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DETERMINANTS OF OPTION SPREADS IN A MULTIPLE LISTING ENVIRONMENT

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This study empirically determined the predictors of bid-ask spreads of equity options within the context of the current multiple-listed options market. Price emerged as the most powerful predictor followed by multiple listing. Price and volatility increased spreads, while multiple listing and volume reduced them. Multiple listing was more powerful than volume in explaining spreads. This study establishes that spread reductions prevail several years after initial multiple listing and supports the importance of competition over economies of scale in explaining spreads.

INTRODUCTION

Since their inception in 1975, trading in equity options was first confined to the Chicago Board Options Exchange (CBOE) and the American Stock Exchange (AMEX) then spread to the Pacific Stock Exchange (PCX), the Philadelphia Stock Exchange (PHLX), the Boston Stock Exchange (BOX), and most recently, the International Securities Exchange (ISE). The bid-ask spread is charged by market makers on the exchanges to traders as a transactions fee. It is the profit to the market maker whose purchase quote for options is the bid price and the sale quote to broker-dealers is the ask price. Demetz's (1968) seminal work identifies the bid-ask spread as "the markup that is paid for predictable immediacy of exchange in organized markets" (Demsetz, 1968: 35-36). The market maker is being compensated for the function of making options available to customers and the bid-ask spread is the premium paid to market makers for supplying options.

Traditionally, the bulks of equity options have been traded on a single exchange or are single-listed options. This provided exclusive and potentially exorbitant franchise fees to the exchanges as the bid-ask spreads charged on the options could be set independently by a single exchange with no competitive pressures forcing prices downward (as no other exchange could list the same option). In an attempt to improve the quality of service and decrease spreads, the U. S. Securities and Exchange Commission
(SEC) adopted Rule 19c-5 in 1980 which mandated multiple listing. The exchanges vigorously resisted multiple listing for a decade. Their recalcitrance ended with the Justice Department filing suit against the American Stock Exchange in 2000, the settlement of the suit being contingent upon the exchanges accepting a consent decree to reform the market with a view towards increasing competition.

For the past four years, the exchanges have plunged into campaigns designed to attract other exchanges to purchasing options that had hitherto been singly listed so that at present, fully 85% of put and call options traded on the American Stock Exchange are multiple listed. During the options campaign of 1999 alone, listings on a single exchange declined in volume from 61% during the pre-options campaign phase to 24% at the close of the campaign. We may assume that the current options market is a mature market from a multiple listing perspective.

Other determinants of option spreads derived from the literature (see Coughenour & Shastri, 1999, for a review) include price, volume of trading, and the volatility of option prices. Traditional models of spreads (Benston & Hagerman, 1974; Coughenour & Shastri, 1999, George, Kaul, & Nimalendran, 1991; Huang & Stoll, 1997) have incorporated these predictors. The few empirical studies of multiple listing effects on spreads were performed in the immediate aftermath of a particular options campaign in the 1980s and late 1990s before the majority of options became multiple listed and were therefore, confined to small sample sizes of about 70-280 options (Danis, 2003; De Fontnouvelle, 2003; Mayhew, 2002; Neal, 1987). Consequently, there is a need for a large-scale assessment of spreads that includes both the traditional pricing variables and multiple listing. It is this objective to which this study is directed.

Predictors of Option Spreads

As stated, the bid-ask spread may be likened to a transactions fee. Accordingly, the higher the price of a good, the higher will be the fee (Neal, 1987). Danis (2003) used the example of a commission to be paid to the dealer selling a $ 40,000 Lexus being substantially higher than that paid to a dealer of a $ 1,000 car. Khoury

et al. (2002) argued that the options price is an investment in options inventories that provides liquidity in the market. As prices rise, there is greater investment in options inventories, and in turn, higher bid-ask spreads. They tested the differential effects of price, number of daily transactions, and the in- or out-of-the-money status of the option for options listed on both the U.S. and Montreal exchanges. Price was found to be the most powerful predictor of bid-ask spreads accounting for 31.6% of the variation in spreads.

Bid-ask spreads are reduced with rising volumes. As orders for the purchase or sale of options arrive through broker-dealers, the market maker uses the inventory of options available to provide options. The market maker is being compensated for the function of making options available to customers and the bid-ask spread is the premium paid to market makers for supplying options. With options being made available for sale on multiple exchanges, volumes rise. Rising volumes mean that more orders are arriving to be executed by the market maker, so that the market maker need not be compensated highly for making options available for sale. In other words, bid-ask spreads decrease with rising volumes (Danis, 2003).

Volatility is the risk to the market maker of holding options on a particular stock. The higher the risk, the greater the return the market maker will demand for holding the option. As the return to the market maker is the bid-ask spread, a rise in risk will lead to the demand for higher bid-ask spreads (Danis, 2003). The dealer is forced off the efficient frontier and his initial indifference curve consisting of optimal portfolio combinations of the risk-free asset and risky assets by investors with their own stock and option preferences.

Customers have to pay the dealer an additional amount to keep him satisfied at the new investment level with its higher level of risk That additional amount is a higher bid-ask spread so that increasing volatility is associated with higher spreads (Stoll, 1978). Empirically, tests of the impact of volatility on bid-ask spreads have shown weak results with volatility being either insignificant in explaining spreads (De Fontnouvelle et al., 2004; Khoury et al., 2002) or with inconsistent signs (Danis, 2003, Neal, 1987). Perhaps, as Neal conjectured, there is bias in the method of determining volatility, i.e., as the standard deviation of transactions prices. The bid-ask spread will cause the sequence of transactions to fluctuate about the true price, so that spreads and volatility will have positive correlations regardless of security risk, or spreads will be overstated.

Intuitively, as the spread is compensation to the market maker for providing an inventory of options, the presence of market makers offering identical products on other exchanges should cause all market makers to reduce transaction fees (spreads) to remain competitive in attracting customers. The fear of fragmentation or loss of order flow to rival exchanges is sufficient incentive to keep spreads at lower competitive prices (Coughenour & Shastri, 1999). Empirical support for this thesis is provided by several observations of the formation of competitive equilibria either through simulations or on the trading floor. Bloomfield and O'Hara (1998) demonstrated that spreads declined far more rapidly in three-dealer markets than two or single dealer markets primarily due to the fact that the competitive effect of the addition of a third dealer in a two-dealer market causes the existing dealers to lower their ask prices and raise their bid prices to attract order flow.

In the competitive market, spreads declined to 79% in a three-dealer market with a decline of only 56% of average spreads in the two-dealer market. Given that options may be multiple listed on up to six different exchanges, the competitive effects of adding the fourth, fifth, and sixth dealers will only intensify the competitive effect of the third dealer. Battalio, Greene, & Jennings (1997) used trading floor data from an adjustment instituted to attract order flow to regional exchanges by permitting traders to become dealers on those exchanges. Spreads on the primary exchange declined by 66% and those on the regional exchanges did not increase after trading commenced on these exchanges as they continued to direct order flow at the national best bid and offer prices.

Multiple listing was the outcome of the Justice Department s filing suit against the exchanges for noncompetitive action. A regulatory requirement thus forced competition among exchanges that had long colluded to keep most options singly listed. From the literature on the effect of regulatory reforms on the stock exchanges, Barclay et al. (1999) assessed the impact of introducing limit orders submitted by the public in a multiple-dealer market and full disclosure to NASDAQ traders of superior quotes offered by NASDAQ dealers to each other in private trading locations. Both reforms were undertaken with a great deal of publicity and exposure of hitherto noncompetitive practices. Likewise, the Justice Department's action was accompanied by a great deal of negative publicity about collusive price allocation by the exchanges.

That competition was the main predictor of the decline in spreads is supported by the Barclay et al.

(1999) study with spreads in their post-reform NASDAQ sample converging to the lower levels of the NYSE (Barclay et al., 1999). Specifically, Barclay et al. (1999) averaged effective spreads of $ 0.179 and $ .169 for two separate NASDAQ samples while Huang and Stoll's (1978) actively traded NYSE stocks showed spreads of $ 0.158. We may also use the literature on the regulatory effects of establishing a National Market System requiring the exchange of real-time quote information across stock exchanges (see Coughenour & Shastri, 1999, for a review). In a variety of environments, spreads decreased with the introduction of shared quotes by more dealers on the U.S. stock exchanges (Benston & Hagerman, 1974; Stoll, 1978), the London Stock Exchange (Hansch, Naik, & Vishwanathan, 1998) and the interbank foreign exchange market (Huang & Masulis, 1999).

Given the above review, we may state the hypotheses as follows:

- **H_1:** Bid-ask spreads of equity options vary directly with option prices.
- **H_2:** Bid-ask spreads of equity options vary directly with option volatility.
- **H_3:** Bid-ask spreads of equity options vary inversely with option volume.
- **H_4:** Bid-ask spreads of equity options vary inversely with multiple listing. Specifically, multiple listed options will have significantly lower bid-ask spreads than single listed options.

METHODOLOGY

All stocks traded on the AMEX as of July 1, 2004, were screened. The data range was the first five trading days of July 2004, or July 1-3, and 6-7, 2004. We first excluded all American Depository Receipts, and foreign firms. After exclusion of foreign stocks, and those with missing data, the final sample of options on the remaining stocks consisted of 10,577 call options and 8,599 put options traded in July 2004. Only near-term (1 month maturities), at-the-money options were used.

Additional quote data filters included (1) that ask quotes be greater than bid quotes, (2) all bid quotes be greater than zero. Trade data filters included (1) identifying exchanges and listing dates from Options Industry Council data only, (2) ensuring that trade price and trade size were greater than zero, and (3) restricting trades to AMEX-listed stocks. Using separate data from the AMEX, the number of single and multiple listed options was determined (table 1), with 1,736 single listed calls and 1,320 single listed puts and 8,841 multiple-listed call options and 7,279 multiple-listed put options.

Table 1: Distribution of Options Among Exchanges

Number of Exchanges	Calls	Puts
One Exchange	1736	1320
Two Exchanges	1501	1249
Three Exchanges	1791	1483
Four Exchanges	1974	1645
Five Exchanges	1688	1413
Six Exchanges	1887	1489

Table 2: Relative Frequency Distribution of Quoted and Effective Bid-Ask Spreads of Equity Options

Quoted Bid-Ask Spread	Relative Frequency Single-Listed Call Options (%)	Relative Frequency Multiple-Listed Call Options (%)	Relative Frequency Single-Listed Put Options (%)	Relative Frequency Multiple-Listed Put Options (%)
<=.10	6.31	41.86	5.67	42.04
.11-.15	6.54	13.45	6.95	12.58
.16-.20	14.86	21.44	16.55	22.70
.21-.25	37.18	5.42	40.67	6.78
>.25	35.11	17.83	30.16	15.90
Effective Bid-Ask Spread	Relative Frequency Single-Listed Call Options (%)	Relative Frequency Multiple-Listed Call Options (%)	Relative Frequency Single-Listed Put Options (%)	Relative Frequency Multiple-Listed Put Options (%)
<=.05	10.88	38.59	7.04	71.51
.06-.10	11.85	13.27	6.28	5.79
.11-.20	21.01	11.48	18.32	5.52
.21-.30	5.04	5.62	7.34	3.20
>.30	51.00	31.00	60.79	13.91

For both call and put options, the majority of the options were listed on four exchanges. The mean quoted bid-ask spreads were significantly higher for single-listed over multiple-listed options for calls and puts for both quoted spreads ($t = 27.55$, $p<.001$, $s_1 = .29$, $s_2 = .17$ for calls and $t = 3.45$, $p<.05$, $s_1 = .28$, $s_2 = .02$ for puts) and effective spreads ($t = 7.39$, $p<.001$, $s_1 = 1.35$, $s_2 = 0.95$ for calls and $t = 3.4$, $p<.001$, $s_1 = 1.43$, $s_2 = 1.23$ for puts). Table 2 above provides a relative frequency distribution showing that quoted spreads cluster at lower levels for multiple-listed options and at higher levels for single-listed options [>.25 for quoted spreads of single-listed calls and puts, <=.1 for multiple-listed calls and puts; >.30 for effective spreads of single listed calls and puts, and <.1 for multiple-listed calls and puts].

Table 3 below shows the descriptive statistics of the sample. Single-listed call and put options are offered by firms with considerably lower market capitalizations averaging approximately $ 1.3 million while multiple-listed options have about $ 13 million. It follows that similar differences are observed in the volume of trades (< 100 for single-listed options versus > 150 for multiple-listed options) indicating not surprisingly, that multiple-listed options are more actively traded. However, volatility measures are comparable ranging from 0.3-0.7 for each type of option.

Table 3: Descriptive Statistics of Single and Multiple-Listed Options

Single-Listed Call Options N = 1,736 Variable	Mean	Standard Deviation	Minimum	Maximum	25% Quartile	50% Quartile	75% Quartile
Market Cap	$ 1.37 x 10^6	2.69 x 10^6	34,946	19.83 x 10^6	225,892	509,666	1.3 x 10^6
Price	1.9972	2.4848	0.025	14.50	0.125	0.125	3.2
Volume	21.769	33.9793	1	249	5	7.8	21
Volatility	0.7026	0.6998	0.037	0.763	0.32	0.35	0.78
Multiple-Listed Call Options N = 8,841 Variable	Mean	Standard Deviation	Minimum	Maximum	25% Quartile	50% Quartile	75% Quartile
Market Cap	13.40 x 10^6	55.84 x 10^6	15,713	952.70 x 10^6	557,875	2.25 x 10^6	8.13 x 10^6
Price	2.4625	3.0781	0.2	49.9	0.1	1	4.15
Volume	202.6029	619.4039	1	111.35	10	33	127
Volatility	0.6401	0.5992	0.0092	0.86079	0.3158	0.4662	0.70735
Single-Listed Put Options N = 1,320 Variable	Mean	Standard Deviation	Minimum	Maximum	25% Quartile	50% Quartile	75% Quartile
Market Cap	1.21 x 10^6	2.20 x 10^6	34,946	19.83 x 10^6	241,926	509,666	1.21 x 10^6
Price	1.9139	2.1566	0.025	12.65	0.225	1.125	2.85
Volume	93.5303	153.8191	677	1	5.25	24.5	91.75
Volatility	0.5016	0.3200	0.1169	0.2677	0.302	0.411	0.582
Multiple-Listed Put Options N = 7,279 Variable	Mean	Standard Deviation	Minimum	Maximum	25% Quartile	50% Quartile	75% Quartile
Market Cap	13.42 x 10^6	72.23 x 10^6	15,713	1.40 x 10^9	532,436	1.90 x 10^6	7.58 x 10^6
Price	2.4734	2.8777	0.025	66.65	0.102	1.325	4.05
Volume	154.615	549.96	1	107.39	10	26	103
Volatility	0.5048	0.3851	0.01	0.778	0.299	0.410	0.585

To test the hypotheses, the Neal (1987) formulation was used to create four models of bid-ask spreads. Linear, logarithmic, squared logarithmic, and square root functional forms were tested for the following model:

$$BAP_i = \alpha_i + \beta_1 PRC_i + \beta_2 VOL_i + \beta_3 VLTLY_i + \beta_4 PRCF_i + \beta_5 ML_i + \beta_6 VOLXML + \beta_7 TME_i \quad (1)$$

Where:

BAP_i = Quoted spreads measured as (Ask Price – Bid Price) and Effective spreads measured as [ABS(Trade Price – (Ask+Bid)/2].

PRC_i = Option price = $\frac{[\text{Bid} + \text{Ask}]}{2}$

VOL_i = Daily option volume

$VLTLY_i$ = Option volatility = The implied standard deviation from the Black-Scholes model

ML_i = Multiple listing dummy; 0 = single listed options and 1 = multiple-listed options

$PRCF_i$ = Low price correction factor (0 for price > .5, 1 for price < .5)

$VOLxML$ = The multiple listing-volume interaction

TME = Time to maturity

All models used quoted and effective spreads as the criteria. The use of both spreads is justified in that they provide a comprehensive description of spreads, with quoted spreads showing the quoted buy and sell prices, and effective spreads reflecting actual transaction prices which may be different from quoted prices. The Gujrati and Maital correction for first-order autocorrelation and weighted least squares correction for heteroscedasticity

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was applied to functional forms tested including the linear, logarithmic, squared logarithm and square root forms of volume.

Results

Hypotheses 1-4 were supported with price, volume, volatility and multiple listing being highly significant in explaining spreads. Price positively influenced spreads being the single most powerful predictor in 14 of 16 models for both quoted and effective spreads for put and call options (t values ranged from 3.57-15.96). Although volatility has shown inconsistent sign in previous studies (see Khoury et al., 2002 for a review), in this case its effect on spreads was predominantly positive in 14 of 16 models, possibly indicating the presence of a risk premium demanded by market makers for moving off the efficient frontier. Volume and multiple listing were inversely related to spreads. The interaction between volume and multiple listing was significantly negative ($p<.01$) indicating that multiple listing acted in conjunction with volume to significantly reduce spreads in all models or the variance due to competition and that due to increased volume jointly explained an average of 4% of the variance in call options and 3% of the variance in spreads for put options respectively.

Table 4: Regressions of Bid-Ask Spreads on Call and Put Options

Quoted Spreads	Model 1 (Calls)	Model 2 (Calls)	Model 3 (Calls)	Model 4 (Calls)	Model 1 (Puts)	Model 2 (Puts)	Model 3 (Puts)	Model 4 (Puts)
Price	.024*** (15.96)	.025*** (8.88)	.022*** (16.98)	.025*** (8.57)	.076*** (3.57)	.076*** (3.57)	.02*** (5.27)	.1*** (3.76)
Volume	-1.4×10^{-5}*** (-3.00)	-1.08×10^{-5}*** (-4.52)	-7.9×10^{-3}** (-2.00)	-1.3×10^{-3}*** (-7.81)	-3×10^{-5}*** (-4.14)	-3.2×10^{-5}*** (-4.14)	-1.2×10^{-2} (-1.69)	-7.4×10^{-3}* (-2.35)
Volume^2			-2.18×10^{-2}*** (-7.43)				-6×10^{-4}* (1.96)	
Multiple Listing	-.11*** (-7.83)	-.09*** (-9.53)	-.09*** (-10.47)	-.09** (-11.59)	-.06 (-.46)	-.13** (-2.98)	-.1*** (-4.64)	-.13** (-2.98)
Volume x Multiple Listing	-4 x 10^{-5}*** (-3.60)	-1 x 10^{-5}* (-2.01)	-1.67 x 10^{-2}*** (-12.23)	-4 x 10^{-5}*** (-3.60)	-9 x 10^{-5}*** (-2.85)	-8.6 x 10^{-5}*** (-2.85)	-4 x 10^{-5}** (2.89)	-9 x 10^{-5}*** (-2.85)
Volatility	.009*** (3.31)	.009*** (3.31)	.009*** (3.31)	.013*** (3.80)	.476*** (3.61)	.476*** (3.61)	.009 (.88)	.5*** (3.58)
Low Price Factor	-.002 (-1.66)	.012*** (2.46)	-8 x 10^{-4} (-.49)	-.0023 (-1.03)	.135*** (3.59)	.135*** (3.59)	5.8×10^{-4} (.06)	.1*** (3.43)
Time	.017** (3.01)	.017** (2.59)	.012** (2.59)	.017* (2.49)	.111 (1.70)	.111 (1.70)	.0069 (.70)	.117 (1.80)
R^2	.13	.14	.20	.13	.08	.03	.09	.03
Effective Spreads								
Price	.069*** (4.62)	.069*** (4.53)	.065*** (13.18)	.069*** (4.58)	.144*** (6.98)	.107*** (7.85)	.1*** (4.98)	.1*** (7.05)
Volume	-1.6×10^{-6}*** (-4.27)	-8.4 x 10^{-3}*** (-1.87)	-.03*** (4.95)	-1.3×10^{-3}*** (-3.59)	-2 x 10^{-4} (-.45)	-6 x 10^{-5}*** (-2.98)	-.0265* (-1.90)	2×10^{-4} (-.09)
Volume^2			-.026** (-3.28)				-.013* (-1.9)	
Multiple Listing	-.12*** (-2.77)	-.11* (-2,54)	-.09* (-2.09)	-.12** (-2.65)	-.21** (-2.85)	-.22*** (-3.93)	-.21** (-2.85)	-.2*** (-3.9)
Volume x Multiple Listing	-4 x 10^{-4}*** (-3.33)	-1 x 10^{-3} (-1.88)	-.14*** (-5.37)	4 x 10^{-4}*** (-3.33)	-1.2×10^{-4}*** (-2.54)	-2 x 10^{-4}*** (-5.15)	-1.2 x 10^{-4}** (-2.54)	-1 x 10^{-2}*** (-3.4)
Volatility	.26*** (7.35)	.26*** (8.84)	.04* (1.83)	.03 (1.41)	.001 (1.28)	.23** (2.39)	.03 (0.59)	.3*** (3.68)
Low Price Factor	.23*** (2.58)	.23*** (4.98)	-.02*** (-4.89)	.23*** (2.58)	-.03 (-.48)	-.02 (-.33)	-.01 (-.19)	-.03 (-.48)
Time	.03 (1.4)	.03 (1.4)	.03 (1.4)	.03 (1.4)	.06 (1.4)	.06 (1.4)	.05 (.61)	.06 (1.3)
R^2	.09	.09	.17	.09	.18	.10	.10	.10

*p<.05, **p<.01, *** p<.001
t ratios in parentheses

Multiple listing emerged as the more powerful predictor in relation to volume with fully 3.8-5.2% of the variance in spreads being explained by multiple listing as opposed to only .8-3.4% by volume for quoted spreads of call options. For quoted spreads of puts, 1.5% of the variance in spreads was explained by multiple listing versus .04-.05% for volume. Multiple listing showed higher significance in 6 of 8 models for quoted spreads and 5 of 8 models for effective spreads.

CONCLUSION

In the first empirical examination of current options markets using all options traded on a major exchange (the American Stock Exchange), this study has observed that bid-ask spreads in a predominantly multiple listed environment are determined by traditional Black-Scholes options characteristics including price, volume, and volatility along with multiple listing as a measure of competition among exchanges for order flow.

Higher priced options command a premium and are therefore linked with rising spreads. Volatility effects support Stoll's (1978) contention that the assumption of greater risk leads market makers to demand higher spreads. Volume effects are more complex in nature. By definition, economies of scale in options markets assume the existence of rising volumes of options for sale on the exchanges which, as volume is inversely related to spreads, drives down spreads. Multiple listing leads to rising volumes with large volumes being associated with multiple listing (mean volumes for multiple-listed options = 159-202 as opposed to 21-93 for single-listed options) as more options on the same stock are available for sale on multiple exchanges. Both volume (economies of scale) and multiple listing reduce spreads. Yet, our comparative analysis of multiple listing and volume indicates that multiple listing effects dominate volume effects.

In other words, the reduction of spreads due to competition from other exchanges is more powerful that similar reductions due to the mere increase in options available for sale up to 4 years after most of the options on the AMEX were initially multiple listed. This result indicates the robustness of competitive effects on spreads over time and should form the basis for future longitudinal examinations of spreads in the 1, 2, 3, 4, and 5, year period after initial multiple listing.

Future research should address the underlying causes of the importance of multiple listing in explaining spreads. There are two types of traders, informed traders who seek profit-making opportunities at lower transactions costs and liquidity traders who wish to add options to their portfolios. We may expect that in a multiple-listed environment, both numbers of both types of traders will increase, i.e. the liquidity traders who wish to add options which are more readily available with larger volumes, and informed traders who wish to find options with greater profit potential. Admati and Pfleiderer (1988) model the effects of informed traders trading on the same private information (presumably information about an upcoming multiple listing announcement). Such traders will compete with each other limiting their gains or reducing their losses to the market maker who will set lower spreads. Empirical tests of this theory may be undertaken using pre- and post multiple listing options data.

The equity options market may be on the cusp of a transition in market structure. Options trading on a single exchange represented a monopoly with the exchanges reaping monopoly profits due to their existence as a single source for a particular option. When the Securities and Exchange Commission imposed a moratorium on new listings from 1985-1989, the market became contestable (Neal, 1987). In a contestable market, competitors await the opportunity for market entry given the existence of significant entry barriers. The current climate of successive waves of multiple listing may have rendered a structure of perfect competition in which there is free entry and exist, entry barriers are few, and the product is standardized (for example, the same option on Coca Cola stock listed on 2 exchanges is indistinguishable). Future research must conduct tests of the options market as a contestable market in the mid-1980's followed by tests for competitive markets for data from 2000-present. If the market is found to be competitive, the next research question to be addressed is if competitive short-run equilibrium has been reached.

Implications

Spreads have declined since August 1999, when options first became multiple listed to a large extent. Therefore, it is less expensive for traders to purchase options possibly stimulating an increase in options trading. Smaller traders who were not able to trade in equity options are in a position to enter the options market. As the options market offers the benefit of unlimited upside potential (albeit with downside risk), such small traders and investors have an expanded array of investment opportunities. For options traded on six exchanges, i.e. the largest firms and those that became

multiple listed at the very beginning of the options campaign, such as IBM, Motorola, WalMart, and Johnson & Johnson, the spread declines are substantial. In the wake of the uncertainty in the financial markets following the events of September 11, 2001, new listings have been predominantly in this category. Further reductions in spreads benefit traders who choose to trade in these options.

Electronic trading commenced in 1999 with the opening of the International Securities Exchange, the first fully electronically traded exchange. This was followed two years later with the opening of the Boston Exchange. The International Securities Exchange, in particular, has diverted order flow from the floor-based exchanges. For example, IBM's primary exchange (the exchange on which the bulk of its options were traded) was the Chicago Board Options Exchange for several years. Today, IBM's primary exchange is the International Securities Exchange. Such diversion has occurred to the extent that the floor-based exchanges have started their own electronic trading divisions. Traders should benefit as spreads continue to decline with electronic trading.

Exchanges have attempted to protect their profit margins by engaging in payment for order flow, whereby they pay customers for the diversion of order flow to themselves. Such practices are being curtailed by the Securities and Exchange Commission as indicated by a recent rejection of a request by the Pacific Stock Exchange to expand payment for order flow. The regulatory environment appears to favor a free fall in spreads to the advantage of traders.

Market makers may be able to profit from declining spreads as part of a hedging strategy. If stock prices decline, they may short sell calls whereby they borrow call options, sell them, at higher spreads, and repay call owners with calls at reduced spreads. If stock prices rise, they may short sell puts where a similar sequence of events will occur with puts instead of calls. Empirically, such activity may be tested by examining daily short sales values and the change in daily put call ratios. Given that market makers are attempting to erect barriers to entry through payment for order flow, it is possible that they have not embarked on such a hedging strategy at this time.

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