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THE IMPACT OF OPTIONS DELISTING ON THE UNDERLYING STOCKS

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Abstract

This paper examines the effect of options delisting on the variance and the beta of the underlying stock using Canadian data. The contention is that whatever effects options listing have, such effects should reverse when options are delisted, our study provides independent and additional evidence that options listing (and delisting) are volatility-neutral. In particular, this paper investigates if there is a differential response to complete delisting, and limited market listing to some (but not all) exchanges, as part of a reallocation of options trading by the Trans-Canada Options Inc. It also researches the effect of listing limited to smaller versus a larger exchange market. Our results show that, on average, complete delisting of Canadian options reduces trading volume after the delisting event; however, it does not alter the variance or the beta of the underlying stocks. Nevertheless, when options are delisted from some exchanges, the market-adjusted variance increases. This effect can be driven by the reallocations that lead to options trading on a larger exchange. Also, the evidence on listings limited to a smaller exchange is consistent with the "liquidity explanation" of the volatility effect.

INTRODUCTION

Previous research has mainly considered the effect of options listing on the underlying stock. Theoretical analyses of the effect of options listing lead to conflicting conclusions, depending upon what assumptions are made (See the citations in Harris, 1989).

For instance, in the United States, the empirical evidence on this issue is mixed. Nathan Associates (1974) and CBOE (1975, 1976) find options listing to stabilize stock prices. Klemkosky and Maness (1980) find no pronounced tendency for either total risk or systematic risk. Trennepohl and Dukes (1979), Whiteside, Dukes and Dunne (1983), Conrad (1989) and Skinner (1989) also find no significant effect on systematic risk. The last two studies find variance to decline on average. However, Harris (1989) reports a modest but a significant increase in standard deviation of the S&P 500 stocks since the start of trading in index futures and options. For the Canadian market, Chamberlain, Cheung and Kwan (1993) report no significant effect of options listing on either the volatility (measured by variance), the trading volume or the liquidity of the underlying stock. On the other hands, Elfakhani and Chaudhury (1995) use distribution-free non-parametric tests to find that, on average, Canadian option listings reduced the variance as well as the beta of the optioned stocks during the early years of trading (1970's). A comparison of simultaneous listing of call and put options to listing of call options only reveals that put options reduce the beta as well as the variance of the underlying stock.

The potential effect of volatility is also of special importance to the Canadian institutional investors, who represent the major participants in the Canadian option market (Mandron, 1988a,b). The Canadian regulatory authorities, such as the Federal Department of Insurance, closely supervise the option market transactions of the institutional investors. The Canadian financial institutions also face regulations on the type of stocks they can hold in their portfolio.

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If options destabilize the stocks, regulators may put further restraints on the institutional investors' participation in the Canadian option market. Many financial institutions already consider the legal environment to be too restrictive for the development of a deeper option market in Canada.[1]

This paper examines the effect of options delisting in Canada on the variance and the beta of the underlying stock. The study of options delisting provides an alternative means of testing the effect of options listing. Whatever effects the listing of options had on the underlying stock, such effects might reverse once the options are delisted. One implication is that if options listing destabilizes the stock, the delisting should restore the stability, and vice versa. Of course there could be many reasons why a stock option is delisted completely or delisted in one market and relisted on another market. Possible reasons include geographical preferences, opportunities for speculation in a particular market, or the desire of the three Canadian exchanges to have a respectable share of option trading. This paper, however, investigates the effect of delisting on the stability of the price of the underlying stock. To the authors' knowledge, the existing literature does not provide any direction with regard to the volatility effect of options delisting either in Canada or elsewhere.

Furthermore, Whiteside, Dukes and Dunne (1983) note that 90 percent of the U.S. options listing lead to a lower beta in 1981 compared to 50 percent in 1973, the first year of CBOE listings. This evidence suggests that as time passes, market participants may find novel use of listing events and new option trading strategies. One advantage of testing the volatility effect using the delisting events is that any bias related to the market's learning experience is avoided. This is because usually the date of delisting is much later than the date of original listing.

This paper examines the volatility effect of complete delisting of options. A complete delisting is defined as a case where options on the stock once delisted, are never relisted on any Canadian exchange within 500 trading days of the delisting date. The case where options are delisted from some, but not all, Canadian stocks exchanges is also examined. Partial listings, announced by the options clearing corporation (Trans-Canada Options Inc.), present a reallocation of options trading among the three exchanges (Toronto, Montreal, and Vancouver). In this case, an option, which was listed on two (three) exchanges, is now listed on one exchange. Thus, limiting option listing restricts the option market coverage for the stock and concentrates options trading on fewer (mostly one) exchanges. As such, if the volatility effect of options listing is driven by changes in the volume or the liquidity of the underlying stock, one should witness a volatility effect of partial listing that would result in volume and liquidity changing materially.

Moreover, this paper investigates if there is a differential response to the type of reduced option market coverage. It also identifies cases where the market coverage changes to a larger market (for example, from Vancouver Stock Exchange to Montreal Exchange or Toronto Stock Exchange) and where the market coverage changes to a smaller market (for example, from Toronto Stock Exchange to Montreal Exchange or Vancouver Stock Exchange). If there is a differential response between these two types of reallocations, it should provide a better understanding of how options trading affect the underlying stock. Furthermore, previous research (Skinner, 1989; Conrad, 1989; Chamberlain, Cheung, and Kwan, 1993; Elfakhani and Chaudhury, 1995; and Kim and Young, 1991) investigate the cross-sectional variation in option listing effect. Thus, the cross-sectional variation in our sample of options delisting is also examined.

Our results show that on average, complete delisting of Canadian options reduced trading volume after the delisting; however, it has no impact on the variance or the beta of the underlying stocks. Nevertheless, when options are delisted from some, but not all, exchanges, the market-adjusted variance increases. Also, consistent with the "liquidity explanation" hypothesis, smaller optioned stocks are likely to experience a smaller decline or a larger increase in variance following partial listing to a smaller exchange.

The plan for the rest of this paper is as follows. First, data sampling, hypotheses that are tested and the empirical methods employed to test the hypotheses are described. Empirical results are presented next, followed by a summary of the findings and some concluding remarks.

DATA AND METHODOLOGY

Sample Selection

Option trading on the Canadian exchanges (Toronto, Montreal and Vancouver) is now coordinated by Trans-Canada Options Inc. (TCO), the common clearing corporation jointly owned by the exchanges. The TCO provides the information about option listing, delisting and relisting on a total of 155 underlying stock series from

September 1975 through June 1990. Of these, the number of stocks that have options delisted is only 41. The first delisting occurs at least four years from the initial listing date.[2] These 41 events represent the whole population for the 1975-1989 period. Obviously, the population size may be small to draw conclusive statistical inferences. Therefore, and consistent with McCloskey and Ziliak (1996), our final conclusions emphasize the substantive significance of the delisting events more than their statistical significance. This approach is also consistent with their argument that large sample size is more likely to lead to statistically significant results, which may compromise the power of the statistical tests. Thus, the emphasis is on the importance and implications of delisting to policy makers and investors rather than on statistical significance only.

Not all 41 options delisting, however, are independent. This is due to name changes, mergers and restructures. Thus, in these particular cases double sampling should be avoided. Also, the daily return data for some underlying stock series are not available on the Toronto Stock Exchange-University of Western Ontario database. These stocks are dropped during the missing dates. All events after March 31, 1989, are dropped since the data series for our sampling interval of 100 trading days after the event date was not available.[3] These optioned stocks are large and well known. Therefore, thin trading problems are minimal. Still as a precautionary measure, all events on either side of which there are less than 80 daily returns are dropped. Also, to lessen the influence of possible outliers, all events where the after-to-before market-adjusted variance ratio (to be discussed shortly) is greater than 10 or less than 0.1 are also excluded. So, these filters result in a final sample of 28 delisting events. Of these, 14 events are classified as complete delisting, and the remaining 14 are classified as partial listing as they are delisted in some market(s) and remained listed in another market. In the partial listing group, seven cases of options listing are limited to a larger exchange, and seven cases of listing are limited to a smaller exchange.

Measures of Volatility

For each of the 28 optioned stocks, two alternate measures of volatility are estimated -- the daily return variance and the market model beta. Note that the volatility of the optioned stocks may change in response to contemporaneous change in the market volatility. Thus, the variance of the stock is adjusted by that of the market index.

If the optioned stocks are relatively large, and thus weigh heavily in the market index, as they do in the TSE 300 index for example, the use of a value-weighted index may bias the findings in the direction of no change in adjusted variance. On the other hand, the well-known anomalous behavior of small stocks may unduly influence the results. This can occur if an equally-weighted market index is used to adjust the variance of the optioned stocks, because these stocks are usually large and well known. This problem is potentially more acute in Canada due to the preponderance of small stocks in the Canadian market. Moreover, since theoretical arguments favor the use of a value-weighted index in estimating beta, it would be preferable, for the sake of consistency, to use a value-weighted index instead. As a compromise, the TSE/Western value-weighted (VW) index of all TSE stocks is used, since it is broader than the TSE 300 value-weighted index. Thus, the influence of the large stocks is weakened. Also, unlike its equally-weighted counterpart, the VW is not overly influenced by most small stocks in the Canadian market.[4]

For each stock, the adjusted variance is estimated twice, one time for the period before the event date, and a second time for the period after the event date. Both variances are deflated by the market variance during the corresponding sampled period. A market-adjusted variance ratio (or simply the adjusted variance ratio) is then formed using the contemporaneous variance estimates of the TSE/Western value-weighted market index returns. If option delisting increases (reduces) the volatility net of the market-wide changes relative to an average non-optioned stock, this ratio would be greater (less) than 1.0.

Hypotheses Tested

Our main goal in this paper is to examine whether complete options delisting or partial listing by themselves can influence the volatility (variance and beta) of the optioned stocks. Toward this end, the following two hypotheses are tested:

Hypothesis 1: On average, there is no effect for option delisting (or limited listing) on the variance of the optioned stock.
Hypothesis 2: On average, there is no effect for option delisting (or partial listing) on the beta of the optioned stock.

Failure to reject Hypotheses 1 and 2 does not necessarily rule out a volatility effect for the individual stocks. Some may experience heightened volatility, while for others volatility may decrease.[5] The average effect may thus be volatility-neutral. Therefore, the two following hypotheses are tested for each optioned stock:

Hypothesis 1A: There is no effect for option delisting (or partial listing) on the variance of the optioned stock.
Hypothesis 2A: There is no effect for option delisting (or partial listing) on the beta of the optioned stock.

Many studies examine the effect of option listing on stock volatility. However, only a few (Skinner, 1989; Conrad, 1989; Kim and Young, 1991; Chamberlain, Cheung, and Kwan, 1993; and Elfakhani and Chaudhury, 1995), also link cross-sectional variation in option listing effect to variables such as size, volume, bid-ask spread and pre-event beta of the underlying stock, and time. With respect to the volatility effect of (first ever) option listing, Skinner (1989) reports a statistically significant positive association between the variance change and the volume change around option listing. He also shows a negative, but insignificant, relationship between the variance change and the size of the stock (as a proxy for liquidity). Chamberlain, Cheung, and Kwan (1993) report a statistically significant positive relationship between the liquidity of the stock and the change in its volume around Canadian options listing. The negative relationship between liquidity and variance changes was also significant when the variables are adjusted for market effect.

One potential benefit of a cross-sectional analysis of the variation in the volatility effect is it may enhance our understanding of how option delisting affects the stock volatility. A prominent hypothesis in this regard is the "liquidity explanation" hypothesis (Skinner, 1989). According to the "liquidity explanation" hypothesis, options listing reduces stock volatility by enhancing the liquidity (as measured by the bid-ask spread) of the market for the underlying stock. Market makers in the stock reduce the bid-ask spread due to the flow of information-based trading to the options market, and greater trading activities by hedgers and arbitragers.

For options delisting, one would, however, expect a reversal of the above effect. Thus, following options delisting, liquidity should worsen (higher bid-ask spread) and stock volatility should accordingly go up. Since liquidity as measured by the bid-ask spread is empirically inversely (directly) related to firm size (stock return variance) as reported by Amihud and Mendelson (1986), the smaller optioned stocks are likely to experience a smaller decline or a larger increase in variance following delisting, if other things are equal and the "liquidity explanation" is important.[6] Accordingly, the following hypothesis of cross-sectional variation in the effect of option delisting or partial listing are tested:

Hypothesis 3: The variance effect of option delisting (or partial listing) is cross-sectionally negatively related to pre-event liquidity.

A support for Hypothesis 3 would amount to an indirect support for the "liquidity explanation" hypothesis of the effect of option delisting (or partial listing). While the "liquidity explanation" hypothesis does not concern the market-related risk, the following hypothesis is also tested for the sake of completeness:

Hypothesis 4: The beta effect of option delisting (or partial listing) is cross-sectionally negatively related to pre-event liquidity.

Methodology

Hypothesis 1 relates to the average effect of option delisting on the variance of the underlying stocks. To figure out the statistical significance of the variance effect on average, the Wilcoxon signed-rank test (two-sided at the 5 percent level) is applied separately to the sub-samples of unadjusted variance ratios. Under the null hypothesis (1) of no variance effect on average, the adjusted variance ratios would have a median value of 1.0 in each sample.

Like any other average, the average variance effect could be misleading, which leads to testing of Hypothesis 1A for each stock. If Hypothesis 1A holds for a delisted option, its true adjusted variance ratio would be 1.0. If stock returns are normally distributed, an F-test can then be undertaken to determine if the adjusted variance ratio for a given optioned stock is significantly different from 1.0.

Skinner (1989), however, shows that the F-distribution is not a proper empirical model for the variance ratios. Therefore, Moses test (Daniel, 1978, pp. 97-101) of a change in variance is also performed. Like most non-parametric tests, the Moses test neither assumes nor requires normality; also, it does not depend on the assumption

of the populations under consideration having known or equal location parameters (mean, median). This feature is desirable since previous research (e.g., Conrad, 1989, Kim and Young, 1991, and Stucki and Wasserfallen, 1994) suggests a possible change in mean return following option listing. Thus, in this paper both F-test and Moses test results are reported for Hypothesis 1A.

To test Hypotheses 2 and 2A, the beta estimates for the optioned stocks are needed. For each delisted option, the before-delisting (or partial listing) beta (b_i) and post-delisting (or partial listing) beta ($d_i=b_i+c_i$), and their difference, or change in beta (c_i), are estimated from the following regression equation 1:

Equation 1

$$R_i(t) = a_i + b_i\, R_m(t) + c_i[\, R_m(t)\, D(t)] + e_i(t)$$

where $t = -T_1, ..,-1,0,1, .., T_2$, with *0* as the delisting event date, T_1 and T_2 are the last available trading days before and after the event date within the 100-day sampling interval; $R_i(t)$ and $R_m(t)$ are the natural logarithms of one plus the rate of return on the stock and the market respectively; $D(t)$ is a dummy variable that assumes a value of one for $t = 1, 2, .., T_2$ and *0* otherwise; and $e_i(t)$ is an i.i.d. error term.

In the existing literature, the beta effect of option listing is tested by comparing the pre-listing to the post-listing betas. Using similar method in our paper, if option delisting, or partial listing, increases (reduces) non-diversifiable risk, c_i would be positive (negative). A t-test can determine if the change in beta is statistically significant at the two-sided 5 percent level.

Lastly, Hypotheses 3 and 4 relate to a "liquidity explanation" of the volatility effect of option complete delisting (or partial listing). While the proper definition of the liquidity of a stock is debatable, a commonly used indicator of liquidity is the stock's bid-ask spread. Unfortunately, bid-ask spread data was not accessible. So, following Skinner (1989), firm size is used as a proxy for the liquidity of the optioned stock. One complication that arises in testing this hypothesis is that the trading volume of the stock may change following option delisting. Volume is known empirically to be positively related to both stock return and liquidity. If the "liquidity explanation" hypothesis is important in explaining the cross-sectional variance (and beta) effect of option delisting (or partial listing), and if the effect of volume is controlled, one should expect a negative association between firm size and the post-delisting (partial listing) to pre-delisting (partial listing) variance ratio. To this end, the following multiple regression equation 2 is estimated:

Equation 2

$$(\textit{Measure of change in volatility})_i = a + b \times ln[(\textit{post-delisting market adjusted volume} / \textit{pre-delisting market adjusted volume})_i] + c \times ln(size_i) + e_i$$

where the measure of change in volatility is either the ratio of post-delisting market adjusted variance to pre-delisting market adjusted variance, or the pre-delisting beta subtracted from the post-delisting beta.[7] If the slope coefficient '*c*' in the above equation is positive and statistically significant (in a t-test set at the 5% level), then the volatility effect of option delisting (or partial listing) can be interpreted by the cross-sectional "liquidity explanation."

In regression (2), the size of a stock is its market capitalization measured at the end of the year previous to the call option delisting. This data is available from the TSE/Western database. Monthly stock volume the 24 months before and the 24 months after the option delisting event are collected from various issues of the Toronto Stock Exchange, Montreal Exchange, and Vancouver Stock Exchange Reviews. Unfortunately, our volume and size data is complete for only 9 of the 14 complete delistings and 13 of the 14 partial listings in the sample. One problem with running the Ordinary Least Squares (OLS) on regression (2) in a small sample such as ours is the potential influence of extreme outliers that may make our conclusions unreliable. Thus, the rank-based regression (RR) method of the statistical software MINITAB is used.[8] While the OLS method minimizes the sum of squared residuals, the RR method minimizes a linear function of the residuals with weights depending upon the ranks (rather than values) of the residuals. Hence, the RR parameter estimates are less sensitive to extreme outliers.

EMPIRICAL RESULTS

Adjusted Variance Results

Table 1 reports the mean, the median, and the number and the percent of firms that had increases or decreases in the market-adjusted variance ratio, for all 4 groups (complete delisting, partial listing, listing limited to a smaller exchange, and listing limited to a larger exchange). The table also reports the results of the F-test, Moses-test, and the two-tailed Wilcoxon signed-rank test for the adjusted variance ratio.

The table shows that options delisting and partial listing tend to increase the variance of the underlying stock. The average increase is about 9 (17) percent for a complete delisting (partial listing). The increase in variance is the highest (32 percent) for the case of listing limited to a larger exchange. Moreover, there is virtually no change in variance when limited listing leads to concentration in a smaller exchange. Listing limited to a smaller exchange is also the only event that leads to less than half of the stocks experiencing an increase in variance. In contrast, listing limited to a larger exchange experiences the most frequent incidence (86 percent of the relevant stocks) of a variance increase.

TABLE 1
Tests of Hypotheses 1 And 1a: Variance Ratios For Firms With Optioned Stocks Around The Date of Complete And Partial Listing of Such Options.

The null hypothesis 1 states that, on average, option delisting has no variance effect on the underlying stock, and is tested using the Wilcoxon signed-rank non-parametric test (two-sided at the 5 percent level). The null hypothesis 1A states that option delisting has no variance effect on individual stocks, and is tested using F-test and Moses non-parametric test. The sampling period is September 1975 to March 1989.

			Listing Limited to:	
Event	**Complete Delisting**	**Partial Listing**	**Smaller Exchange**	**Larger Exchange**
Number of firms with data available	**14**	**14**	**7**	**7**
Adjusted Variance Ratios: Estimated market-adjusted variance for period after options delisting, or following option partial listing, divided by estimated market-adjusted variance before				
Mean	1.091	1.168	1.016	1.321
Median	1.075	1.197	0.988	1.273
Number(%) of firms with:				
adjusted variance increase	8(57)	9(64)	3(43)	6(86)
adjusted variance decrease	6(43)	5(36)	4(57)	1(14)
Two-tailed Wilcoxon signed-rank probability for change in adjusted variance	0.670	0.049	0.813	0.031

Number(%) of firms with significant (at 5 percent level):	F test	Moses test	F test	Moses test	F test	Moses test	F test	Moses test
adjusted variance increase	2(14)	0(0)	2(14)	0(0)	0(0)	0(0)	2(29)	0(0)
adjusted variance decrease	2(14)	0(0)	1(7)	0(0)	1(14)	0(0)	0(0)	0(0)

The change in the variance for the average optioned stock is not, however, statistically significant in the Wilcoxon test, and thus Hypothesis 1 that, on average, there is no variance effect for options delisting cannot be rejected. The average effect of an increase in variance following the decision of partial listing is, however, statistically significant. The significance of the partial listing effect is driven mainly by the statistically significant effect of the subgroup of options listing coverage limited to a larger exchange. In fact, the average effect is not significant for the listing limited to a smaller exchange.

The F and Moses tests of Hypothesis 1A for individual stocks show quite low to no evidence of a statistically significant change in adjusted variance. As expected, the non-parametric Moses test shows a lower (zero) incidence of a significant change in adjusted variance than the F-test.

Beta Results

Table 2 is similar to Table 1 with one difference; it focuses on the change in beta using the Wilcoxon test and the t-test. Table 2 displays a decline in the systematic risk following a complete delisting of options. Although 64 percent of the relevant stocks experience a drop in systematic risk, Wilcoxon test shows that the average effect, however, is not statistically significant. Thus, we fail to reject Hypothesis 2.

TABLE 2
Tests of Hypotheses 2 And 2a: Betas For Firms With Optioned Stocks Around The Date of Complete And Partial Listing of Such Options.

The null hypothesis 2 states that, on average, option delisting has no beta change effect on the underlying stock, and is tested using the Wilcoxon signed-rank non-parametric test (two-sided at the 5 percent level). The null hypothesis 2A states that option delisting has no beta change effect on individual stocks, and is tested using t-test. The sampling period is September 1975 to March 1989.

			Listing Limited to:	
Event	**Complete Delisting**	**Partial Listing**	**Smaller Exchange**	**Larger Exchange**
Number of firms with data available	**14**	**14**	**7**	**7**
Change in beta: estimated beta for period after options delisting, or following option partial listing, minus estimated beta before				
Mean	-0.017	0.101	0.001	0.200
Median	-0.116	0.164	-0.125	0.357
Number(%) of firms with:				
beta increase	5(36)	8(57)	3(43)	5(71)
beta decrease	9(64)	6(43)	4(57)	2(29)
Two-tailed Wilcoxon signed-rank probability for change in beta	0.542	0.426	0.938	0.109
Number(%) of firms with significant (in t-test at 5 percent level):				
beta increase	1(7)	1(7)	1(14)	0(0)
beta decrease	2(14)	2(14)	2(29)	0(0)

The partial listing systematic risk (beta) results are similar to the variance results; however, the average effect of beta changes lacks statistical significance as shown by the Wilcoxon test. While a limited listing to a larger exchange continues to show the largest average increase (0.20) and the highest incidence (71 percent of the relevant stocks) of a beta increase, the Wilcoxon test of Hypothesis 2 of no average effect cannot be rejected at the conventional 5 percent level.

Like the case of variance, the individual t-test results provide very little evidence of a significant change in beta. Thus, also Hypothesis 2A cannot be rejected. The lack of statistical significance in individual cases may have been caused by the lack of control for other stock-specific factors that can affect stock variance or beta.

TABLE 3
Summary Statistics on The Relationship Between Size, Change in Volume And Volatility of The Underlying Stock Around Complete Delisting And Partial Listing of Options

The market-adjusted variance ratio is the post-delisting to pre-delisting variance ratio deflated by the variance of the market index during the corresponding sampling period. The market-adjusted share volume ratio is the post-delisting (partial listing) to pre-delisting (partial listing) share volume ratio deflated by the trading volume of the market index during the corresponding sampling period. The size of a stock is measured by its market capitalization at the end of the year previous to the call option delisting (partial listing). Change in beta is post-delisting (partial listing) beta minus pre-delisting (partial listing) beta. The sampling period is September 1975 to March 1989.

			Listing Limited to:	
Event	**Complete Delisting**	**Partial Listing**	**Smaller Exchange**	**Larger Exchange**
Number of firms with data available	**9**	**13**	**7**	**6**
Average:				
Size (in billion dollars)	0.739	1.320	1.560	1.040
Market-adjusted share volume ratio	0.675	0.844	0.918	0.757
Correlation coefficient between:				
Size and market-adjusted variance ratio	0.050	0.036	0.445	0.239
Market-adjusted share volume ratio and market-adjusted variance ratio	0.200	-0.556	-0.797	0.452
Size and change in beta	0.177	0.218	0.325	0.619
Market-adjusted share volume ratio and change in beta	0.624	-0.406	-0.474	0.002
Size and market-adjusted share volume ratio	0.257	-0.149	-0.243	-0.391

Cross-Sectional Variation of Volatility Effect

In analyzing the adjusted variance and beta results, different stocks' responses (direction- and magnitude-wise) to the event of complete delisting or partial listing are documented. It is also clear that there is a difference in the volatility effect between listing limited to a larger exchange and listing limited to a smaller exchange. While not all these responses are statistically significant, the results suggest a possible cross-sectional variation in the effect of options delisting.

Table 3 presents summary statistics for the size and market-adjusted volume variables, which is used in the cross-sectional analysis for all four (delisting and partially listed) groups. As expected, the optioned stocks in our sample are large (the average market capitalization varies from 739 million dollars to more than a billion dollars). The table shows that the stocks, options on which are completely delisted, are considerably smaller (average size: 739 million dollars) than those with partial listings (average size: 1.32 billion dollars). In turn, stocks with options reallocated to a larger exchange are relatively small (1.04 billion dollars) compared to other stocks (with an average size of 1.56 billion dollars) with options reallocated to a smaller exchange.

Irrespective of the nature of delisting, average figures for volume ratio show that stocks experience a reduced trading activity on a market-adjusted basis. The average drop in volume is high for the complete delisting (32.5 percent) and the listing limited to a larger exchange (24.3 percent) groups. Incidentally, these are also the sub-samples with relatively small capitalization of the underlying stocks. Hence, the evidence of a drop in trading volume following delisting conforms with the previous studies, all of which have reported an increase in stock trading around first ever option listing.

The simple bivariate correlation coefficients in Table 3 lend support to a positive association between size and change in total risk, and size and change in non-diversifiable risk. The association between change in volume and the two risk measures is, however, less clear cut. Also, there is a positive (negative) relationship for complete delisting (partial listing) and listing limited to a larger (smaller) exchange. Similar relationships exist between size and market-adjusted share volume ratio. These bivariate associations may be affected by the non-negligible magnitude of correlation between size and change in volume. Thus, the bivariate relationships between size and change in risk should further be investigated controlling for change in volume and vice versa.

In Table 4, the results for the rank-based regression (RR) equation (2) are presented. Recall that using the RR regression, the problem that few outliers can drive the results in our small sample can be avoided.

According to the F-tests, neither the regression nor the coefficient estimates are significant for any of the delisting and partial listing types. Considering the sign of the slope coefficients, the consistently positive bivariate relationship between size and change in beta remains even after controlling for change in volume, thus rejecting Hypothesis 4. The relationship between size and change in variance turns, however, into a negative one for the group of options listing limited to a smaller exchange, and the partial listing group. On the other hand, the cross-sectional variation in the adjusted variance effect of listing limited to a smaller exchange is consistent with the "liquidity explanation" of the effect of options listing.

The liquidity explanation, however, is supported neither by the cross-sectional variation in the complete delisting group, nor by listing limited to a larger exchange. If complete delistings are primarily caused by the lack of interest by the investor in the option, one would not expect much of a change in liquidity following options delisting. If limiting options listing to a larger exchange is motivated by greater investor's interest in the larger market, it may actually enhance rather than lessen liquidity.

SUMMARY AND CONCLUSIONS

In this paper the effect of the Canadian options delisting on the volatility of the underlying stocks during the September 1975 to March 1989 period has been examined. Since any volatility effect of options listing is expected to be reversed when options are completely delisted, our study provides independent and additional evidence (to Chamberlain, Cheung and Kwan, 1993, and Elfakhani and Chaudhury, 1995) that option listing is volatility-neutral. Nevertheless, and consistent with McCloskey and Ziliak's (1996) argument that researchers should focus more on substantive than statistical significance, the economic significance of our results should be more relevant than their statistical significance.

In this context, it is found that the complete delisting of options had no significant impact on either the variance or the beta of the underlying stock. As such, the heightened concerns on the part of Canadian regulators about derivatives trading (Star Phoenix, June 10, 1994, p. C15) may be unwarranted at least for equity options.

Our results, however, suggest that when options are partially listed from some, but not all, the exchanges (as opposed to complete delisting), the variance of the underlying stock increases although the beta remains unaffected. This effect is particularly strong and consistent when partial listing leads to coverage on a larger compared to a smaller exchange.

TABLE 4
Cross-sectional Rank Regression Results for Complete and Partial Options Listing

Regression equation:

$$(\textit{Measure of change in volatility})_i = a + b \times ln[(\textit{post-delisting market-adjusted volume} / \textit{pre-delisting market-adjusted volume})_i] + c \times ln(size_i) + e_i$$

The variance effect of option delisting (or partial listing) is cross-sectionally negatively related to pre-delisting liquidity. The null hypothesis 3 states that the variance effect of option delisting (or partial listing) is cross-sectionally related to pre-delisting liquidity. The null hypothesis 4 states that the beta effect of option delisting (or partial listing) is cross-sectionally related to pre-delisting liquidity. The sampling period is September 1975 to March 1989.

Measure of change in Volatility	**Coefficient estimates*** **(standard error)**			**F-statistic****
	a	**b**	**c**	
A. Complete delisting (9 cases)				
Post-delisting adjusted variance / Pre-delisting adjusted variance	-0.530 (13.030)	0.100 (0.568)	0.013 (0.643)	0.00
Post-delisting beta - Pre-delisting beta	-2.160 (12.140)	0.848 (0.529)	0.114 (0.599)	1.43
B. Partial listing (13 cases)				
Post-partial listing adjusted variance / Pre-partial listing adjusted variance	2.887 (6.352)	-0.353 (0.275)	-0.118 (0.304)	0.42
Post-partial listing beta - Pre-partial listing beta	-3.340 (12.740)	-0.547 (0.552)	0.157 (0.610)	0.88
C. Listing limited to smaller exchange (7 cases)				
Post-partial listing adjusted variance / Pre-partial listing adjusted variance	0.870 (13.510)	-0.613 (0.418)	-0.036 (0.642)	1.11
Post-partial listing beta - Pre-partial listing beta	-14.120 (30.840)	-0.799 (0.953)	0.651 (1.464)	0.89
D. Listing limited to larger exchange (6 cases)				
Post-partial listing adjusted variance / Pre-partial listing adjusted variance	-6.045 (6.013)	0.432 (0.332)	0.331 (0.292)	1.16
Post-partial listing beta - Pre-partial listing beta	-28.050 (15.840)	0.701 (0.875)	1.379 (0.770)	1.28

*The constant does not have its usual meaning; hence no statistical test of significance was undertaken for the constant.
**The F-statistic tests the hypothesis that b=c=0.

Consistent with the literature on the effect of options listing, there is a decline in stock volume following options delisting. Analyzing cross-sectional variation in the volatility effect of options partial listing, there is a clear difference between the two types of limited coverage of options listing. The evidence on listing limited to a smaller exchange is consistent with the hypothesis that option listing enhances the liquidity of the market for the underlying stock, thus providing a stabilizing influence on the stock return variance. The same, however, cannot be said about the case of listing limited to a larger exchange.

Finally, one limitation of this study is the few delisting events that have occurred in Canada. To handle the small sample problem, however, non-parametric tests and rank-based (rather than value-based) regressions are used. Another limitation is that this study does not look at the reasons for delisting. Nevertheless, future research with a larger set of delisting events in Canada or elsewhere and an examination of factors leading to delisting are conceivably desirable.

ENDNOTES

1. See Mandron (1988b, p.16) and the citations therein. Up until the end of 1980, option transactions, other than issuing covered-calls on the part of the institutional investors, are considered improper by various regulators. Since then, the buying of protective puts have become acceptable to the regulators. Nevertheless, naked put sales and buying calls are still governed by the "prudent man rule."

2. Hatch (1983, p. 402) mentions that option trading began around mid-September 1975. The first delisting took place at least four years after that. In fact, most delistings (or partial listing) occurred in the 1980's.

3. By limiting the window of delisting period to 100 days is one way of reducing the effect of other noisy factors surrounding the event period.

4. The results where the equally-weighted market index was used to adjust the variance of the stock and estimate its beta vary somewhat from when the value-weighted index is used instead.

5. Ma and Rao (1988) show that whether option listing would lead to an increase or decrease in the volatility of the underlying stock depends on the pre-listing mix of informed versus uninformed traders in the stock.

6. Actually, for the U.S. options listing, Fedenia and Grammatikos (1992) find that the spread increases (decreases) for stocks that are more (less) liquid to start with.

7. We adjust for a contemporaneous change in the volume for the market as a whole since the market volume has increased by 52 percent on average around the 22 options delisting (or partial listing) events.

8. Since the ranks are invariant to a constant shift, there is no natural interpretation of the estimated intercept term in the regression equation. Depending on whether the distribution of the error term is symmetric, the intercept estimate will differ. We use the default assumption in MINITAB that the error distribution is symmetric, although not necessarily normal.

   The significance of an individual regressor is assessed by testing the restriction that its coefficient is zero. Of the two alternatives available in MINITAB to test the restrictions, we used the default, which calculates the following statistic with a limiting F distribution:

   $$F = [(D_R - D_U) \times J] / (0.5 \times TAU)$$

   where D_R (D_U) is the dispersion of the restricted or limited (unrestricted or full) regression model, J is the number of restrictions, and TAU is the rank-based regression scale estimate. For an extensive discussion of the rank-based regression method, see Hettmansperger (1984).

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