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Listing of Put Options: Is There Any Volatility Effect?

Mohammed Chaudhury
University of Saskatchewan and McGill University
Said Elfakhani
University of Saskatchewan

This paper examines the effects of Canadian put option listings on the volatility of the underlying stocks. It also tests whether the "liquidity hypothesis" can explain the cross-sectional effect, if any, of option listing. According to this hypothesis, option listing enhances the liquidity of the market for the underlying stock, and should lead to a lower variance for the optioned stock. Our results show that Canadian put options are not redundant when it comes to influencing the volatility of the underlying stocks. The evidence shows a decrease in the beta risk following the listing of put option. The evidence also shows a decrease in the variance following earlier put option listings. Cross-sectionally, we find indirect support for increased liquidity leading to a variance-stabilization effect.

I. Introduction

Lacking complete markets, options can be useful in attaining efficiency in competitive equilibrium by expanding the set of contingencies covered by the marketed assets (Ross, 1976). However, this gain in efficiency can be jeopardized if the introduction of options makes the underlying assets more volatile. While in recent time the availability of exchange-traded and over-the-counter options has soared, and a significant body of option valuation literature has emerged, the volatility implications of options listing are not yet clearly understood.

Theoretical analyses of the effect of options listing on the volatility of the underlying asset led to conflicting conclusions, depending upon what assumptions were made (Harris, 1989). The empirical evidence on this in the U.S. markets is mixed. Also, it focuses on the volatility effect of only the initial exchange-listing of options. These are either call options alone or simultaneous listings of call and

Direct all correspondence to: Said Elfakhani, College of Commerce, University of Saskatchewan, 25 Campus Dr., Commerce Bldg., Saskatoon, Saskatchewan, Canada S7N 5A7.

put options.[1] On the other hand, there is not much empirical work on the volatility effect of put options (later) listing, especially in the Canadian markets. This paper attempts to fill this gap.

This paper uses a sample of Canadian put option listings to examine if a later put option listing is volatility-neutral. The volatility effect of put options is of special relevance to the Canadian institutional investors. Option transactions on their part, other than writing covered calls or buying protective puts, are not deemed prudent by the Canadian regulatory authorities (Mandron, 1988a and 1988b). A risk-stabilization effect of put option listing would benefit stock market participants, and would thus justify and promote an expanded base of stocks with listed put options. Perhaps more important, if put option listing destabilizes the underlying stock, the pressure to further regulate derivatives trading in general and the use of derivatives by institutional investors in particular may intensify.[2] Hence, the growth of a deeper option market in Canada may thus be adversely affected. This issue is particularly important given the growing practice of "portfolio insurance" during the last decade that has also been criticized by various corners for emphasizing stock market volatility.

Chamberlain, Cheung, and Kwan (1993) find that neither the volatility effect nor the volume and listing effects of the initial stock option listings in Canada to be statistically significant. These initial listings are, however, either call options alone or simultaneous listings of call and put options. Thus, they do not reveal the volatility effect of just put option listing.

Our results show that a later put option listing is not volatility-neutral, and therefore a put option is not empirically redundant. There is proof that the market-related risk (beta) of the optioned stock is reduced following a put option listing. There is also evidence of a reduced variance effect following the put option listings during the early stage of the Canadian options market. A cross- sectional examination of the listings lends indirect support to the hypothesis that an enhanced liquidity following the put option listing leads to a variance-stabilization effect.

A. *Literature Review*

Options are often viewed as redundant securities since in theory their payoff can be duplicated using the underlying asset and the risk-free asset. If the listing of a put option on an exchange offers investment opportunities that were previously unavailable, the listing can affect the risk and return of the underlying asset (see, for example, Detemple and Selden, 1991). The risk and return of the optioned stock may change as traded options reveal information about future trading intentions of investors that are not conveyed by synthetic options (Grossman, 1988), to the extent trading in listed options invites speculators (Stein, 1987), or because of the possible impact on the liquidity of the stock (see Skinner, 1989, for a discussion). The listing of a put option also may affect skewness of the optioned stock's return distribution especially in the presence of short selling constraints (Watt, Yadav, and Draper, 1992).

In prior research, Conrad (1989) and Kim and Young (1991) note a permanent increase in price following the first-ever option listing on a stock. They find

that a later put option listing (the listing of a put option on a stock that has prior call option listing) in the U.S. does not affect the price of the underlying stock. Long et al. (1994) find no evidence that listing of an option on OTC stocks results in a change in volatility during the 1985-1990 period. Similarly, once Lamoureux and Panikkath (1994) account for market-related changes in volatility of stocks, particularly in 1975, option introduction does not affect variances of NASDAQ stocks. So, Freund et al. (1994) control the dependency on sampling period and any changes in market variance to conclude that an option-only introduction does not affect stock volatility. Freund et al., however, find that risk reduction occurs only in early call option introductions. Similarly, Kim and Young (1991) find that only the option listings during the early stage of the option market generate a price increase. Stucki and Wasserfallen (1994) find similar evidence for the Swiss market. The U.K. evidence of Watt, Yadav and Draper (1992), on the other hand, supports a skewness reducing effect of put options.

This paper complements earlier studies by examining the volatility effect of a put option listing in Canada when the underlying stock has a prior call option listing. If a later listing of put option is volatility-neutral, combined with the earlier evidence on return-neutrality (Conrad, 1989, Kim and Young, 1991, and Freund et al., 1994), it will suggest an empirical redundancy of put option listing in terms of the most commonly used measures of risk and return.

The remainder of this article is organized as follows. Section II describes the sample data, the hypotheses tested and the empirical methods employed to test the hypotheses. Empirical results are presented in Section III. Finally, Section IV provides a summary of the findings of this paper and some concluding remarks.

II. Data and Methodology

A. *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 provided us with information about 155 optioned stocks on which options are listed from September 1975 through June 30, 1990.[3] Of these, the number of stocks that have put-only options listed later than call options is only 38.[4] Obviously, the sample 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 put-only 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, we emphasize the importance and implications of put-only listing to policy makers rather than narrowing our focus on statistical significance.

Not all 38 put-only options, however, are independent due to name changes, mergers and restructures. In such cases we keep the earliest put listing only. 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. We further drop all events beyond March 31, 1989, since the data series for our sampling interval of 100 trading days after the event date was not available. These optioned stocks are mostly large and well-known. Therefore, thin trading problems are minimal. Still as a precautionary measure, we drop all events on either side of which there are less than 80 daily returns. Furthermore, to lessen the influence of possible outliers, we also exclude all events where the after-to-before variance or the market-adjusted variance ratio (to be discussed shortly) is greater than 10 or less than 0.10. We are left with a final sample of 30 put option listing events on stocks that had prior call options listed at least three years earlier.[5]

B. Measures of Volatility

For each of the 30 optioned stock, 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 changes in market volatility. Thus, we adjust the variance of the stock by that of the market index.

The optioned stocks are relatively large, and thus weigh heavily in the market index (as they do in the TSE 300 Index, for example). Thus, the use of a value-weighted index may bias the findings in the direction of no change in the adjusted variance. On the other hand, the well-known anomalous behavior of small stocks may unduly influence the results when using the equally- weighted market index to adjust the variance of the optioned stocks. Thus, due to the preponderance of small stocks in the Canadian market, the use of the equally-weighted index may be improper. Moreover, since theoretical arguments favor the use of a value-weighted index in estimating the beta, it would be preferable for the sake of consistency, to use a value-weighted index instead. As a compromise, we use the TSE/Western value-weighted (VW) index of all TSE stocks, 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.

For each stock, we estimate two variances for a given sampling interval, 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 contemporaneous TSE/Western value-weighted market index return variance. We then form a market-adjusted variance ratio (or simply the adjusted variance ratio). If option listing 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.

C. Hypotheses Tested

Our main goal in this paper is to examine whether put option listings by themselves have any impact on the volatility (variance and beta) of the optioned stocks. Toward this end, we test the following two hypotheses:

> **H1:** *On average, there is no effect of a later put option listing on the variance of the optioned stock.*

H2: *On average, there is no effect of a later put option 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 optioned stocks. Some may experience heightened volatility while for others volatility may decrease;[6] the overall average effect may be volatility-neutral. Therefore, we test the two following hypotheses for each optioned stock:

H1A: *There is no effect of a later put option listing on the variance of the optioned stock.*

H2A: *There is no effect of a later put option listing on the beta of the optioned stock.*

Whiteside, Dukes, and Dunne (1983) and Detemple and Jorion (1990) show that the effect of option listing may not be stable over time. As time passes, market participants may find novel and diverse use of listed options including new trading strategies involving the options. The mix of market participants and the availability of alternate instruments also evolves over time. Further, regulations governing the use of options and their trading mechanism change over time as well. It would be thus interesting to see if the volatility effect of put option listing is stable or not:

H3: *The effect of a later put listing on the variance of the optioned stock is stable.*

H4: *The effect of a later put listing on the beta of the optioned stock is stable.*

While many studies examine the effect of (initial) option listing on stock volatility, only a few (Skinner (1989), Chamberlain, Cheung, and Kwan (1993), and Kim and Young (1991)) also link cross-sectional variation in the option listing effect to variables such as size, volume, bid-ask spread, pre-event beta of the underlying stock, and time. With respect to the volatility effect of (first ever) option listing, Skinner 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 option listings. The negative relationship between liquidity and variance is also significant when the variables are adjusted for the market effect.

One potential benefit of a cross-sectional variation in the volatility effect is that it may enhance our understanding of how option listing affects the stock volatility. A prominent hypothesis in this regard is the "liquidity explanation" hypothesis (Skinner, 1989). According to this hypothesis, option 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 in response to the flow of information-based trading to the option market, and greater trading activities by hedgers and arbitragers.[7]

Since the bid-ask spread is empirically directly related to the stock return variance (Amihud and Mendelson, 1986),[8] option listing should lead to a lower variance for the optioned stock. Any such liquidity-related variance stabilization effect, however, would be small for stocks that are liquid before option listing. In fact, Fedenia and Grammatikos (1992) find that the spread increases (decreases) for American stocks that are more (less) liquid to start with. Accordingly, we test the following hypothesis concerning the pattern of cross-sectional variation in the effect of put option listing:

H5: *The variance effect of put option listing is cross-sectionally positively related to pre-listing liquidity.*

If we find support for Hypothesis 5, it would amount to an indirect support for the "liquidity explanation" hypothesis of option listing effect. While the "liquidity explanation" hypothesis does not concern the market-related risk, we also test the following hypothesis for the sake of completeness:

H6: *The beta effect of put option listing is cross-sectionally positively related to pre-listing liquidity.*

D. Methodology

Hypothesis 1 relates to the average effect of a later put option listing on the variance of the underlying stocks. For the average case, we apply the Wilcoxon signed-rank test (two-sided at the five percent level) separately to test the samples of adjusted and unadjusted variance ratios. Under the null hypothesis of no variance effect on average, the 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 individual stock. If Hypothesis 1A is valid for an optioned stock, its true variance ratio would also be 1.0. If stock returns are normally distributed, a F-test can then be undertaken to find out if the unadjusted or the adjusted variance ratio for a given optioned stock is significantly different from 1.0. Skinner (1989), however, showed that the F-distribution is not a suitable testing model for the variance ratios. Furthermore, Conrad (1989), Kim and Young (1991), and Stucki and Wasserfallen (1994) suggest a possible change in mean return following option listing. Therefore, we also test Hypothesis 1A using the Moses test (Daniel, 1978, pp. 97-101) of a change in variance. Like most nonparametric tests, the Moses test neither assumes nor requires normality. Furthermore, it does not depend on assumptions of known or equal location parameters (mean, median) of the populations concerned.

To test Hypotheses 2 and 2A, the beta estimates for the optioned stocks are needed. For each optioned stock, the before-listing beta (b_i) and after-listing beta ($d_i=b_i+c_i$), and the difference between them (or change in the beta), c_i, are estimated from the following regression equation:

$$R_i(t) = a_i + b_i R_m(t) + c_i[R_m(t) D(t)] + ei(t) \quad (1)$$

where $t= -T_1,..,-1,0,1,.., T_2$, with 0 as the listing date, T_1 and T_2 are the last available trading days before and after the listing 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. If option listing increases (reduces) the nondiversifiable risk of the underlying stock, c_i would be positive (negative). Under Hypothesis 2 of no average beta effect, the median value of c_i's is expected to be zero. Thus, we test c_i using Wilcoxon signed-rank test. For testing Hypothesis 2A of no beta effect at the individual stock level, a t-test can determine if the change in beta (c_i) is statistically significant.

These tests of beta effect using the c_i's can, however, be misleading in the presence of a regression tendency of the estimated betas toward 1.0 (Blume, 1971). If the pre-listing estimated stock beta is above (below) 1.0 because of sampling error, the post-listing beta estimate would likely be lower (higher) than the pre-listing estimate. In their study of CBOE listings, Klemkosky and Maness (1980, p. 15) note a minor regression tendency. The regression tendency is further confirmed by Whiteside, Dukes, and Dunne (1983, Table 2) and Trennepohl and Dukes (1979, Table III). Similarly, Skinner (1989, Table 2) and Chamberlain, Cheung, and Kwan (1993, Table 2) show the average pre-listing beta is above 1.0, and beta decreases following option listing. Unfortunately, none of the above authors account for this problem.

To guard against a possible regression tendency effect, we adapt Blume's technique to adjust the estimate of the beta change. The regression tendency equation is estimated by regressing the pre- listing betas on the nonevent betas; the latter betas are estimated using the return observations during the 100-day period before the pre-listing 100-day interval. The individual beta forecasts for the post-listing period are then formed by using the pre-listing beta as the predictor variable value in the estimated regression equation. We then compare the post-listing betas with the beta forecasts (instead of the pre-listing betas). To test Hypothesis 2 of no average beta effect adjusted for the regression tendency, the Wilcoxon signed-rank test is applied to the deviations of the post-listing betas from the beta forecasts.

Hypotheses 3 and 4 are about the stability of the variance effect and the beta effect respectively. Here, similar to other option listing studies, we divide the sample of put option listings into two sub-samples according to whether the listing event took place during the 1970s or during the 1980s. The similarities and differences in the test results concerning Hypotheses 1, 1A, 2 and 2A across the two

sub-periods are then discussed to arrive at a general conclusion about Hypotheses 3 and 4.

Lastly, Hypotheses 5 and 6 relate to a "liquidity explanation" of the volatility effect of put option 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, we do not have access to bid-ask spread data on the sample optioned stocks. However, empirical evidence by Amihud and Mendelson (1986) shows a negative (positive) association between the firm size and the bid-ask spread (liquidity). Therefore, following Skinner (1989), we use firm size as a proxy for the liquidity of the optioned stock. If the "liquidity explanation" is important, smaller optioned stocks are likely to experience a larger decline or a smaller increase in the variance (i.e., smaller post-listing to pre- listing variance ratio), other things are equal.

One complication that arises in testing this hypothesis is that the trading volume of the optioned stock may change following the option listing. Volume is empirically positively related to both stock variance and liquidity. Once the effect of volume is controlled, if the "liquidity explanation" hypothesis is important in explaining the cross-sectional variance effect of option listing, we should expect a positive association between firm size and the post-listing to pre-listing variance ratio. Thus, we estimate the following multiple regression equation using the Ordinary Least Squares (OLS) method:

$$(\text{Measure of change in volatility})_i = a + b \times \ln\,[\text{post-listing market adjusted volume/pre-listing market adjusted volume})_i] + c \times \ln(\text{size}_i) + e_i \qquad (2)$$

where the measure of change in volatility refers to either the ratio of the post-listing market adjusted variance to the pre-listing market adjusted variance, or the pre-listing beta subtracted from the post- listing beta.[9] A positive and statistically significant slope coefficient 'c' in the above regression would support Hypothesis 5 or 6 of a "liquidity explanation" of the cross-sectional variation in the corresponding volatility effect of put option listing.

In regression equation (2), the size of a stock is measured by its market capitalization at year- end before the year of put option listing. This data is retrieved from the TSE/Western database. Monthly stock volume data for the 24 months before and the 24 months after put option listing are collected from the various issues of the Toronto Stock Exchange, the Montreal Exchange, and the Vancouver Stock Exchange Reviews. The post-listing average volume of the stock relative to that of the market is then divided by the pre-listing average volume of the stock relative to that of the market to form the volume ratio. [10]

Unfortunately, our data on both volume and size is complete for only 23 (1970s: 8, 1980s: 15) of the 30 (1970s: 13, 1980s: 17) put option listings in the sample. OLS regression results in such a small sample may, however, be suspect because of the potential influence of extreme sample observations. As an alternative, we also present the results using the rank-based regression (RR) method of the statistical software MINITAB.[11] While the OLS method reduces the sum of squared residuals, the RR method reduces the linear function of the residuals with

weights depending upon the ranks (rather than values) of the residuals. As such, the RR parameter estimates are less sensitive to extreme sample observations.

III. Empirical Results

A. *Overall Sample Results*

Panel A of Table 1 shows that put option listing did not affect the stock unadjusted variance on average. The median variance ratio, on the other hand, shows a 29 percent decline and nearly three out of four stocks experience a decline in the variance. The change in the variance for the average optioned stock is not, however, significant in the Wilcoxon test. Thus, we are unable to reject Hypothesis 1 that, on average, there is no variance effect using the variance ratios.

Looking at the F test results for individual stocks, we find that Hypothesis 1A is rejected. In fact, a significant change in the unadjusted variance takes place for four out of five stocks. Furthermore, fifty-three percent of the stocks experienced a significant decrease in the unadjusted variance while twenty-seven percent had a significant increase in the unadjusted variance.

Compared to the F test of Hypothesis 1A, the nonparametric Moses test shows a much lower incidence of a change in the unadjusted variance. Out of five stocks, only one experiences a change in unadjusted variance according to the Moses test. However, as in the F test, relatively more stocks experience a significant decrease in the unadjusted variance.

The picture changes in panel B as stock variances are adjusted for the contemporaneous change in the market variance. The average figure shows a 22 percent increase while the median shows an 11 percent decline in the adjusted variance following put listing. Similar to the case of the unadjusted variance, this average effect is not significant in the Wilcoxon test; thus, we are unable to reject Hypothesis 1. Furthermore, F and Moses tests of Hypothesis 1A for individual stocks do not show any clear direction of a change in the adjusted variance. Therefore, put option listing has, on average, no total risk implication for the underlying stock.

B. *Beta Results and Regression Tendency of Beta*

The results in panel A of Table 2 suggest a stabilizing effect of put option listing on the systematic (or nondiversifiable) risk of the underlying stock. On average, the beta of an optioned-stock experienced a nearly 20 percent decline following put listing and more than three out of four stocks shared the decline. Unlike the variance effect, the average beta effect is highly significant according to the Wilcoxon test. Therefore, Hypothesis 2 is rejected. The effect at the individual level is not, however, as strong as shown by the t-test results on Hypothesis 2A.

As reported in panel B of Table 2, 18 stocks in our sample of put listings have a pre-listing beta estimate more than 1.0, and the remaining 12 stocks have a pre-listing beta estimate less than 1.0. Although both groups show a beta decline on average that is statistically significant, the high beta stocks show a greater decline (–0.404) than the low beta stocks (–0.047), as reflected by the mean forecast beta. However, the beta-stabilization effect seems wide spread—8 of the 12

Table 1. Variance Ratios for Firms with Optioned Stocks around the Date of Put Option Listing Subsequent to Initial Listing of Call Option Only

Period	*September 1975 to March 1989*		*September 1975 to December 1979*		*January 1980 to March 1989*	
Number of firms with data available	*30*		*13*		*17*	
(A) Variance ratios: estimated variance for period after options listing divided by estimated variance before						
Mean	0.995		1.386		0.695	
Median	0.709		1.217		0.653	
Number(%) of firms with:						
variance increase	9(30)		7(54)		2(12)	
variance decrease	21(70)		6(46)		15(88)	
Two-tailed Wilcoxon signed-rank probabilityfor change in variance	0.651		0.168		0.015	
Number(%) of firms with significant (at 5 percent level)	F test	Moses test	Moses test	F test	Moses test	Moses test
variance increase	8(27)	1(3)	6(46)	1(8)	2(12)	0(0)
variance decrease	16(53)	5(17)	4(31)	0(0)	12(71)	5(29)
(B) Adjusted variance ratios: estimated market-adjusted variance for period after options listing divided by estimated market-adjusted variance before						
Mean	1.220		0.744		1.583	
Median	0.887		0.624		1.219	
Number(%) of firms with:						
adjusted variance increase	13(43)		2(15)		11(65)	
adjusted variance decrease	17(57)		11(85)		6(35)	
Two-tailedWilcox on signed-rank probabilityfor change in adjusted variance	0.710		0.048		0.071	
Number(%) of firms with significant (at 5 percent level:	F test	Moses test	Moses test	F test	Moses test	Moses test
adjusted variance increase	9(30)	3(10)	1(8)	0(0)	8(47)	3(18)
adjusted variance decrease	12(40)	3(10)	10(77)	2(15)	2(12)	1(6)

low beta stocks and 15 of the 18 high beta stocks show a decrease in beta following put listing. Thus, the results in Panel B of Table 2 reject Hypothesis 2.

When the beta forecasts, estimated based upon the regression tendency of the betas, are used instead of the post-listing beta estimates, the beta stabilization effect remains significant, i.e., Hypothesis 2 is rejected. Overall, Table 2 results lend support to the view that put option listing has a stabilizing effect on the beta of the underlying stock, and that this effect is not merely an artifact of a possible

Table 2. Betas for Firms with Optioned Stocks Around the Date of Put Option Listings Subsequent to Initial Listing of Call Option Only

(A) Change in beta: estimatedbeta for period after options listing minus estimated beta before			
Period	*September 1975 t March 1989*	*September 1975 to December 1979*	*January 1980 to March 1989*
Number of firms	30	13	17
Mean	–0.261	–0.414	–0.144
Median	–0.266	–0.489	–0.140
Number(%) of firms with:			
beta increase	7(23)	2(15)	5(29)
beta decrease	23(77)	11(5)	12(71)
Two-tailed Wilcoxon signed-rank probabilityfor change in variance	0.001	0.022	0.080
Number(%) of firms with significant (in *t*-test)			
beta increase	1(3)	1(8)	0(0)
beta decrease	6(20)	5(39)	1(6)
(B) Regression tendency of Beta: September 1975 to March 1989			
Number of firms	30	12	18
Meanpre-listing beta	1.400	0.710	1.859
Mean post-listing beta	1.138	0.663	1.455
Number(%) of firms with:			
beta increase		4(33)	3(17)
beta decrease		8(67)	15(83)
Wilcoxon test p-value		0.034	0.002
Mean forecast beta		1.157	1.801
Comparing post-listing beta and forecast beta, number (%) of firms with:			
beta increase		1(8)	2(11)
beta decrease		11(92)	16(89)
Wilcoxon test p-value		0.034	0.001
(C) Change in beta adjusted for regression tendency: estimated beta for period after options listing minus forecast beta based upon regression tendency			
Number of firms	30	13	17
Mean	–0.405	–0.338	–0.457
Median	–0.473	–0.378	–0.623
Number(%) of firms with:			
beta increase	3(10)	1(8)	2(12)
beta decrease	27(90)	12(92)	15(88)
Wilcoxon test p-value	0.000	0.017	0.000

regression tendency of the estimated betas. The reduction in beta following put-only option introduction is one area where evidence in Canada appears to differ from that of the U.S.

C. *Stability of Volatility Effect*

To see if the volatility effect of put option listing has changed over time, we also present in Tables 1 and 2 (Panels A, C) the results for the 1970s and the 1980s sub-periods separately. Panel A of Table 1 displays that put options listing led to an increase in the unadjusted variance during the 1970s and the effect then reversed to a significant decrease during the 1980s. The market-adjusted results (Panel B of Table 1) show, however, an exactly opposite pattern of a change in the adjusted variance in the two periods.[12] One possible explanation for this reversal is the high volatility in the Canadian market in 1970s compared to the low volatility in early 1980s. A similar observation was documented by Lamoureux and Panikkath (1994). As a result, the post-listing market-adjusted variance appears to increase as the deflator factor (i.e., market variance) decreases over time in early 1980s.

As shown by Panel B of Table 1, the evidence of a decline in the variance during the earlier period is stronger than the evidence of an increase in the more recent period. The Wilcoxon test result of an average increase during the 1980s is not significant (hence, Hypothesis 1 is not rejected), while the average decline during the late 1970s is significant (hence, Hypothesis 1 is rejected). Supporting evidence is also provided by the proportion of increase versus decrease and the F-test results about Hypothesis 1A. The Moses test results of Hypothesis 1A, however, show a much lower incidence of variance effect than the F-test results.

Panels A and C of Table 2 show a tendency of betas to decline during the 1970s and during the 1980s. In the Wilcoxon test, the average effect adjusted for a regression tendency is significant (hence, Hypothesis 2 is rejected) in the earlier period and in the most recent period. The panel A t-test results about Hypothesis 2A are also consistent with a beta stabilization effect of put option listing. Overall, these results differ from the US evidence (e.g., Freund et al., 1994), and they may be unique to the Canadian markets. They may also be due to the use of nonparametric tests, which are more appropriate when normality of the data is not tested.

D. *Cross-Sectional Variation of Volatility Effect*

In analyzing the variance, adjusted variance, and beta results, and their stability over time, we have noted differential responses (direction- and magnitude-wise) across stocks to the event of put option listing. While not all these responses are statistically significant, they, however, show a possible cross-sectional variation in the effect of put option listing on stock volatility.

Panel A of Table 3 presents summary statistics for size and market adjusted volume. As expected, panel A of Table 3 shows the median stock to have market capitalization more than a billion dollars. The standard deviation, however, shows considerable variation in size among the 23 stocks. Consistent with previous studies, panel A statistics also show a median increase of 11 percent in market-adjusted stock volume following put option listing, but with large variation across the sample stocks.

In Panel B of Table 3, we present some summary statistics on size, market-adjusted volume ratio, market-adjusted variance ratio, and beta change. These results are separated according to whether the underlying stock is larger or

Table 3. The Relationship between Size, Change in Volume and Volatility of the Underlying Stock Following Put Option Listing[a]

(A) Summary statistics on change in market adjusted volume (RSV) and size (SIZE)

Variable	RSV	SIZE (in billion dollars)
Number of firms (N)	23	23
Mean	1.612	1.120
Median	1.114	1.110
Standard Deviation	1.579	0.676

(B) Summary statistics by small (SIZE is smaller than its median) vs. large (SIZE is greater than its median) capitalization, and low (RSV is smaller than its median) vs. high (RSV is greater than its median) adjusted share volume ratio

Statistics	Small SIZE Low RSV	Large SIZE Low RSV	Small SIZE High RSV	Large SIZE High RSV	Small SIZE	Large SIZE	Low RSV	High RSV
Number of firms	10	2	2	9	12	11	12	11
Average SIZE	0.587	1.490	0.778	1.700	0.618	1.660	0.737	1.530
Average RSV	0.754	0.759	1.450	2.790	0.870	2.421	0.755	2.547
Average RAVAR	2.249	3.804	1.118	3.349	2.060	3.432	2.508	2.944
Percent of cases RAVAR>1	70	100	50	89	67	91	75	82
Average BETACH	–0.201	1.037	–0.357	0.130	–0.227	0.295	0.005	0.042
Percent of cases BETACH>0	30	100	50	56	33	64	42	55

(C) Simple correlation coefficients (Number of firms: 23)

	RAVAR	BETACH	SIZE
BETACH	0.516		
SIZE	0.484	0.347	
RSV	0.069	0.267	0.616

Note: a. Measures of change in volatility are: post-listing market adjusted variance/ pre-listing market adjusted variance (RAVAR), post-listing beta - pre-listing beta (BETACH). Measure of change in share volume is: post-listing market adjusted volume/ pre-listing market adjusted volume (RSV). Size is measured by the market capitalization of the underlying stock in billion dollars (SIZE).

smaller than median market capitalization, and whether the market-adjusted stock volume ratio is higher or lower than the median.

The average figures for size and volume ratios show that small (large) optioned stocks experience a reduced (enhanced) trading activity on a market-adjusted basis. The incidence and the size of an increase in the market-adjusted variance are, however, lower for the small stocks.[13] A noticeable thing in Panel B of Table 3 is that, on average, and despite the volume change, the beta of the small (large) stocks go down (up) following put option listing. This differential effect on beta according to size is also supported by the relatively higher

incidence of an increase in the beta for the large stocks. These results have to be interpreted with caution because of the paucity of data points.

The simple bivariate correlation coefficients in Panel C of Table 3 lend support to the Panel B evidence of a positive association between size and change in volume, size and change in total risk, and size and change in nondiversifiable risk. The strongest (0.616) of the bivariate correlations is 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 Panel A of Table 4, we present the Ordinary Least Squares (OLS) results for the regression equation (2). The regression for market-adjusted variance ratio (beta change) is (not) significant at the five percent level for the F-test, explaining only 39 (15) percent of cross-sectional variation.

Moreover, despite the positive association between size and both changes in total risk and beta risk (controlled for the change in volume), only the relationship between size and change in total risk is statistically significant (in a *t*-test at the 5% level). Once the effect of size is controlled for, the bivariate positive association between change in volume and both changes in total risk and beta risk, however, turns into a negative one with the volume effect is statistically insignificant.

Table 4. Cross-sectional Ordinary Least Squares and Rank Regression Results for Put Option Listings Subsequent to Initial Listing of Call Option Only

Regression equation:

*(Measure of change in volatility)i = a + b * ln[(post-listing market adjusted volume/ pre-listing market adjusted volume)i] + c * ln(sizei) + ei*

Measure of change of volatility	*Coefficient estimates (standard error)*			*R-square (%)a*	*Regression F-statistic (2,20)*
A. Ordinary Least Squares					
Post-listing adjusted variance/Pre-listing adjusted variance	−17.037*	−0.442 (5.007)	0.863* (0.282)	39 (0.245)	6.47*
Post-listing beta - Pre-listing beta	−8.466	−0.052 (5.306)	0.413 (0.299)	15 (0.259)	1.76
B. Rank Regression					
Post-listing adjusted variance/Pre-listing adjusted variance	−15.311	−0.361 (5.349)	0.782* (0.301)	4.42* (0.262)	
Post-listing beta - Pre-listing beta	−5.209 6.483)	0.009 (0.365)	0.255 (0.317)	0.87	

Notes: a: R-square is not meaningful in the context of rank regression. The constant also does not have its usual meaning; hence we do not undertake any statistical test of significance for the rank regression estimate of the constant.

b: The regression F-statistic tests the hypothesis that b=c=0.

*Significant at 5% level in a t-test for Ordinary Least Squares coefficient estimates; in all other cases, significant at 5% level in an F-test. For rank regression, the significance of the slope coefficient (b,c) estimates are tested by using approximate F-test of the restriction that the coefficient in question is equal to zero

Contrary to Skinner's (1989, p. 76) observation about the first ever option listings in the U.S., size, not volume, emerges as important for the total risk effect of the Canadian put option listings.[14] Accordingly, our results provide indirect support for Hypothesis 5 of a "liquidity explanation" of the cross-sectional variation in the variance effect of put option listings. While the cross-sectional variation in the beta effect is also consistent with the "liquidity explanation," the result is not statistically significant. Thus, the decrease in systematic risk (beta) reported in Table 2 is related neither to liquidity of the optioned stock, nor to its size.

Since our sample size is small, one question that arises is whether our results are driven by a few extreme sample observations. This is not so as shown by the Rank Regression (RR) results in Panel B of Table 4 that are similar to our OLS results in Panel A of the same table.

IV. Summary and Conclusions

In this paper we examine the effects of the Canadian put option listings on the volatility of the underlying stocks during the September 1975 to March 1989 sampling period. Consistent with the Canadian evidence by Chamberlain, Cheung, and Kwan (1993) on call listing effect, we find a variance decrease following early put option listings in the 1970s. However, contrary to the existing evidence on first ever option listing, later put option listings have a stabilizing effect on the systematic volatility (beta) of the underlying stock. As such, unlike the evidence for American options (e.g., Conrad, 1989; Kim and Young, 1991; and Freund et al., 1994), Canadian put options may not be redundant when pricing optioned stocks.

At the theoretical level, an important implication of the nonredundancy of the put options is that the familiar arbitrage-based option valuation approach may not apply to the listed put options (Back, 1993). From a practicing manager's standpoint, the listing of a put option should be a welcome event as it lowers the beta of the stock and accordingly the cost of equity capital in a CAPM-setting. However, a disconcerting fact in this regard is that the CAPM valuation framework itself may break down with the introduction of options (Dybvig and Ingersoll, 1982).

Analyzing the cross-sectional variations in the volatility effect of put options listing, we find indirect support for the hypothesis that option listing enhances the liquidity of the market for the underlying stock, and thus has a stabilizing influence on the stock variance. Consistent with Jennings and Starks (1986), Skinner (1990), and Figlewski and Webb (1993), this evidence supports the notion that put option listing reduces noise trading in the underlying stock and expedites the adjustment of the stock price to new information. As market participants face constraints on short selling and on writing call options in the Canadian market, the effect of later put option listing is expected to be stronger.

Consistent with McCloskey and Ziliak's (1996) argument that researchers should focus more on substantive than statistical significance, the economic significance of a reduction in beta risk is more relevant than its statistical significance. Thus, the strong evidence of a beta stabilization effect of put option listing requires a rigorous explanation. One possible reason is perhaps that the regulatory

environment in Canada restricts institutional investors from speculative trading in stocks and derivatives. With listed put options, the institutional investors can buy the put options instead of short-selling or selling off the stock (Mandron, 1986, p. 16). Many institutional investors find short selling either too risky or inconsistent with their investment philosophy. Selling the stock, on the other hand, may not be a good alternative to an institutional investor. Furthermore, in a falling stock market, the existence of put options should reduce the selling pressure on the optioned stocks if institutional trading plays an important role, which it does in Canada. It also should reduce possible losses from unloading a sizable investment in a stock during a short period, especially in the Canadian market where the market for many stocks is not deep enough to quickly absorb large blocks of institutional trading. The price pressure hypothesis (demand curve for stock is less than perfectly elastic) would also result in a reduced covariation of the optioned stocks with the overall stock market (see Harris and Gruel, 1986, for a discussion of the price pressure hypothesis). Moreover, an institutional portfolio manager may be reluctant to sell off a stock based on its negative short-term prospect since the perceived long-term prospect could be favorable.

It is to be emphasized, however, that this type of explanation for a reduction in beta risk has yet no theoretical underpinning nor it has been empirically tested. At this stage, this explanation is advanced merely as a casual conjecture.

On a more positive note, the evidence in this paper should help lessen the worry of the Canadian regulators regarding a potential destabilizing effect of options trading on the stocks. For the institutional investors holding a diversified portfolio of stocks, put option listing may be a welcome event since it dampens the market-related volatility of the optioned stocks.

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Notes

1. A variance stabilization effect is noted by Nathan Associates (1974), CBOE (1975, 1976), Conrad (1989), Skinner (1989), Bansal, Pruitt, and Wei (1989), Detemple and Jorion (1990), Damodaran and Lim (1991), and Stucki and Wasserfallen (1994). Poon (1994) provides indirect evidence of a decline in the conditional stock return volatility. Lenzner (1976), Roa and Ma (1987), and Harris (1989), on the other hand, note a destabilizing influence of option introduction. Yet another group of studies (Klemkosky and Maness (1980), Trennepohl and Dukes (1979), Whiteside, Dukes, and Dunne (1983), Chamberlain, Cheung, and Kwan (1993) find no significant effect of option listing on the variance of the underlying stock. Fedenia and Grammatikos (1992) and Ma and Rao (1988) show that option introduction does not lead to a uniform effect on the variance of the underlying stock. Further, Klemkosky and Maness (1980), Trennepohl and Dukes (1979), Whiteside, Dukes, and Dunne (1983), Conrad (1989), Skinner (1989), Chamberlain, Cheung, and Kwan (1993), and Stucki and Wasserfallen (1994) find no significant effect of option introduction on the beta of the underlying stock.

2. See Cox and Rubinstein (1985, pp. 93-98), for a discussion of how the "Prudent Man Rule" and other legal restrictions on institutional investment management hinder the use of options by the U.S. institutional investors. The situation in Canada is no less restrictive, if not more, than in the U.S.
3. Hatch (1983, p. 402) mentions that option trading began around mid-September, 1975.
4. The number of listed stocks in Canada is almost one tenth of those listed in the U.S. Thus, the number of put-only options is proportionally equivalent to that of the U.S. (e.g., Freund et al., 1994, show 193 put-only options during similar periods).
5. Of the 30 put-only option introductions, 13 were listed in 1979, 4 in 1980, 10 in 1981, and 4 in 1983. It appears that, after 1983, option introductions were calls and puts together. As pointed out by an anonymous referee of this journal, a similar trend started in the U.S. after 1981.
6. 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.
7. Damodaran and Lim (1991) find evidence to support the explanation that the noise component of the underlying stock's variance declines upon option introduction, and that this is associated with a narrower bid-ask spread.
8. The direction of causality between the bid-ask spread and the stock return volatility is, however, unclear. For example, market makers may post a lower bid-ask spread if volatility goes down. On the other hand, if the bid-ask spread is lower, the change in price between two consecutive trades is expected to be lower and thus a lower observed volatility may result.
9. As we shall see in the next section, the beta effect does not depend on the adjustment for regression tendency. Therefore, we do not adjust the betas for their regression tendency in this cross-sectional regression.
10. It is necessary to adjust for a contemporaneous change in the volume for the market as a whole since the market volume seems to have increased by 52 percent on average around the 23 put option listings for which we have complete data.
11. 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 or not the distribution of the error term is symmetric or not, the intercept estimate will differ. We use the default assumption in MINITAB, viz., the error distribution is symmetric, although not necessarily normal. The significance of an individual regressor is evaluated 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:

$$F = [(D_R - D_U)^* J] / (0.5^* TAU)$$

where $D_R(D_U)$ is the dispersion of the restricted or reduced (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).
12. This reversal is puzzling, as correctly pointed out by an anonymous referee of this journal. A similar reversal effect occurs in Freund et al. (1994) study (Exhibit 2), but in the opposite direction. Freund et al. (994) find that, for the call option case, there are decreases in raw variances for early introductions (1973 to 1982), and increases in market-adjusted variances in the same period. The results for later introductions (1982-1986), however, are reversed. This reversal was never explained for the American evidence.
13. The increase in market-adjusted variance is likely due to the preponderence of the listings during the 1980s. Earlier in Table 1, we noticed an increase in market-adjusted variance following these listings, although the increase was not statistically significant.

14. Our regression results are not directly comparable to those of Chamberlain, Cheung, and Kwan (1993) regarding the first ever option listings in Canada. They regress the bid-ask spread ratio on the volume ratio and the variance ratio. Also, they do not perform any regression for the change in the beta risk.

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