Another Look at Option Listing Effects*

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Abstract

Previous research documents that the introduction of options seems to affect the volatility, liquidity, price and other characteristics of the underlying stock. Existing research, however, has not adequately accounted for the fact that option listing is endogenous, a result of decisions made by exchanges and regulators. We investigate the factors affecting the exchanges' listing decisions by comparing the characteristics of stocks selected for option listing to other stocks that were eligible but not listed. We find that firm size, volume, and volatility are positively related to the probability of listing, but their relative contributions have changed significantly over time. We then use the results of this analysis to construct various matched samples, composed of stocks that were eligible, but not selected for option listing, and we re-examine some of the option listing effects reported in the literature using a control-sample methodology. Contrary to previous research, we find that in recent subperiods, volatility increases with option listing, consistent with the hypothesis that forward-looking exchanges list options in anticipation of increasing volatility. We verify previous findings that underlying volume increases with option listing, and that there was a positive price effect associated with option listing prior to 1981. However, evidence of a negative price effect after 1981 appears to be much weaker than previously reported. Finally, we document a cross-sectional relationship between the price effect, the volume effect and the volatility effect.

Since the early days of exchange-based option trading, there has been some concern on the part of regulators and other market participants about the effect option trading might have on the underlying market. One concern has been that speculation in the option market might lead to increased volatility in the underlying stock market. Many authors have studied this issue empirically. The results of these studies are nearly unanimous in concluding that the introduction of options does not destabilize the underlying stock market, but the studies come to conflicting conclusions on whether there is a significant stabilizing effect.

The issue of causality is a recurring concern in interpreting the results of these papers. To the extent that exchanges choose to list options on stocks that have recently experienced temporary episodes of high volatility, the result that option introduction decreases volatility may conceivably be attributed to selection bias. Another form of selection bias might work in the opposite direction: if exchanges list options in anticipation of high volatility events, then the observed evidence might suggest that option listing has a greater volatility-dampening effect than previously supposed.

In addition to a volatility effect, previous research has found a positive price effect associated with option introductions prior to 1981, and a negative price effect after 1981. Furthermore, various authors have documented that option listing has a significant impact on trading volume, bid-ask spreads, and the informational efficiency of the underlying stock markets. As with the volatility results, the issue of causality is of great concern here. As long as changing market characteristics influence the listing decision, market changes will coincide with option listings, even if the option introduction has no impact on the underlying market.

In this paper, we re-examine these option-listing effects using a methodology that explicitly attempts to correct for the fact that the listing decision is endogenous. Although a great amount of research has been dedicated to measuring the relationship between option introduction and market changes, very little effort has been made to account for the endogeneity of the listing decision in interpreting the results. In an attempt to mitigate this problem, some researchers have excluded the period immediately prior to listing, and used earlier data for their pre-listing sample. We would expect this procedure to correct for

selection bias in cases where options are listed in response to recent but transitory shocks in the market. If there is a long delay between the shock and the listing, however, or if options are listed in response to a permanent change in market conditions, or if options are listed in anticipation of imminent changes in market conditions, then using an earlier pre-listing sample will not help. In some cases, using an earlier pre-event sample period may exacerbate the selection bias problem.

We argue that the potential for selection bias goes far beyond the simple possibility that listing may be induced by recent high volatility. Listing decisions may be influenced by changing market conditions in various ways. For instance, the underlying stock must meet certain requirements in order to be eligible for option listing, and changing market conditions may affect the stock's eligibility. Furthermore, during the 1970's and to some extent through the 1980's, regulators controlled the total number of options listed, by controlling the number of new listings permitted. This constraint was relaxed over time, but sporadically, and at the discretion of regulators. Prior or anticipated changes in market conditions may have affected the willingness of the Securities and Exchange Commission to permit an expansion in the set of listed options. Conceivably, regulators may have been reluctant to approve new listings in periods of high market volatility. Moreover, there have been various structural changes in option markets over the years, which may have altered the way in which market conditions influence the listing decision.

In this paper, we analyze the observed option-listing choices made by the exchanges, in an effort to better understand the nature of the listing decision. As expected, we find that characteristics such as firm size, prior volume and prior volatility do influence the listing decision. Furthermore, we document that the relative importance of these factors has changed significantly over time, and also that the relative importance of short-term vs. long-term prior volatility and volume has changed over time.

Having investigated the determinants of option listing, we then construct matched control samples, composed of stocks that were eligible but not selected for option listing, and that we believe were good candidates for option listing, based on the criteria that the exchanges appear to have been using at the time. Then, we reassess some of the results reported in the literature, by examining changes in volatility, volume,

and price around actual option listings, and comparing these with the corresponding changes in the control samples. This analysis is performed on various subperiods, in order to determine whether option listing effects have changed over time.

Contrary to the prior literature, we find that in some subperiods, volatility of optioned stocks increases relative to stocks in the control sample. This result is strongest in the later part of the sample, and does not appear at all prior to 1980. Because this effect appears to have evolved over time, we interpret this not as evidence that option introduction impacts volatility, but rather that exchanges have gradually become forward-looking, listing options in anticipation of volatility increases.

With respect to the volume effect, we confirm the findings reported in the literature - in most subperiods, we find significant volume increases of selected stocks relative to those in the control samples.

With respect to the price impact of option listing, we confirm the results reported by Conrad (1989) and others that there appears to have been positive abnormal returns for the early listings. However, we find that the negative returns after 1981, documented by Sorescu (1999) and others, are much less pronounced than previously reported. In many cases, the negative abnormal returns observed for optioned stocks are found to be significantly indistinguishable from those in the control samples.

The existing empirical research on option listing effects will be summarized in section one, below. In section two, we argue that there are many factors affecting the exchange's listing decision, and that a simple correction like using an earlier pre-event sample is inadequate to account for the many possible forms of selection bias that may enter into the picture. In section three, we briefly review the history of option trading in the United States, with a focus on regulatory changes that may have influenced the exchanges' listing decisions. In section four, we develop several hypotheses for testing whether option listing effects may be influenced by the endogeneity of the listing decision, and in section five, we describe the data that we use in our analysis. In section six, we present some graphs comparing the characteristics of stocks selected for listing with those of previously optioned stocks, and with stocks that were eligible for listing but not selected. In section seven, we report the results of a logit analysis investigating the

importance of various factors influencing the option listing decision. Then, in section eight, we re-examine the volatility, volume and price effects of option listing using a control-sample methodology based on the logit model used in the previous section. Section nine concludes, and contains suggestions for future research.

1. A Brief Review of the Literature

This section briefly summarizes the empirical literature on option listing effects. For more detailed reviews of this literature, refer to the surveys by Damodaran and Subrahmanyarn (1992), Hodges (1992), and Mayhew (1999). These authors also summarize several theoretical arguments why option listing might affect the underlying market.

1.1 Effect on Volatility

Shortly after the introduction of stock options, Nathan Associates (1974) studied the first sixteen options listed on the Chicago Board Option Exchange (CBOE), and reported that the introduction of options seemed to have a stabilizing influence on the underlying stocks. This result has subsequently been verified by Skinner (1989) and many other authors, not only for the U.S. market, but for option listings in the U.K., Canada, Switzerland, and Sweden.[1] In nearly all of these studies, options are reported to have a stabilizing impact on the total volatility of the underlying stock, but no significant impact on the stock's beta.

More recent work by Lamoureux and Pannikath (1994), Freund, McCann and Webb (1994), and Bollen (1998) has shown that a similar volatility effect appears in a matched control sample of stocks that were not selected for option listing. These authors also find that the direction of the volatility effect is not consistent over time. Bollen (1998), for example, reports that after 1987, the residual variance of both optioned stocks and stocks in a matched control sample increased at the time of option listing.

This control-sample evidence may be interpreted in various ways. One interpretation is that option listing has no true impact on volatility, and the apparent effect is spurious. One might expect to see such a result if a common factor drives the magnitude of different firms' idiosyncratic risk. Another possibility is that the listing of an option on one stock might influence the dynamics of other, related stocks, as suggested by the theoretical work of Detemple and Jorion (1991) and Cao (1999). In this case, stocks in the control sample would not be immune from the effects of option listing.

1.2 Effect on Liquidity

Around the time exchange-traded options were introduced in the United States, some expressed concern that because options are a substitute investment vehicle, they might divert volume away from the underlying stock market. The Nathan Associates (1974) study found no evidence that trading volume changed with option introduction. However, many subsequent studies, beginning with Hayes and Tennenbaum (1979), have documented that volume in the underlying stock market tends to increase, not decrease with the introduction of options.

Nathan Associates (1974) also documented a reduction in bid-ask spreads in the underlying stock market associated with option listing. Subsequent research has supported this finding, and has also found that other measures of market quality also improve with option listing, such as the adverse selection component of the bid-ask spread, and speed with which information is impounded into prices.[2]

[1] For references, see Mayhew (1999)
[2] See, for example, Kumar, Sarin and Shastri (1998)

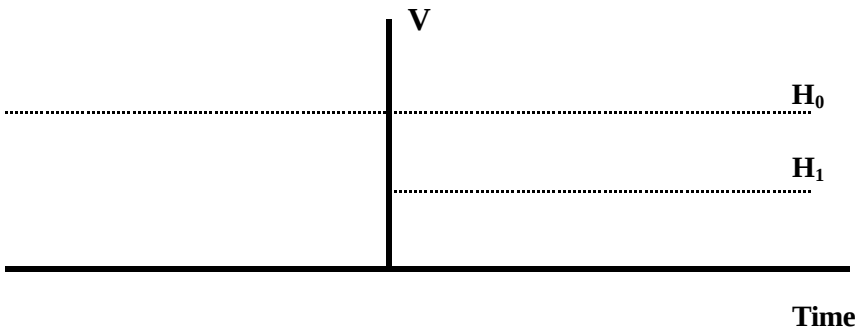
1.3 Effect on Price

Branch and Finnerty (1981), Conrad (1989), and several other authors who have examined the early U.S. data documented a positive abnormal return in the underlying stock at the time of option listing. This positive price effect has also been documented in the U.K., Switzerland, and Norway. There is, however, some disagreement in the early literature as to whether the effect occurs on the listing date or the announcement date, and as to whether the effect is permanent or temporary. More recent research by Detemple and Jorion (1990) and Sorescu (1999) indicates that this effect reversed in the U.S. after 1981.

2 The Endogeneity Problem

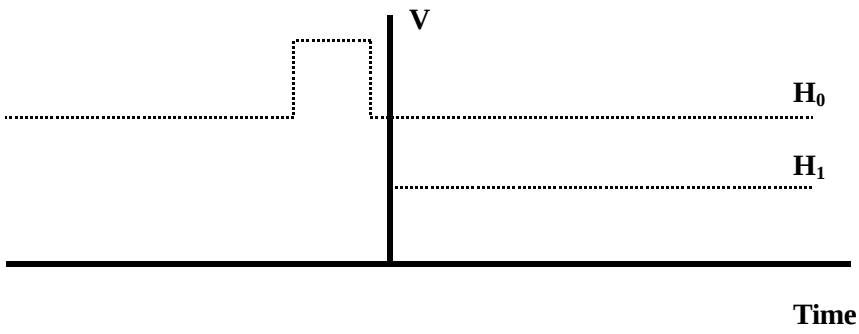
The statistical techniques employed in the literature described above generally assume that market conditions are unchanging throughout the pre-listing period, and throughout the post-listing period, the goal being to test whether conditions change between the two periods. This implicit assumption is illustrated in figure 1, where V denotes a market characteristic of interest, such as volume or volatility.

Figure 1: Hypothesized Effect of Option Introduction
Under the null hypothesis, there is no effect



Various authors have recognized that endogenous listing is a potential problem.[3] The predominant concern raised by these authors is that the option may have been listed in response to a recent period of unusual activity in the underlying market. This situation is illustrated in figure 2. In this case, the presumption is that the period prior to option listing may not be representative of "normal" market conditions prior to listing. For this reason, several authors have excluded the period immediately prior to the option listing from their pre-event window.

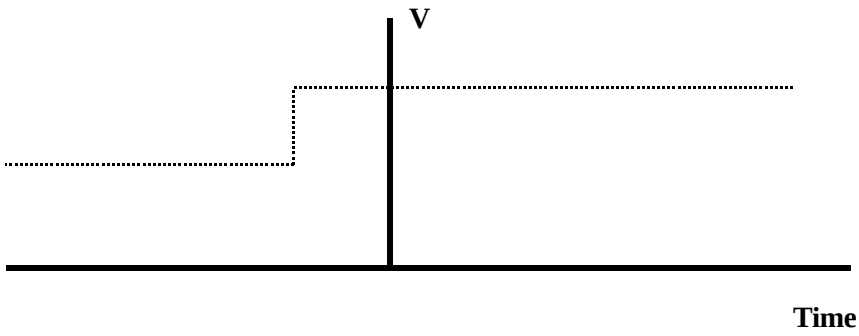
Figure 2: Transitory Event Prior to Option Introduction



Note, however, that if an option is listed in response to a permanent change in market conditions, such a procedure might actually make things worse. For example, suppose that a company suddenly moves from an obsolete industry into a trendy new market, and there is a permanent positive shock in the stock's trading volume. Furthermore, suppose that an exchange chooses to list the option three months after the move. This situation is illustrated in figure 3. In this case, using the period immediately prior to the listing would have given the correct result, while using a lagged pre-listing sample might lead the researcher to conclude that option introduction had caused the increase in volume, even if there was no true effect.

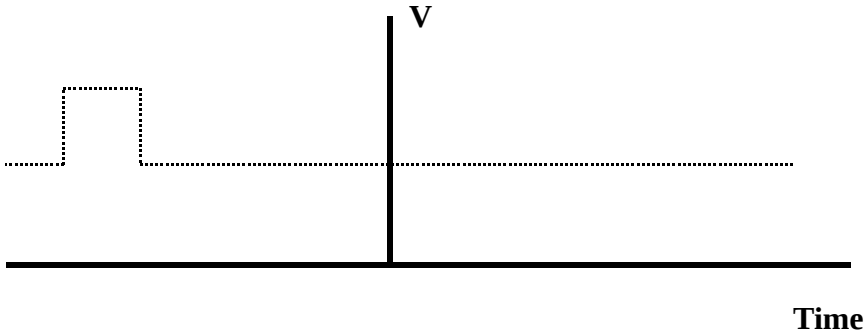
[3] For example, Branch and Finnerty (1981), Skinner (1989), Conrad (1989), Damodaran and Lim (1991), Fedenia and Grammatikos (1992)

Figure 3: Permanent Event Prior to Option Introduction



Alternatively, suppose that an option is listed in response to a transitory change in market conditions, but is listed with a lag. Lagged listing may occur as a result of administrative delays, or other natural lags built into the regulations governing eligibility. This situation is illustrated in figure 4. Again, using an earlier pre-listing sample might introduce selection bias, rather than correcting for it.

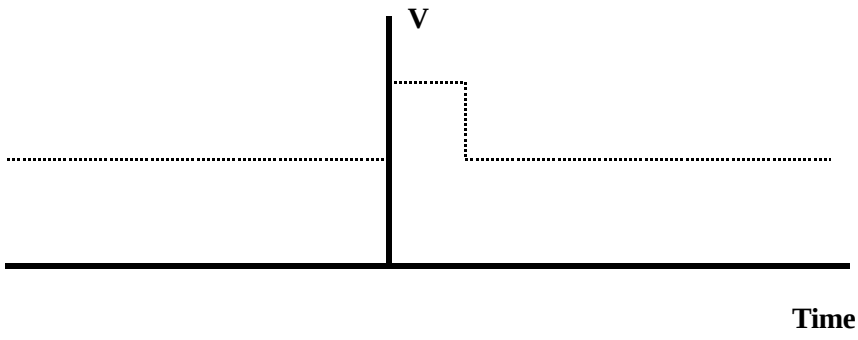
Figure 4: Delayed Option Introduction in Response to a Transitory Event



Often, stocks that are eligible for option listing remain unlisted. In a case where the stock was eligible but remained unlisted prior to a transitory shock, it is difficult to understand why an exchange would wish to list the option after the shock has dissipated, as depicted in figure 2. Presumably, the exchanges wish to benefit from high trading volume associated with unusual activity in the underlying market. If the transitory shock was predictable, the exchange might prefer listing prior to the shock, as

depicted in figure 5. If not, the exchange should at least want to list before the shock dissipates - once market conditions return to normal, the exchange is in the same position as before the shock, and will not find it optimal to list.

Figure 5: The Exchange Prefers to List Prior to the Event



Thus, it appears that discarding the period immediately prior to listing will correct for selection bias only in the special case when there has been a recent transitory shock in the underlying market. We argue, that in this case, forward-looking exchanges are likely to be uninterested in listing the option. Note that in many other cases, using an earlier pre-event window introduces, rather than diminishes the problem of selection bias.

It may be noted in all the cases illustrated in figures 2 through 5, the observed relationship between option introduction and the change in market conditions will be sensitive to the choice of pre- and post-event windows. In each case, different inferences may be drawn from the same data, depending on both the size and location of these windows. This is not the case in figure 1, where the listing decision is exogenous. This suggests that examining the robustness of listing effects to window choice is one way of determining whether options are in fact listed in response to short-term fluctuations in market conditions.

We suggest that the propensity of exchanges to list options in response to changes in market conditions is likely to have evolved over time. In the earliest days of option trading, there were many large,

actively traded stocks that were not yet optioned, and in this environment it would be natural for exchanges to select stocks based on "permanent" characteristics, rather than fluctuations in market conditions. More recently, we have been in an environment where exchanges have already had many opportunities to list options on eligible stocks. If a stock is not optioned today, it is because it was not eligible for listing earlier, or because the exchanges have endogenously chosen not to list it earlier. Thus, we would expect options today to be listed in response to changes in market conditions.

In summary, there are many reasons why it is difficult to address properly the empirical question of whether option introduction affects the underlying stock market. Decisions regarding which options to list are made by the exchanges, and may be influenced by changing market conditions prior to the listing and anticipated changes in market conditions. Even if the option introduction has no impact on underlying markets, econometricians who do not observe the factors affecting the exchange's decision may falsely conclude that there is a listing effect. For listings that were caused by a sudden shock in the underlying market, this observed effect is likely to be sensitive to the choice of event windows. Eligibility requirements and other regulatory restrictions also affect the listing decision, and so introduce another kind of selection bias into studies on option listing effects. The relative importance of these various factors may have changed over time, as option markets have developed and regulation has altered the structure of the market.

3 A Short Summary of Regulatory Changes

In addition to the factors mentioned above, there have been various structural and regulatory changes over the years that may have had an effect on listing policy. First, there have been changes in the number of competing option exchanges. From 1973 until 1975, options traded on only one exchange, the Chicago Board Options Exchange (CBOE). In 1975 and 1976, options were initiated on the American (AMEX), Philadelphia (PHLX), Midwest and Pacific Stock Exchanges (PSE). The Midwest exchange dropped out of the options business in 1980, selling their contracts to the CBOE. The New York Stock Exchange established an options division in 1985 and sold it to the CBOE in 1997.

Second, there have been changes in the policy regulating the cross-listing of options on multiple exchanges. Prior to 1976, options were listed on only one exchange. From 1976 to mid-1977, multiple listing was allowed. From mid-1977 to 1980, there was a moratorium on new listings and virtually no options were listed. Beginning in 1980, the "allocation plan" went into effect, under which options could be listed on only one exchange. In 1985, options on OTC stocks began trading and were made eligible for multiple listing. Multiple listing for all options resumed in 1990. At this time, all new option listings instantly became available for cross-listing. Existing contracts already trading on one exchange were "grandfathered in" over the next few years, and gradually became available for cross-listing.[4]

Third, there have been changes in the market structure under which options have traded. Prior to 1987, options on the CBOE and PSE were assigned to trading crowds resembling futures pits, while options on AMEX and PHLX were assigned to specialists. In 1987, the CBOE introduced the "Modified Trading System," which allowed them to list certain options under a "Designated Primary Market Maker" (DPM), a structure very similar to the specialist system used at AMEX. The PSE introduced a similar structure in 1991, allowing them to assign options to a "Lead Market Maker."

Fourth, eligibility requirements have been revised over time. These changes are summarized in table 1. The initial requirements, specified in 1973, were that the stock be listed on a national exchange, and have a "large number of shares outstanding which are widely held and actively traded," although exactly what was meant by this was not quantified until later. Also, it was specified that "the list of approved underlying securities shall be representative of issuers engaged in a wide variety of business activities." In 1975, an income and no-default requirements were added. In 1976, the minimum income requirement was increased, and a no-deficit requirement was established. Also in 1976, exact criteria replaced the broadly defined requirements with respect to public float, number of shareholders, underlying volume, and share price. In 1981, the no-default, income, public float, number of shareholders, trading

[4] It should be noted, however, that the exchanges refrained from cross-listing each others' options until 1999

volume and share price requirements were modified. In 1985, the set of securities eligible for option listing was expanded to include NASDAQ stocks. In 1991, the requirements were further relaxed.

4 Testable Hypotheses

Our empirical investigation has two main components. First, in order to better understand the option listing decision, we investigate the relative importance of firm size, underlying trading volume, and volatility in explaining the exchanges' observed choices. We distinguish between "long-term" and "short-term" volume and volatility, in an attempt to measure the potential for selection bias arising from the endogeneity of the listing decision. We also examine whether the relative importance of these factors has changed over time. Thus, we have the following hypotheses:

H_1: *Exchanges are more likely to list options on larger firms, stocks with higher prior trading volume, and stocks with higher volatility*;

H_2: *The relative importance of firm size, volume and volatility in explaining option listing decisions has changed over time*;

H_3: *Long-term (short-term) prior volume and volatility has become a less important (more important) determinant of option listing over time*.

The second component of our empirical analysis is to re-examine, in light of what we have learned about the listing decision, results previously reported in the literature with respect to volatility, volume and price effects of option introduction. In order to accomplish this, we will construct control samples of stocks that were eligible but not selected for listing, but that we believe to be good candidates for option listing,

based on our previous analysis of observed listing choices. By comparing apparent listing effects between the sample of selected stocks and the control samples, we can test the additional hypotheses:

H_4: *The apparent effect of option listing on volume and volatility is significantly different for stocks that were actually selected and stocks that appear to be good candidates for listing but were not selected;*

H_5: *After accounting for the endogeneity of the listing decision, apparent option listing effects have changed over time.*

In section 2, we provided intuition to help explain why the endogeneity of the listing decision might bias our measurement of the volume and volatility effects, but did not suggest any reason why exchanges might list options on stocks about to experience abnormal returns. Nor, in fact, would we expect exchanges to have special information about future abnormal returns that might influence their listing decision. However, we are still interested in re-examining the price effect, for two reasons. First, it is possible that the results reported by previous authors may be influenced by model misspecification in the event-study methodology. For instance, suppose that firm size proxies for a priced risk factor. Then the market model based on the CRSP value-weighted portfolio, which underlies the results reported by previous authors, is misspecified, and the abnormal returns arising from this model may be correlated with firm size. Because options listed in the 1970's tended to be on large firms, while those listed in the 1990's tended to be on smaller firms, this may account for the apparent switch from positive to negative abnormal returns. The second reason we are interested in re-examining the price effect is that we believe the price effect may be related to the volume effect, if the price is responding to changes in the liquidity of the underlying stock, or to the volatility effect, if the price is responding to anticipated changes in risk. Thus, we have the following additional hypotheses:

H_6: *The apparent abnormal stock return in a window around option listing is significantly different for stocks that were actually selected relative to stocks that appear to be good candidates for listing but were not selected;*

H_7: *The apparent abnormal stock returns around option listing are cross-sectionally related to changes in the volume and/or volatility of the underlying stock.*

5 Data

The first step in constructing our sample was to collect the data necessary to identify, at any point in time, the universe of stocks eligible for option listing.

We attempt to establish the eligibility of all publicly traded securities, at various points in time, by comparing their characteristics to the option listing requirements, summarized in table 1. We obtain from the CRSP database data on prior volume, price, number of shares outstanding, exchange listing, and type of share, for the all underlying securities in the database, as of each listing date (or as of the middle of each month, for the months in which there were multiple listing dates) over the period 1973-1996.

We use the prior trading volume, prior share price, exchange listing, and type of share data to establish directly eligibility based on these criteria. Because our focus is the option listing effect on the market for underlying securities, we exclude from our analysis securities such as ADRs and country funds, since their primary underlying markets are not in the U.S.

To establish whether securities meet the eligibility requirements with respect to income, we obtain data for income before extraordinary items, but after taxes, from the Compustat database, for the years in which the income requirement for eligibility existed (1975-1991), for all securities in the database, and merge this information with the data from CRSP. Also from Compustat, we obtain data for all securities

whose debt is indicated to be in default by the assigned S&P rating, and use this information to identify additional firms that were ineligible for option listing.

To establish eligibility based on the public float criterion, we obtain data for number of shares held by insiders from the Disclosure database, and subtract it from the number of shares outstanding. The Disclosure database reports the data since 1986. For the years before that, and for firms with missing insider ownership data, we rule out eligibility based on the public float requirement using simply the number of shares outstanding.[5] We also hand-collect insider ownership data from proxy statements for the period after October 1991 for the firms for which Disclosure does not provide this information.

From Disclosure we also obtain data on the number of shareholders, to establish eligibility based on this criterion. However, this number, as well as the original number published in the firms 10K report, reflects only the number of registered shareholders. We find numerous examples of firms that were listed, and appeared to be eligible with respect to other listing requirements, but had fewer shareholders than required, based on the number recorded in their 10K reports. Given that many shareholders hold their shares in street name, it is practically impossible to determine the true number of shareholders for each firm. In our conversations with representatives of CBOE, they confirmed that when listing a security, they often call brokerage firms to investigate the true number of current shareholders. However, such an investigation regarding past shareholders, and for the universe of all listed securities, is not possible. In fact, SEC has explicitly recognized the difficulty of this task for the options exchanges, and has used it as the main motivation to reduce the required number to 2,000 from 6,000 in 1991. Therefore, we do not use the number of shareholders to rule out stocks as ineligible. However, this number is correlated with number of shares outstanding, public float, and market capitalization (price times shares, which the public

[5] This allows a small fraction of securities, whose total number of shares barely exceeds the requirement for public float, and therefore we cannot rule them out as eligible, to enter the sample, although they may be ineligible. Given that insiders hold, on average, around 10%, including such firms would not seem to allow firms that are highly ineligible, based on this criterion, to enter the sample.

float and the price requirements collectively measure), so it is unlikely that that the omission of this criterion allows securities that are obviously ineligible to enter the sample.

This approach yields a total of 1,188,161 firm-months as of 226 listing dates over the period 1973-1996, of which we classify 845,002 as ineligible, leaving 343,159 firm-months that satisfy the option-listing eligibility requirements.

The next step was to identify the options that were actually chosen for listing. Listing dates for equity options listed on all domestic exchanges were obtained from a document provided by the CBOE. This document also contained information on delisting dates, for options that have been delisted. Combining the listing and delisting data, we constructed, at each point in time, the set of all stocks with options currently trading. By removing this set from the set of all eligible firms, we identified the set of options that were both eligible and "available" for option listing, resulting in a set of 221,668 option listing opportunities. During this period, we have a record of 2,606 option listings, counting simultaneous multiple listings as a single event. Of these, 2,402 option listings on may be found within our larger set of eligible, available, listing opportunities. These listings occurred on 2,305 unique firms.[6]

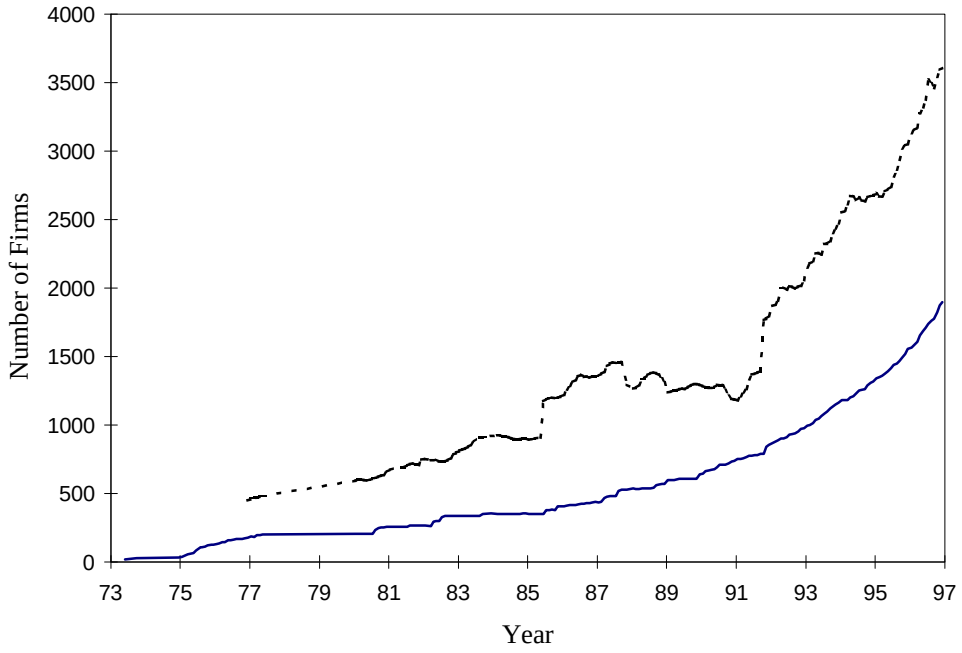
Figure 6 depicts the time series of the resulting sample size from 1973-1996. The lower line depicts the number of stocks with listed options, and difference between the upper line and the lower line represents the number of eligible but non-optioned stocks. Although there have been a large number of options listed over the years, there has also been a large increase in the number of stocks eligible for option listing.[7] We require that all stock used in the analysis of the price, volume and volatility before and after option listing (see Section 8) to have data available to calculate variance and volume over a 250-day window before and after the option listing dates, as well as data on price and number of shares outstanding needed for our logistic regressions. There are 1,953 listed stocks that satisfy this requirement. Volume and

[6] Firms listed more than once include those that were crosslisted by a second exchange, but not during the same month as the original listing, and those that were first listed on one exchange, delisted, and then listed again at a later date.

returns data around listing dates were extracted from CRSP, and we use these returns to calculate measures of volatility, over various horizons around the listing date.

Figure 6: Optioned vs. Eligible Non-Optioned Stocks: 1973-1996

The dashed line represents the total number of stocks meeting the eligibility requirements for option listing, as of each month in which options were listed. The solid line represents the total number of listed stocks.



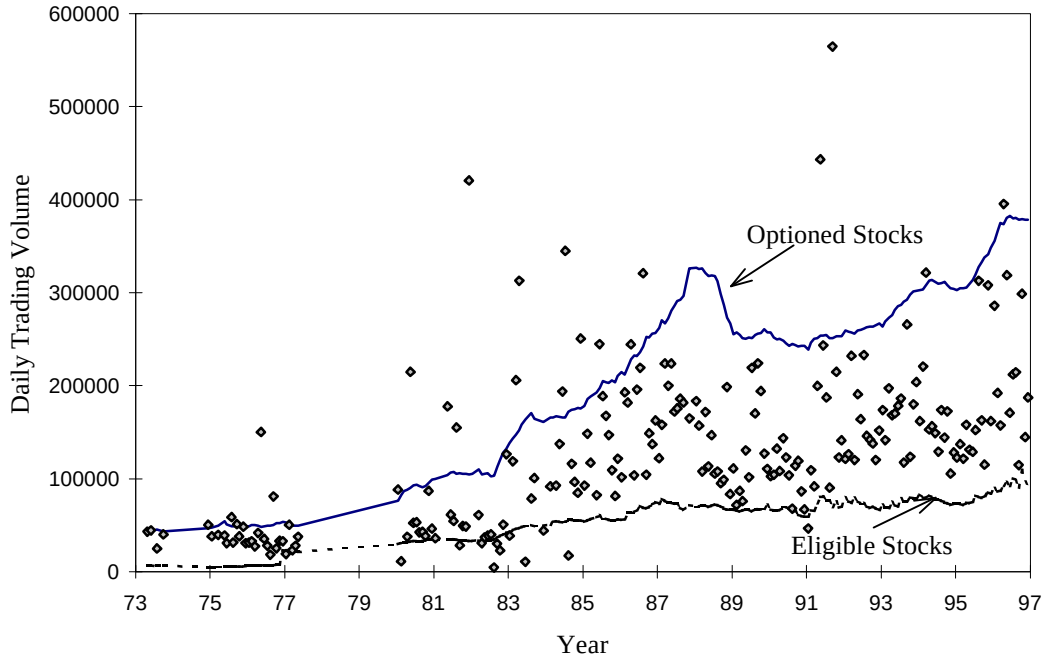
6 A First Look at the Data

For each month in our sample, and for each stock, we calculated the average daily trading volume over the 250 trading days prior to the fifteenth of the month, and the standard deviation of daily returns over the same period. For each month, we then calculated means across monthly subsamples of stocks, including those stocks already optioned, the universe of stocks eligible for listing but not already listed, and those that were actually selected during that month. Figure 7 shows how average daily trading volume differs across these three groups.

[7] It is difficult to know exactly how to define eligibility in the earliest period of options trading, when eligibility was restricted only by qualitative statements such as "widely held" and "actively traded."

Figure 7: Prior Volume

Average daily trading volume over the 250 prior trading days. The dots represent monthly observations of the average prior trading volume across all stocks selected for option listing during the month. The solid line represents the average volume across all stocks already optioned, and the dashed line represents the average volume across non-optioned stocks that were eligible but not selected for listing.



Notice that the options selected for listing generally have a higher trading volume than those not selected, and a lower trading volume than those previously selected. It is not surprising that prior trading volume appears to be an important determinant of option listing. It is interesting to note that in absolute (contract volume) terms, options that are eligible but not selected for option listing today tend to have a higher trading volume than the options that were selected for listing in the 1970's.

Figure 8: Prior Volatility

Prior volatility, calculated as the annualized standard deviation of the continuously compounded daily stock returns over 250 trading days prior to listing. The dots represent monthly observations of the average prior volatility across all stocks selected for option listing during the month. The solid line represents the average volatility across all stocks already optioned, and the dashed line represents the average volatility across non-optioned stocks that were eligible but not selected for listing.

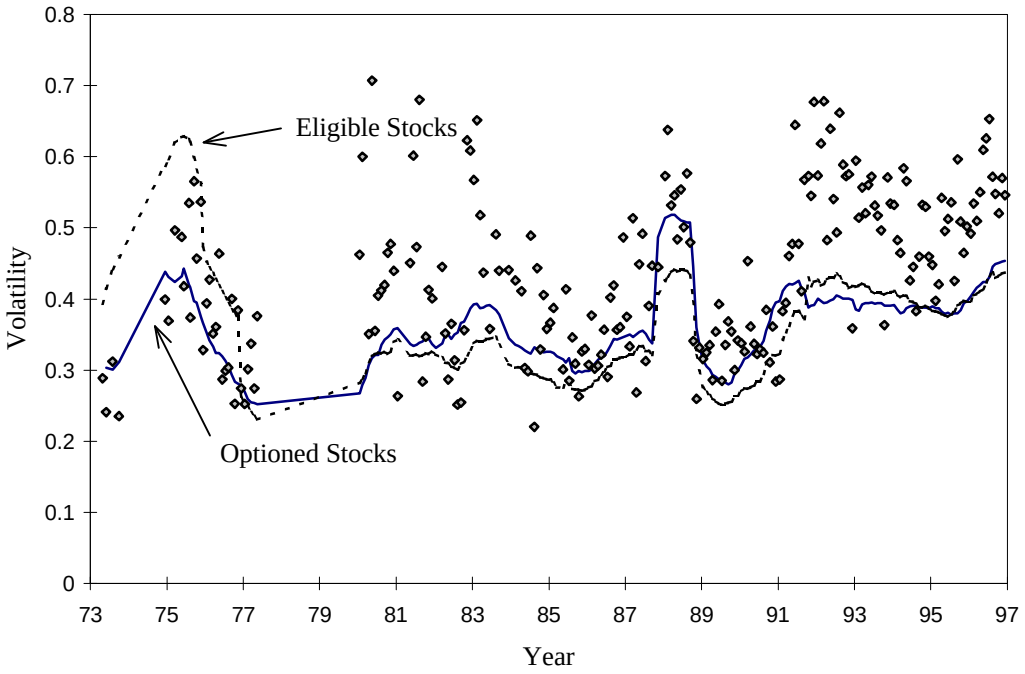


Figure 8 shows the prior volatility over the same three groups. A first glance at this figure suggests that in the period since 1980, option exchanges have tended to select options on high volatility stocks. Prior to 1980, however, this does not appear to have been the case. Thus, we see that since 1980 the newly selected options not only tend to have higher volatility than the stocks that were not selected, but also higher than the stocks that were previously selected. Coupled with the previous figure, this figure suggests that in the early days of option markets, exchanges concentrated on listing the most actively traded stocks with little regard to volatility, but then once the largest stocks had been listed, exchanges began considering both volume and volatility.

Figure 9: Market Capitalization

Market capitalization at the time of listing, in million dollars, calculated as the product of price and number of shares outstanding. The dosts represent observations of the average market capitalization across all stocks selected for option listing during the month. The solid line represents the average market capitalization across all stocks already optioned, and the dashed line represents the average capitalization across non-optioned stocks that were eligible but not selected for listing.

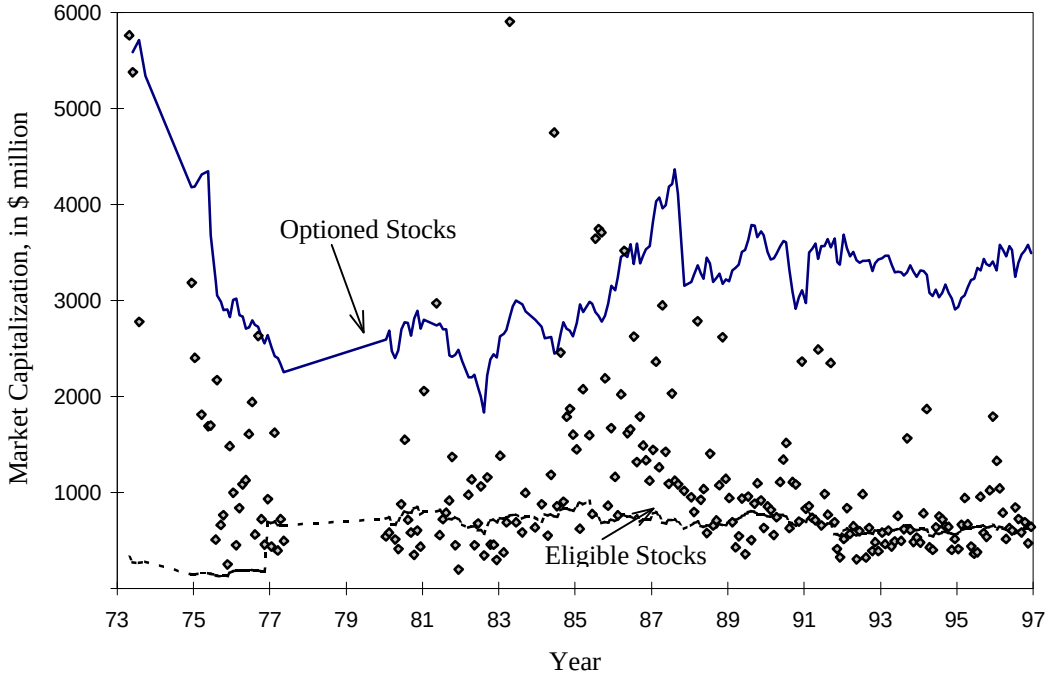


Figure 9 compares the same groups on the basis of market capitalization. Here, a number of stylized facts may be observed. First, as we would expect, options tend to be listed on larger stocks first, so that the stocks selected for option listing tend to be considerably smaller than those already optioned. However, once the really large stocks had already been listed, it appears that firm size became less important in the listing decision, as evidenced by the fact that during the early 1980's, the average market cap of firms selected for option listing actually tended to be smaller than the average eligible, non-optioned firm. In the late 1980's, we appear to have returned to a regime where the stocks selected for option listing are larger than the average eligible firm. This may be related to the expansion of eligible firms to include OTC stocks in 1985. Then in the 1990's, we once again observe a large number of options listed on firms smaller than the average eligible firm.

7 The Determinants of Option Listing

In this section, we report the results of Logistic regressions examining the relative importance of various factors influencing the exchanges' decision of which options to list. We estimate a logit model of the following form on a pooled dataset containing monthly observations for all stocks classified as eligible for option listing but not yet optioned:

$$L(LIST) = b_0 + b_1\, VOLUME + b_2\, STD + b_3\, ABVOL + b_4\, ABSTD + b_5\, SIZE + e \qquad (1)$$

where *L(LIST)* is the log-odds ratio that a stock will be selected for option listing, *VOLUME* is average daily trading volume over the 250 trading days prior to the fifteenth of the month, *STD* is the annualized standard deviation of log returns over the same period, *ABVOL* is the ratio of 30-day to 250-day average daily trading volume, *ABSTD* is the analogous measure for volatility, and SIZE is the market capitalization of the firm.

Table 2 reports the standardized slope estimates from the logit model estimated over the entire sample (1973-1996), as well as for various subperiods, defined by regulatory changes. The year 1980 seems to be the first natural place for a structural break because there was a moratorium on listings immediately prior to 1980, because around 1980 there were changes in the multiple listing policy, the eligibility requirements, and the number of exchanges, and because other authors, such as Sorescu (1999), have reported changes in observed option listing effects around that time. We also break the sample into smaller subperiods based on the expansion of option-eligibility to include OTC stocks in May, 1985, and the additional relaxation of the eligibility requirements and the move back to multiple listing in October, 1991.

Over the entire period, and in each subperiod, we find a positive coefficient on VOLUME, indicating that options are more likely to be listed on high volume stocks. Looking at the magnitude of the standardized estimates, volume appears to have been a more important determinant prior to 1980.

The coefficients on prior volatility are consistent with the intuitive observations made from figure 8: prior to 1980, options tended to be listed on lower-volatility stocks, while in every subperiod after 1980, high volatility stocks were more likely to be selected. With respect to abnormal trading volume in the thirty days prior to option listing, we find that the coefficient is positive and significant in every subperiod. It is unclear whether this represents exchanges listing options on stocks going through periods of unusual trading activity, or excess stock trading in response to an announcement of imminent option listing.

In order to examine the common claim that option exchanges are more likely to list options on stocks undergoing periods of unusually high volatility, we may examine the coefficients on abnormal volatilty (ABSTD). Although this coefficient is positive and significant in the entire sample, the subperiod results suggest that this appears to be driven primarily by option listings in the late 1980's. A closer examination reveals that the median ratio of abnormal volatility over the full sample is actually close to one (0.977) for the selected stocks, while it is significantly lower than one (0.919) for the stocks that were eligible, but not selected for listing, which indicates that options tended to be listed in periods of market-wide decline in volatility.

Finally, examining the coefficients on SIZE, we see a significant, positive coefficient in every subperiod prior to 1990, suggesting that larger firms were more likely to be listed. After 1990, this effect vanishes. This result may be related to the move to multiple listing, as argued by Mayhew (1998).

8 Option Listing Effects

In the previous section, we documented that the relationships between firm characteristics and the likelihood of option listing seem to have changed over time. This suggests the possibility that the endogeneity of the listing decision may induce bias in studies of option-listing effects, and in particular, that the direction and/or the magnitude of this bias may be different in different periods.

In this section, we re-examine the volatility, volume, and price effects of option listing, using a control-sample methodology, through which we attempt to account explicitly for changes in the nature of endogeneity of the listing decision. More specifically, we construct three control samples of stocks that were eligible, but not selected for option listing, and that we believe to be good candidates for listing, based on our previous analysis of the listing decision.

8.1 Construction of Control Samples

Each of the three control samples is composed of 1,953 stock/dates, matched in time to the 1,953 actual listing events. The control samples are constructed by selecting, for each stock that was actually chosen for listing, a matching stock that was eligible for option listing on that date, but was not selected for listing any time within the subsequent twelve months. This ensures that the control sample is composed entirely of non-optioned stocks over the entire period over which post-event volume and volatility are measured. In addition, stocks that have already been included in the control sample within the preceding twelve months are excluded from consideration, in order to prevent overlapping volume or volatility windows in the control sample.

Our first control sample is constructed by matching firms solely on the basis of firm size, as measured by market capitalization of equity. This captures what we believe, based on our previous examination of the listing data, to be the most significant change over time in the characteristics of stocks selected for option listing. Naturally, large-cap stocks, which also tend to be actively traded, were selected

for option listing first, then the exchanges appear to have gradually worked their way down to smaller stocks.

The second and third control samples are constructed using a matching procedure that is based on the logit model described above. First, we divided the sample into yearly subperiods, and estimated annual coefficients for the logit model described in equation 1. Then, for each month in which options were listed, all the stocks that were eligible but not selected for option listing are ranked, on the basis of their predicted probability of listing, according to the logit model. As mentioned above, we exclude from consideration those stocks that were actually selected for option listing any time in the subsequent year, and also those that have already been included in the control sample any time over the past year. Our second control sample is constructed by selecting the *n* stocks having the highest predicted probabilities, where *n* is the number of stocks actually selected for listing in that month. Our third control sample is constructed by choosing the stocks that match the original sample as closely as possible in terms of probability of listing, as predicted by the logit model.

Table 3 provides summary statistics for the 1,953 actual option listings, and the 1,953 in each control sample. As expected, the characteristics of the control sample do not match those of the selected sample exactly - presumably, the exchanges selected the best candidates for listing, and we are attempting to identify the next best candidates. The first sample comes quite close to matching the original sample in firm size, as it was designed to do, but the stocks in this sample tend to have lower prior volatility and volume than those selected for option listing. The logit-based control samples are made up of somewhat smaller stocks, but more closely match the volume and volatility characteristics of the original sample. The second control sample, based on the highest predicted probabilities, comes closest to matching the long-term trading volume of the original sample, but the stocks in this sample have a higher short-term volume and volatility than the selected stocks. The third control sample, based on matched predicted probabilities, matches the original sample quite closely in terms of short term volume and prior volatility, and matches long term volume nearly as well as the second control sample.

8.2 Volatility Effect

Previous authors have suggested various methods for testing whether option introduction affects the volatility of the underlying stock. The methods differ primarily in how they adjust for market volatility. Because our control samples are matched in time to the original sample, time varying market volatility should have a similar effect on the two samples.

The first step in our analysis of the volatility effect is to calculate the sample variance of raw continuously compounded daily returns before and after each event in the selected sample and the three control samples. Recall that we generally calculate volatility for a window of 250 trading days before and after the event, yet for inclusion in the both the original and control samples, we only require that the stocks have 150 trading days of data. Thus, it is possible that there may be a slight mismatch in window sizes between some pairs of stocks in the original and control samples. This is only a minor problem, occurring in only a few cases. To correct for this, we normalize each variance estimate by dividing by the variance of the CRSP value-weighted portfolio calculated over the corresponding period. The resulting number we will call "market-adjusted variance."

Table 4 reports, for each of the four samples and across various subperiods, the median ratio of market-adjusted variance after option listing to before option listing. In order to determine whether option listing appears to be associated with a change in volatility, we use Wilcoxon rank-sum tests to determine whether the variance change is significantly different for the selected stocks and those in the matched samples. We report the medians of the volatility ratios year-by-year, and the probability values resulting from the Wilcoxon test are reported for four main subperiods (the subperiods are delimited by structural changes in the market, as described in section 3). The relationship between option listing and volatility changes appears to have evolved over time. In the period from 1973-1980, the median variance increase was lower for the selected stocks than for any of the matched samples, although the differences are statistically indistinguishable. For 1981-1985, the result differs across different control samples. For the

period 1985-1991, the median variance increase was higher for the selected stocks than for any of the matched samples, but the difference is not statistically significant. For the period 1991-1996, we find the same result, but in this case the difference is highly significant.

This finding, that volatility increases with option listing, at least in some time periods, runs contrary to nearly all the previous results reported in the literature. There are various possible interpretations. One is that the option listings caused an increase in volatility. In this case, it is unclear why this effect should be manifested only in certain periods, and not in others. In our opinion, a more likely explanation is that in the early period, exchanges listed options primarily in response to the stocks' permanent characteristics, but then as they began to run out of "obviou
listing options in response to changes in market conditions. Thus, we believe that the coincidence between option listing and a volatility increase in the later part of the sample is a natural consequence of rational listing choices made by forward-looking exchanges. As argued in section 2, we believe that exchanges list options in anticipation of volatility increases, or in response to permanent volatility increases. We performed various robustness checks, and verified that this result holds for the ratio based on raw volatility as well and is not driven by the market normalization, and the result is robust to alternative measures of volatility, such the average sum of squared stock returns based on a zero mean return assumption.

8.3 Volume Effect

In order to examine the effect of option listing on trading volume, we compare the changes in average daily trading volume around the time of option listing in the selected sample and control samples. Table 5 reports the median ratios of average daily volume after listing to average daily volume before listing, for the selected sample and each of the three control samples, over various subperiods. The results are fairly uniform across periods and control samples: in most cases, volume increases significantly more for the optioned stocks than those in the control samples. This confirms what has previously been reported in the literature, that option listing appears to cause an increase in trading volume. We believe that the

most plausible explanation for this result is that option listing leads to increased hedging demand by option traders.

8.4 Price Effect

Conrad (1989) and other authors report finding a positive price effect in response to option listing in the earlier years, while Sorescu (1999) finds a negative price effect after 1981. Our tests are based on exactly the same variant of the Brown-Warner event-study methodology that Sorescu (1999) uses, since our goal is to replicate the existing results as closely as possible, and then examine whether they are related to the endogeneity of the listing decision. We estimate the market model parameters over the period day -100 to day -6 relative to the listing, and then calculate the Cumulative Abnormal Returns (CARS) over an eleven-day event window surrounding option listing, from day -5 to day +5. Table 6 reports the results. The Average Cumulative Abnormal Returns (ACARs) are reported for both the selected stocks and those in the control sample, year by year and for various longer subperiods. Also reported are t-statistics for the null hypothesis that that the ACARs are equal to zero. Because of the data requirements that we impose, our sample is slightly different from that used by Sorescu (1999), and the coefficients are not identical. Nevertheless, the results very closely replicate his results, year by year, both in terms of the magnitude and the significance of the Average Cumulative Abnormal Returns (ACARs). Both in Sorescu's paper and here, the ACARs tend to be significantly positive prior to 1980 and negative after 1980.

Note, however, the ACARs are also negative in many years for the control samples, sometimes significantly so. This calls into question the strength of Sorescu's conclusion that the option listing has been associated with a negative price effect since 1981. We compare the abnormal returns experienced by the selected stocks to the abnormal returns in the control samples. Table 6 reports the probability values arising from t-tests of the null hypothesis of equal ACARs between selected and control samples. For subperiods 1981-85 and 1985-91, these tests fail to reject the null hypothesis of equal means between the selected sample and each of the three control samples. Only for the subperiod 1991-1996 is the ACAR of

the selected sample significantly more negative than that of the control samples. In additional tests, not reported here, we repeated this analysis using a 3-day event window. In this case, the difference between the selected sample and control samples in the post-1981 samples was even smaller--in the subperiod 1991-1996, the ACARs of the selected stocks were indistinguishable from control samples two and three. Overall, these results suggest that the negative price effect after 1980 appears to be less pronounced than previously reported in the literature.

On the other hand, for the subperiod 1973-1980, the data appear to confirm Conrad's (1989) findings of a positive price effect. In this period, the abnormal return around option listing is significantly higher for selected stocks than for those in each of the three control groups. Event study results based on a 3-day event window, not reported here, also confirm this finding.

8.5 Relationship between the Price, Volatility and Volume Effects

In order to shed more light on the price effect, we examine whether the abnormal returns around option listing are cross-sectionally related to changes in volume or volatility. Let us consider the hypothesis that that the market price may respond to anticipated changes in volatility or volume in the underlying stock. If market participants expect the option listing to affect the liquidity and overall risk of the listed stocks, and are able to distinguish among the anticipated changes in the cross-section of listed firms, we would expect to see a positive relation between increase in volume and the abnormal return, and a negative relation between the abnormal return and increase in volatility, for the sample of the selected stocks. However, we would not expect to see such an effect in the control samples.

Alternatively, if we observe such a relationship in both the sample of selected stocks and the control samples, then the price effect will appear to be an indirect manifestation of relations between price movements, and changes of volume and volatility that are not related to option listing, but hold for securities in general.

Finally, if the ACAR is cross-sectionally related to firm size, this would indicate the possibility that the market model used to measure the ACARs is misspecified and firm size proxies for an omitted risk factor.

Table 7 reports the results of ordinary least squares (OLS) regressions of ACAR on the change in volume, the change in volatility, and firm size. The independent variables in these regressions are the ratios of post- to pre-event volume and market-adjusted volatility, as defined earlier, and the log of firm size, measured by market capitalization. Results are reported separately for short-term (30-day) and long-term (250-day) windows. The explanatory power of these regressions is very low. Nevertheless, we see that in most cases, the coefficients on volume and volatility have the anticipated signs, and are often statistically significant: firms experiencing greater abnormal returns tend also to experience a greater increase in volume and/or decrease in volatility. However, this effect is statistically insignificant for the long-term window for the sample of selected stocks. Moreover, just looking at the short-term window, the effect appears to be equally as strong in the control samples as for the selected stocks, indicating that the price effect cannot be solely attributed to option listing. Finally, size appears to be positively and significantly related to the abnormal returns, at least for the selected stocks.

9 Conclusion

In this paper, we have re-examined the question of whether option listing appears to affect the volatility or trading volume of the underlying stock, and whether there is an abnormal return around the listing date. While previous authors have recognized a potential bias associated with the endogeneity of the option listing choice, little effort has been made to explicitly model this choice, or to correct for endogeneity while testing for option-listing effects.

In order to understand better the nature of the listing decision faced by the option exchanges, we use a logit framework to measure the relative contributions of firm size, prior short-term and long-term average trading volume, and prior short-term and long-term volatility in explaining the observed history of

listing choices. We find that prior long-term trading volume is always an important factor, but the relative importance of other factors influencing the listing decision has evolved over time. The first options listed were on large, low volatility stocks, but more recently the focus appears to have shifted toward listing high volatility stocks, regardless of firm size.

We then use the information we have gleaned about the nature of the listing decision to construct three control samples of stocks that were eligible but not selected for listing, and yet which appear to have been good candidates for listing. We compare the observed changes in volatility, volume, and price at the time of option listing across the true sample of listings and the three control samples. Unlike previous authors, we find that selected stocks experience an increase in volatility relative to control stocks after listing, but only in the more recent subperiod. Because this result does not appear in the earlier periods, and has changed over time, we do not interpret this as evidence that option listing has affected volatility, but rather that it is a reflection of evolution in the listing decision faced by the exchanges. Our interpretation is that exchanges are forward-looking, and list options in anticipation of high volatility. With respect to volume, we confirm the results of previous research indicating a significant increase in volume following option listing, perhaps as a result of increased hedging volume. With respect to the price effect, we confirm the results of early research that documented a positive price effect around option listing prior to 1981. On the other hand, recent results reporting a negative price effect after 1981 do not appear to be robust.

Several interesting questions remain to be addressed. As argued in section 2, if the endogeneity of the listing decision is truly important, then we would expect to see apparent option listing effects sensitive to the choice of window size. Careful analysis of the robustness of apparent option listing effects to the choice of pre- and post-event window sizes might yield further insights to the nature of the listing decision, and its evolution over time. In addition, if endogeneity is important, we might expect to see systematic differences between options that are listed as a result of suddenly becoming eligible, for example as a result of relaxation of regulatory requirements, and those that remain eligible for some time prior to being listed.

As discussed in section 3, there are differences in the structure of the different option markets, and it may be worthwhile investigating whether option listing effects appear to be related to market structure. Finally, we believe that the apparent price effect of option listing merits further analysis. Given that the price effect appears to be cross-sectionally related to firm size, it may be interesting to investigate whether any price effect would appear under an alternative event-study methodology, in which firm size proxies for an omitted risk factor.

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Table 1: Initial Listing Requirements for Underlying Securities

This table presents the requirements that the underlying common stocks of option contracts must meet or exceed.* Default is defined as default in the payments with respect to preferred stock, debt or long-term leases. Income is defined as net income, after taxes, but before extraordinary items net of tax effect. Deficit is defined before extraordinary items. In addition, the requirements include that the list of approved underlying securities are representative of issuers engaged in a wide variety of business activities.

Year	Exchange Listing	Public Float	Number of Shareholders	Trading Volume	Price	Default	Income
1973	Listed on a national exchange	"Large number of shares outstanding which are widely held and actively traded";				N.A.	N.A.
1975	Listed on a national exchange	"Large number of shares outstanding which are widely held and actively traded";				No default in last three years	At least $250,000 for the last three fiscal years
1976	Listed on a national exchange	8,000,000	10,000	2,000,000 shares per year in each of last two years	$10.00 per share or higher each business day of the six calendar months preceding the listing	No default in last three years	At least $1,000,000 in three of last four years, including in the most recent year; No more than one annual deficit in the last four years and no deficit in the most recent year;
1981	Listed on a national exchange	7,000,000	6,000	2,400,000 shares per year in the last twelve months	$10.00 per share or higher each business day of the three calendar months preceding the listing	No default in the last twelve months	At least $1,000,000 for the last eight quarters
1985	Listed on a national exchange or a national market system	Same	Same	Same**	Same	Same	Same
1991	Listed on a national exchange or a national market system	7,000,000	2,000	2,400,000 in the last twelve months	$7.50 per share or higher for the majority of business days during the three calendar months preceding the listing	N.A.	N.A.

*After 1991 the SEC allowed the listing of options on securities other than common stock, such as preferred non-convertible stock, ADR's and country funds.

**The stock of MCI Communication was exempt from this requirement.

Table 2: Determinants of Option Listing

The table presents the standardized estimates from a logit model of option listing as a function of characteristics of the underlying stock. VOLUME and STD are the average daily trading volume and standard deviation of daily returns on the underlying stock over the prior 250 trading days. ABVOL and ABSTD are ratios of 30-day to 250-day prior trading volume and standard deviation, and SIZE is the market capitalization of the firm. The model is estimated on a population of pooled monthly observations of all stocks that are not yet optioned but are eligible for option listing. Results are reported for the whole sample, and for various subperiods. One asterisk (two asterisks) indicates statistical significance at the 5% (1%) level.

Variable	1973-96	1973-80	1981-85	1985-91	1991-96
VOLUME	0.0945 **	0.3351 **	0.0748 **	0.0401 *	0.0894 **
STD	0.1531 **	-0.2203 **	0.4021 **	0.2516 **	0.2577 **
ABVOL	0.1677 **	0.1529 **	0.1090 **	0.1518 **	0.2439 **
ABSTD	0.0429 **	-0.0528	0.0112	0.0824 **	0.0002
SIZE	0.0501 **	0.0403 **	0.0921 **	0.1760 **	-0.0052

Table 3: Characteristics of the Samples

The table presents summary statistics for the sample of selected stocks, and three control samples. Control sample 1 is constructed by matching each selected stock with a non-selected stock that has the closest firm size at the time of listing. Control sample 2 is constructed by matching the selected stocks with the same number of non-selected stocks that have the highest predicted probability of listing from a logit analysis at the time of listing. Control sample 3 is constructed by matching each selected stock with a non-selected stock that has the closest predicted probability of listing a the logit analysis at the time of listing. The variables *VOLUME* and *STD* are the average daily trading volume and annualized standard deviation of daily returns on the underlying stock over the 250 trading days prior to listing. *ABVOL* and *ABSTD* are ratios of 30-day to 250-day prior trading volume and standard deviation, and *SIZE* is the market capitalization of the firm. All four samples consist of 1,953 stocks.

		Selected Stocks	Control Sample1	Control Sample2	Control Sample3
VOLUME	*mean*	112,355	64,470	86,709	75,110
	median	91,425	35,648	44,230	41,044
STD	*mean*	0.46	0.32	0.53	0.47
	median	0.43	0.29	0.51	0.44
ABVOL	*mean*	1.47	1.08	2.15	1.48
	median	1.32	0.99	1.93	1.26
ABSTD	*mean*	1.14	0.97	1.51	1.17
	median	0.97	0.83	1.14	0.94
SIZE	*mean*	978,515	887,004	659,469	645,823
	median	520,362	519,585	211,962	243,452

Table 4: Volatility Effect

This table presents the median ratios of market-adjusted volatility after option listing to market-adjusted volatility before option listing, for stocks that were selected for option listing and three control samples of eligible stocks that were not selected, for various subperiods. Volatility is measured as the variance of daily stock returns over 250 trading days. Control sample 1 is constructed by matching each selected stock with a non-selected stock that has the closest firm size at the time of listing. Control sample 2 is constructed by matching the selected stocks with the same number of non-selected stocks that have the highest predicted probability of listing from a logit analysis at the time of listing. Control sample 3 is constructed by matching each selected stock with a non-selected stock that has the closest predicted probability of listing from a logit analysis at the time of listing. In parentheses are reported probability values from Wilcoxon rank-sum median tests for differences between the sample of selected stocks and each control sample.

Period	N	Selected Stocks	Control Sample 1	Control Sample 2	Control Sample 3
1973	29	0.667	0.714	0.714	0.636
1974	8	1.047	1.026	1.381	1.386
1975	87	1.209	1.219	1.241	1.204
1976	65	1.161	1.254	1.282	1.188
1977	23	1.062	0.880	0.828	0.948
1980	54	1.011	1.089	0.868	0.967
1981	14	1.183	1.033	1.048	1.001
1982	72	0.833	0.836	0.643	0.751
1983	29	1.554	1.543	1.355	1.367
1984	20	0.995	1.327	1.007	1.040
1985	70	0.812	0.861	0.701	0.796
1986	54	0.738	0.675	0.572	0.626
1987	108	0.421	0.432	0.372	0.399
1988	95	2.343	2.237	2.169	2.088
1989	82	1.001	0.893	1.155	0.963
1990	112	1.221	0.958	1.164	1.101
1991	132	1.416	1.450	1.234	1.314
1992	116	1.395	1.378	1.220	1.346
1993	174	0.941	0.952	0.764	0.862
1994	184	1.058	1.000	0.987	1.021
1995	249	0.741	0.646	0.636	0.667
1996	176	0.787	0.729	0.696	0.690
1973-80	266	1.093	1.138	1.134	1.103
			(0.385)	(0.851)	(0.774)
1981-85	139	0.955	1.038	0.812	0.836
			(0.280)	(0.004)	(0.023)
1985-91	569	1.011	0.925	0.931	0.948
			(0.286)	(0.108)	(0.122)
1991-96	979	0.958	0.920	0.862	0.888
			(0.008)	(0.000)	(0.000)
1973-96	1953	1.005	0.964	0.904	0.938
			(0.045)	(0.000)	(0.000)

Table 5: Volume Effect

This table presents the median ratios of the average daily volume of the underlying stock over 250 days after option listing to the average daily volume over 250 days before option listing, for stocks that were selected for option listing and three control samples of eligible stocks that were not selected, for various subperiods. Control sample 1 is constructed by matching each selected stock with a non-selected stock that has the closest firm size at the time of listing. Control sample 2 is constructed by matching the selected stocks with the same number of non-selected stocks that have the highest predicted probability of listing from a logit analysis at the time of listing. Control sample 3 is constructed by matching each selected stock with a non-selected stock that has the closest predicted probability of listing from a logit analysis at the time of listing. In parentheses are reported probability values from Wilcoxon rank-sum median tests for differences between the sample of selected stocks and each control sample.

Period	N	Selected Stocks	Control Sample 1	Control Sample 2	Control Sample 3
1973	29	1.107	1.198	0.986	0.893
1974	8	1.202	1.239	1.096	0.903
1975	87	1.312	1.258	1.147	1.152
1976	65	1.111	1.066	1.278	1.101
1977	23	0.956	0.871	0.864	0.870
1980	54	1.211	1.250	1.152	1.135
1981	14	1.630	1.165	1.023	0.747
1982	72	1.844	1.589	1.486	1.493
1983	29	1.041	1.118	1.145	0.991
1984	20	1.324	1.321	1.387	1.440
1985	70	1.479	1.244	1.293	1.320
1986	54	1.432	1.171	1.538	1.300
1987	108	1.308	1.146	1.322	1.280
1988	95	1.209	0.901	1.216	0.952
1989	82	1.213	1.072	1.237	1.033
1990	112	1.264	1.038	1.278	1.185
1991	132	1.338	1.102	1.241	1.088
1992	116	1.302	1.036	1.251	1.061
1993	174	1.338	1.089	1.255	1.104
1994	184	1.319	0.962	1.296	1.143
1995	249	1.587	1.253	1.472	1.336
1996	176	1.446	1.175	1.373	1.133
1973-80	266	1.171	1.159 (0.438)	1.128 (0.173)	1.106 (0.026)
1981-85	139	1.475	1.328 (0.056)	1.272 (0.037)	1.250 (0.007)
1985-91	569	1.291	1.102 (0.000)	1.293 (0.882)	1.193 (0.003)
1991-96	979	1.398	1.103 (0.000)	1.306 (0.020)	1.154 (0.000)
1973-96	1953	1.342	1.135 (0.000)	1.278 (0.001)	1.160 (0.000)

Table 6: Price Effect

This table presents the average cumulative abnormal returns (ACARs) around option listing for stocks that were selected for option listing and three control samples of eligible stocks that were not selected, for various subperiods. The cumulative abnormal returns are calculated using the Brown and Warner (1985) methodology. The market model is estimated over the period -100 days to -6 days relative to the option listing date. The event window consists of days -5 to +5 relative to the option listing date. T-statistics are reported for test of the null hypothesis that the ACARs are equal to zero. In parentheses are reported probability values from t-test for differences between the ACARs for sample of selected stocks and each control sample. Control sample 1 is constructed by matching each selected stock with a non-selected stock that has the closest firm size at the time of listing. Control sample 2 is constructed by matching the selected stocks with the same number of non-selected stocks that have the highest predicted probability of listing from a logit analysis at the time of listing. Control sample 3 is constructed by matching each selected stock with a non-selected stock that has the closest predicted probability of listing from a logit analysis at the time of listing.

		Selected Stocks		Control Sample 1		Control Sample 2		Control Sample 3	
Period	N	ACAR (percent)	t-stat	ACAR (percent)	t-stat	ACAR (percent)	t-stat	ACAR (percent)	t-stat
1973	29	2.21	2.86	0.97	1.31	-1.67	-1.91	1.00	0.91
1974	8	1.35	0.60	-3.26	-2.21	-2.81	-1.42	-1.60	-1.19
1975	87	2.49	2.98	0.35	0.47	-0.81	-0.94	-1.30	-1.49
1976	65	1.50	1.55	0.85	1.25	-0.31	-0.30	-1.16	-1.10
1977	23	0.29	0.18	-0.11	-0.15	0.76	0.71	-0.10	-0.10
1980	54	1.58	1.69	-0.80	-1.05	-1.51	-1.43	-0.15	-0.16
1981	14	-1.51	-0.69	-2.07	-1.42	3.47	1.10	-0.21	-0.14
1982	72	-0.85	-1.08	-0.19	-0.25	-0.35	-0.38	-0.52	-0.65
1983	29	-3.32	-2.35	-1.19	-1.26	-2.46	-1.44	-1.31	-0.97
1984	20	-1.16	-0.90	0.03	0.04	-0.60	-0.33	-0.10	-0.07
1985	70	-1.36	-1.28	-0.59	-0.99	-1.91	-1.34	0.59	0.57
1986	54	-0.04	-0.04	0.89	0.96	-2.33	-1.34	-2.19	-1.66
1987	108	-1.65	-1.80	-0.69	-1.44	0.53	0.42	0.65	0.78
1988	95	0.25	0.38	-0.57	-1.01	-1.96	-1.56	-2.11	-2.54
1989	82	-0.76	-1.10	-0.02	-0.04	-2.29	-1.24	0.09	0.10
1990	112	0.11	0.16	0.64	1.16	-0.87	-0.71	-0.81	-1.06
1991	132	-1.76	-2.16	-1.37	-2.43	-3.18	-2.96	-2.85	-2.61
1992	116	-2.21	-1.85	-1.62	-2.44	-1.36	-0.98	-1.80	-1.62
1993	174	-4.01	-4.76	-0.47	-0.77	-0.51	-0.44	-2.55	-2.77
1994	184	-1.59	-2.08	-0.01	-0.01	-0.58	-0.63	-0.92	-1.10
1995	249	-2.08	-2.96	-1.09	-2.31	-1.17	-1.12	-0.74	-0.98
1996	176	-2.48	-2.58	0.24	0.42	0.11	0.09	0.50	0.53
1973-80	266	1.81	4.08	0.16	0.45	-0.85	-1.85	-0.69	-1.52
				(0.004)		0.000		(0.000)	
1980-85	139	-1.48	-2.51	-0.53	-1.09	-0.64	-0.86	-0.63	-1.12
				(0.215)		0.378		(0.295)	
1985-91	569	-0.71	-2.21	-0.22	-0.98	-1.45	-2.62	-0.75	-2.11
				(0.203)		0.251		(0.937)	
1991-96	979	-2.38	-6.50	-0.63	-2.66	-0.88	-1.83	-1.17	-3.00
				(0.000)		0.014		(0.025)	
1981-96	1687	-1.74	-7.14	-0.48	-2.99	-1.05	-3.08	-0.99	-3.78
				(0.000)		(0.112)		(0.035)	

Table 7: Analysis of Price Effect

This table presents OLS regressions of cumulative abnormal returns (CARs) around option listing, as the dependent variable, on volume ratio, volatility ratio, and firm size, for stocks that were selected for option listing and three control samples of eligible stocks that were not selected. The cumulative abnormal returns are calculated using the Brown and Warner (1985) methodology, where the market model parameters are estimated over the period -100 days to -6 days relative to the option listing date and the event window consists of days -5 to +5 relative to the option listing date. The volatility ratio is calculated by dividing the market adjusted stock variance after option listing by the market adjusted stock variance before listing. Volume ratios are calculated by dividing the average daily volume after listing by the average daily volume before listing. SIZE is equal to the number of shares outstanding times stock price at the time of listing. The reported p-values are from the test of the null hypothesis that the coefficients estimates are equal to zero. Control sample 1 is constructed by matching each selected stock with a non-selected stock that has the closest firm size at the time of listing. Control sample 2 is constructed by matching the selected stocks with the same number of non-selected stocks that have the highest predicted probability of listing from a logit analysis at the time of listing. Control sample 3 is constructed by matching each selected stock with a non-selected stock that has the closest predicted probability of listing from a logit analysis at the time of listing. All four samples consist of 1,953 stocks.

	Selected Stocks		Control Sample 1		Control Sample 2		Control Sample 3	
	estimate	p-value	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	-0.094	0.002	-0.037	0.084	-0.042	0.205	-0.061	0.023
Variance Ratio, 30 day	-0.001	0.001	-0.002	0.013	-0.005	0.001	-0.005	0.009
Volume Ratio, 30 day	0.008	0.008	0.000	0.048	0.003	0.086	0.015	0.000
log(SIZE)	0.006	0.016	0.002	0.137	0.003	0.295	0.003	0.118
Adjusted R^2	0.011		0.005		0.007		0.014	
Intercept	-0.098	0.002	-1.515	0.130	-0.057	0.094	-0.051	0.060
Variance Ratio, 250 day	-0.002	0.340	-0.004	0.010	-0.007	0.002	-0.005	0.009
Volume Ratio, 250 day	0.000	0.852	0.002	0.409	0.004	0.000	-0.002	0.057
log(SIZE)	0.007	0.005	0.002	0.143	0.0038	0.152	0.004	0.095
Adjusted R^2	0.003		0.005		0.009		0.005	