +21 to day +145, and Period T4: day +146 to day +270. The days are calculated relative to the option introduction date.

Table 4

Change in stock volatility around call option introductions

Panel A: Average ratio of standardized total risk:

	T2/T1	T3/T2	T4/T3
Mean (t-value):	1.076 (0.922)	1.059 (0.017)	0.996 (-0.181)
Median:	1.023	0.973	0.970
% higher:	55.6%	33.3%	33.3%

Panel B: Average ratio of non-systematic risk:

	T2/T1	T3/T2	T4/T3
Mean (t-value):	0.977 (-0.185)	1.230 (0.441)	0.797 (-3.472**)
Median:	0.961	1.191	0.796
% higher:	33.3%	77.8%	11.1%

Panel C: Average systematic risk:

Period:	T1	T2	T3	T4
Mean:	0.964	0.889	1.366	1.168
Median:	1.166	0.923	0.965	1.230
% higher:	-	22.2%	88.9%	22.2%

** = statistically significant at the 5% level

Notes: Period T1: day -270 to day -146, Period T2: day -145 to day -21, Period T3: day +21 to day +145, and Period T4: day +146 to day +270. The days are calculated relative to the option introduction date.

Table 5

Change in stock volatility around put option introductions

Panel A: Average ratio of standardized total risk:

	T2/T1	T3/T2	T4/T3
Mean (t-value):	0.899 (-1.854)	1.150 (0.801)	0.868 (-2.116*)
Median:	0.910	1.033	0.868
% higher:	22.2%	66.7%	11.1%

Panel B: Average ratio of non-systematic risk:

	T2/T1	T3/T2	T4/T3
Mean (t-value):	0.952 (-1.184)	1.195 (0.967)	1.031 (0.613)
Median:	0.955	1.504	0.985
% higher:	44.4%	77.8%	44.4%

Panel C: Average systematic risk:

Period:	T1	T2	T3	T4
Mean:	0.933	1.084	0.916	0.861
Median:	0.760	0.803	0.914	0.762
% higher:	-	77.8%	44.4%	33.3%

* = statistically significant at the 10% level

Notes: Period T1: day -270 to day -146, Period T2: day -145 to day -21, Period T3: day +21 to day +145, and Period T4: day +146 to day +270. The days are calculated relative to the option introduction date.

Table 6

Change in stock volatility around simultaneous call and put option introductions analyzed for two subsamples

Panel A: Average ratio of standardized total risk:

	Period 1980-1989 (N=13)			**Period 1990-1993** (N=22)		
Period:	T2/T1	T3/T2	T4/T3	T2/T1	T3/T2	T4/T3[1]
Mean:	1.153	0.892	1.149	1.251	1.047	1.178
(t-value):	(2.29**)	(-1.94*)	(1.23)	(3.06**)	(0.64)	(1.05)
Median:	1.139	0.883	1.244	1.135	1.006	1.049
% higher:	69.2%	30.8%	53.8%	68.2%	50.0%	55.6%

Panel B: Average ratio of non-systematic risk:

Period:	T2/T1	T3/T2	T4/T3	T2/T1	T3/T2	T4/T3[1]
Mean:	0.999	0.972	1.077	1.095	1.205	0.965
(t-value):	(-0.71)	(-0.57)	(0.11)	(0,87)	(2.30**)	(-0.19)
Median:	1.047	0.830	0.965	1.036	1.222	0.841
% higher:	61.5%	38.5%	38.5%	54.5%	81.8%	27.8%

Panel C: Average systematic risk:

Period:	T1	T2	T3	T4	T1	T2	T3	T4[1]
Mean:	0.708	0.922	0.961	0.973	0.933	0.771	0.922	0.800
Mediaan:	0.802	0.970	0.968	1.051	0.863	0.627	0.764	0.768
% higher:	-	69.2%	69.2%	61.5%	-	22.7%	72.7%	38.9%

* = statistically significant at the 10% level
** = statistically significant at the 5% level

[1] Four stocks had to be excluded for this period because sufficient price data were not available.

Notes: Period T1: day -270 to day -146, Period T2: day -145 to day -21, Period T3: day +21 to day +145, and Period T4: day +146 to day +270. The days are calculated relative to the option introduction date.