INFORMATION REVELATION IN THE FUTURES MARKET
Evidence from Single Stock Futures

by

Kuldeep Shastri[1], Ramabhadran S. Thirumalai[2], and Chad J. Zutter[3]

[1] University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA 15260, phone: 412-648-1708, fax: 412-648-1693, e-mail: kuldeep@katz.pitt.edu.

[2] Indian School of Business, Gachibowli, Hyderabad - 500 032, India, phone: +91 (40) 2318 7151, fax: +91 (40) 2300 7035, e-mail: Ram_Thirumalai@isb.edu.

[3] University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA 15260, phone: 412-648-2159, fax: 412-648-1693, e-mail: czutter@pitt.edu.

INFORMATION REVELATION IN THE FUTURES MARKET
Evidence from Single Stock Futures

Abstract

This paper analyzes 31 months of data on 137 single-stock futures (SSFs). The results indicate that SSFs contribute approximately 24 percent of the price discovery for underlying stocks. Information revelation in the SSFs market increases with the ratio (futures to stock market) of volumes, decreases with the ratio of spreads, and decreases with the volatility in the stock market. Moreover, the quality of the market for the underlying stocks improves substantially following the introduction of the SSFs market, with the largest improvement occurring on days with SSFs trading. Evidence also suggests that there exists both market- and security-level learning in the SSFs market which is associated with greater efficiency over time.

INFORMATION REVELATION IN THE FUTURES MARKET
Evidence from Single Stock Futures

In 1982, the Shad-Johnson Accord, which prescribed how options and futures on securities and indices were to be regulated in the United States, was enacted by the Securities and Exchange Commission (SEC) and the Commodities Futures Trading Commission (CFTC). The Accord established the conditions under which futures on broad-based stock indices can be traded and prohibited trading in futures on narrow-based stock indices and individual stocks. The Commodity Futures Modernization Act of 2000 repealed the Shad-Johnson Accord and made it legal to trade single stock futures (SSFs). SSFs began trading in the United States on November 8, 2002 with 21 SSFs listed on OneChicago and 10 listed on the NASDAQ-LIFFE Market (NQLX). The NQLX suspended operations in October 2004, whereas OneChicago's number of listings grew to 204 as of July 2005.[4] The purpose of this paper is to examine whether and to what extent price discovery about the underlying stocks occurs in this relatively new market for SSFs.

There are a number of reasons why trading in derivative securities may affect the pricing dynamics of the underlying stocks, even though the price of a derivative security is itself a function of an underlying stock price.[5] Specifically, as argued by Black (1975), derivative markets can provide a more effective lower-cost venue for informed trading since investors can take advantage of greater financial leverage for each dollar invested. In addition, Easley, O'Hara, and Srinivas (1998) suggest that the unidirectional linkage between the prices of derivatives and their underlying stocks is only valid in complete markets. On the other hand, if information is

---

[4] With the close of trading on Friday, October 22, 2004, and per an agreement between NQLX and OneChicago, the Options Clearing Corporation consolidated open interest for specified NQLX security futures products with open interest in the corresponding OneChicago security future products. The consolidated positions have identical deliverables, contract months, and expiration dates. Effective October 25, 2004, affected contracts were no longer eligible for trading at NQLX, but rather traded solely on OneChicago. The consolidation of these positions was done to facilitate NQLX's plan to suspend trading in all security futures products. See Jones and Brooks (2005) for more information on single stock futures trading in the United States.

[5] Although a number of the papers cited in the following pages focus on the relation between the options and underlying security markets, similar arguments can be made for the relation between the futures and underlying security markets.

impounded into prices through trading, then the ability of informed traders to trade in derivative markets implies that the derivative trading process is not redundant.

Similarly, Back (1993) argues that trades in derivatives versus trades in their underlying assets convey different information. This implies that derivative trading can affect underlying security prices because it changes how information is revealed in prices and trading volume. Moreover, Kraus and Smith (1996) suggest that trading in derivatives can alter the equilibria in markets for underlying securities either by reducing the information asymmetry or by allowing investors to conjecture additional uncertainty about the future prices of underlying securities.

Another possible reason for the existence of a relation between derivative and primary markets is suggested in Nandi (1999). Specifically, Nandi argues that there is a relation between trading in derivative markets and private information about underlying stock volatilities, with higher levels of derivative trading activity indicating less private information. In this framework, derivative trading intensity affects stock price behavior because it provides information on the uncertainty regarding volatility estimates.

Along a similar vein, John, Koticha, Narayanan, and Subrahmanyam (2003) suggest that informed traders prefer trading in derivatives given their advantages over underlying stocks. These advantages stem from the inherent financial leverage in a derivative position, the lower transaction costs associated with establishing a derivative position, and the fact that one can take a bearish position in a derivative without being subject to short sale restrictions that exist on underlying stocks.

Finally, arbitrage links that exist across derivative and underlying markets should allow for the transmission of price changes from one market to the other. Thus, because of interconnected markets, trading activity in derivative markets should affect the market microstructure of underlying stock markets.

A number of studies empirically examine the associations between the existence of derivative markets and the behavior of stock prices. In the context of the futures market, most studies focus on the impact of futures trading on the volatility of underlying asset prices. The results of these studies are mixed, with some finding that futures trading is associated with increases in volatility, and others reporting the opposite result.[6] With respect to the impact of SSFs trading on individual stock volatility, the results indicate that the introduction of futures trading is associated with a decrease in the underlying stock volatility (e.g., McKenzie, Brailsford, and Faff, 2001).

Studies on the impact of option markets are varied with a number of studies analyzing whether the listing and expiration of derivatives impact the dynamics of underlying stock prices. Stoll and Whaley (1987) analyze the behavior of stock trading volume and volatility in the last hour of trading on triple-witching Fridays.[7] They find that trading volume and volatility are higher than normal in this hour, and attribute the result to higher levels of program trading.

The argument that options provide a venue for information-based trading receives empirical support from a number of studies. For example, Amin and Lee (1997) find that option trades lead trades in underlying stocks during periods of earnings news dissemination. This suggests that option trading activity impacts the pricing dynamics of underlying stocks through its effect on the level of information asymmetry for stocks.

Blume, Easley, and O'Hara (1994) show that option trading volume provides evidence regarding the quality of information that cannot be deduced from prices. Similarly, Pan and Poteshman (2006) show that signed option volume provides information about stock returns. In the context of takeovers, Cao, Chen, and Griffin (2005) find that the option market plays an important role in price discovery prior to the announcement of takeovers. Chakravarty, Gulen,

[6] For example, see Powers (1970), Figlewski (1981), Moriarty and Tosini (1985), Aggarawal (1988), Harris (1989), Damodaran (1990), Baldauf and Santoni (1991), Ely (1991), Hodgson and Nicholls (1991), Bessembinder and Seguin (1992), Kamara, Miller, and Siegel (1992), Jegadeesh and Subrahmanyam (1993), Choi and Subrahmanyam (1994), Robinson (1994), Antoniou and Holmes (1995), Chatrath, Ramchander, and Song (1996), Antoniou, Holmes, and Priestley (1998), Edwards (1988a, 1988b), Jochum and Kodres (1998), Kan and Tang (1999), Butterworth (2000), Gulen and Mayhew (2000), Darrat, Rahman, and Zhong (2002), and Jones and Brooks (2005).

[7]Triple-witching refers to the simultaneous expiration of stock options, stock index options, and stock index futures on the third Friday of March, June, September, and December. With the introduction of single stock futures expiring on the same days, triple witching has become quadruple witching.

and Mayhew (2004) report that the option market contributes on average 17.9 percent of the price discovery in the underlying stocks.[8] These results collectively suggest that trading in options provides information about prices for underlying securities.

In a related study, Mayhew, Sarin, and Shastri (1995) find that decreases in equity-option margin requirements are associated with increases in bid-ask spreads and trade informativeness and decreases in quoted depth for underlying stocks. In an analysis of the impact of option listings on the market microstructure of underlying stocks, Kumar, Sarin, and Shastri (1998) conclude that the listing of options results in improved market quality for underlying stocks. They draw this conclusion from evidence that the introduction of options is accompanied by decreases in stock volatility, bid-ask spreads, and information asymmetry and an increase in quoted depths.[9]

In contrast to previous work, the purpose of this paper is not to examine the impact of futures trading on stock volatility. Rather this paper seeks to analyze the effects of futures trading on information revelation in underlying stocks. Based on existing results, we expect that the futures market contributes significantly to price discovery for underlying stocks. It must be noted that this hypothesis is based on theoretical predictions derived for interactions between option and stock markets, and not necessarily for interactions between futures and stock markets. On an intuitive level, it is reasonable to assume that if the option market contributes to price discovery in underlying stocks, then one should be able to extend the argument to the futures market since the two markets are related. As a matter of fact, it is often argued that informed traders find the futures market to be a superior venue for trading vis-à-vis the option market since there is a premium associated with options while there is none associated with futures.

---

[8] This figure is based on the mid-point of the average lower and upper bounds of the information share.

[9] Similar results for volatility are reported in Trennepohl and Dukes (1979), Klemkosky and Maness (1980), Whiteside, Dukes, and Dunne (1983), Bansal, Pruitt, and Wei (1989), Conrad (1989), Skinner (1989, 1997), Detemple and Jorion (1990), Stephan and Whaley (1990), Damodaran and Lim (1991), Watt, Yadav, and Draper (1992), Shastri, Sultan, and Tandon (1996), Bollen (1998), Sorescu (2000), and Chan, Chung, and Fong (2002). See Damodaran and Subrahmanyam (1992) for an excellent review of studies that examine the impact of options on underlying securities.

We use the technique suggested by Hasbrouck (1995) to determine the information share of the single stock futures market relative to that of the underlying stock market. Based on 31 months of data on 137 futures and their underlying stocks, our results indicate that the SSFs market contributes approximately 24 percent of the information revelation about individual stocks. The extent of price discovery in the futures market increases with the ratio of volumes in the futures relative to the stock market and decreases with the ratio of spreads in the two markets and the volatility in the stock market. The informativeness of the underlying stocks improves substantially following the introduction of the SSFs market. Moreover, underlying stock market quality is better on days with futures trading vis-à-vis days with no futures trading. Finally, we find evidence of market- and security-level learning based on improving market quality both over calendar and listing (event) time. These results suggest that the futures market plays an important role in the price discovery process for underlying stocks.

The remainder of this paper is organized as follows. The next section provides a description of the evolution of the single stock futures market in the United States. Section 2 provides a description of the data and the Hasbrouck (1995) methodology. Results are presented in Section 3, while Section 4 concludes.

1. The Single Stock Futures Market in the United States

The Commodity Futures Modernization Act of 2000 repealed the Shad-Johnson Accord and made it legal to trade single stock futures. Figure 1 and Table 1 provide information regarding the listing and corresponding underlying stock market capitalization of OneChicago SSFs. Specifically, over the first 33 months of SSFs trading, monthly new listings range from 0 to 43 with approximately 40 percent of the listings taking place in the first two months of the exchange's existence. One-hundred fifty-five (76 percent) of the 204 SSFs listings as of July 2005 are for stocks listed on the New York Stock Exchange (NYSE), whereas 49 (24 percent) are for NASDAQ-listed stocks.

The cumulative market capitalization (in October 2002 dollars) of the underlying stocks at the start-up of the SSFs listings has risen from $3.1 trillion as of November 2002 to $6.7 trillion in July 2005. Approximately 66 percent of the July 2005 value comes from the listings in the first two months of OneChicago's existence. The average (median) market capitalization (in October 2002 dollars) of stocks underlying the 204 SSFs as of their date of listing is $33 ($16.8) billion with a range of $471 million to $299.5 billion.

The SSFs trading volume on OneChicago for January 2003 (the second full month of trading) is 101,739 contracts, which represent an average of 1,197 contracts per listed stock.[10] The average daily volume in January 2003 is 4,845 contracts or 57 contracts per listed stock. The open interest as of January 31, 2003 is 47,605 contracts. The corresponding figures for July 2005 are 858,018, 4,903, 42,901, 245, and 1,098,710, respectively. The changes represent substantial growth rates of 743 percent, 785 percent, and 2,208 percent in monthly contract volume, daily average volume, and end of month open interest, respectively.[11]

2. Data and Methodology

2.1 Data

Our analysis is based on data from January 2003 to July 2005 for stocks listed on the NYSE and NASDAQ that have SSFs that trade on the OneChicago exchange. Stock market quote and trade data is from the NYSE Trade and Quote (TAQ) database, while the corresponding data for SSFs was provided by OneChicago. To ensure that we can estimate the information share of SSFs, we restrict our sample to SSFs that have at least three trades and two price changes within a day (this restriction results in 137 SSFs), and we focus our attention on the shortest maturity SSFs contract for a given stock. In addition, stock quotes and trades are restricted to those emanating

[10] Each SSF contract is on 100 shares of the underlying stock.

[11] Contract volume and open interest are reported on the OneChicago website at http://www.onechicago.com/060000_press_news/press_news_2003/images/Jan03VolumeReport.pdf and http://www.onechicago.com/060000_press_news/press_news_2005/images/July05VolumeReport.pdf.

from the primary exchange since literature suggests that there is little, if any, price discovery on non-primary exchanges (e.g., Hasbrouck, 1995).[12]

Table 2 provides daily average measures of the percentage effective bid-ask spread, trading volume, and price volatility for both the futures contract and underlying stock. SSFs have a daily average (median) percentage effective spread of 21 (14) basis points. In contrast, underlying stocks have a daily average (median) percentage effective spread of 5 (4) basis points. The ratio of spreads, the futures spread divided by the underlying stock spread, has an average (median) of 4.2 (3.3). Trading volume in the futures contracts averages 9,320 shares a day with a median value of 5,269 shares a day. The corresponding figures for the underlying stocks are 6.1 and 3.9 million shares a day, respectively. The ratio of trading volumes averages 2.6×10^{-3} with a median value of 1.3×10^{-3}. The average (median) price volatility for underlying stocks is 40.0 (35.2) percent. The ratio of price volatilities is essentially one.

2.2 Methodology

Hasbrouck (1995) presents a methodology to determine the contribution of each market to price discovery when a security trades in multiple markets. Chakravarty, Gulen, and Mayhew (2004) adapt this methodology to analyze the extent of price discovery in the option market using the stock price series implied by the price of call options. The Chakravarty et al. methodology is easily extended to the futures market by calculating the stock price implied by the futures price using a no-arbitrage futures model. Specifically, for single stock futures, the futures price is given by $F = (S - PV_{div})e^{rT}$, where S is the stock price, PV_{div} is the present value of the dividends that will be paid on the stock before delivery on the futures, T is the time to delivery, and r is the relevant risk-free rate of return. Therefore, the stock price implied by the futures price is given by $S_{imp} = Fe^{-rT} + PV_{div}$. If T is small then e^{-rT} will be approximately 1 and if PV_{div} is constant then the implied stock price will be approximately equal to the futures price plus a constant, that is, $S_{imp} \approx F + c$. Since we only consider the shortest maturity contracts, the time to delivery, T, is small and,

[12] The primary exchange is the exchange where the underlying stock is listed.

therefore, e^{-rT} can be assumed to be approximately 1.[13] In addition, the small time to delivery also implies that the present value of dividends to be paid till delivery can be treated as a constant. Therefore, we assume that the stock price series that is implied by the futures price is F + c and the change in the implied stock price is equal to the change in the futures price. As a result, we can estimate the information share of the futures market by applying the Hasbrouck methodology directly on the futures price and assuming that the futures market represents another market that trades the stock.

Following Hasbrouck and Chakavarty et al., let V_t represent the efficient stock price. This efficient stock price serves as a state variable underlying the observed stock and futures prices. Then the observed stock and futures prices can be written as:

$$S_t = V_t + \varepsilon_{S,t} \tag{1}$$

$$F_t = V_t + \varepsilon_{F,t} \tag{2}$$

where $\varepsilon_{S,t}$ and $\varepsilon_{F,t}$ are zero-mean covariance-stationary processes that represent the pricing errors due to frictions emanating from market microstructure factors. The common efficient price is assumed to follow a random walk:

$$V_t = V_{t-1} + u_t \tag{3}$$

where u_t is mean zero, constant variance, and serially uncorrelated. The cointegrated prices $p_t = \begin{pmatrix} S_t \\ F_t \end{pmatrix}$ can be written in terms of an error correction model of order N, that is,

$$\Delta p_t = A_1 \Delta p_{t-1} + A_2 \Delta p_{t-2} + \ldots + A_N \Delta p_{t-N} + \gamma(z_{t-1} - \mu) + e_t \tag{4}$$

where A_i is a 2x2 vector of autoregressive coefficients corresponding to lag i, $z_{t-1} - \mu$ is an error correction term with $z_{t-1} = S_{t-1} - F_{t-1}$ and $\mu = E(z_t)$. Alternatively, the price vector can be represented as a vector moving average model:

[13] The contract maturity of the SSFs considered is no more than 1 month.

$$\Delta p_t = e_t + \psi_1 e_{t-1} + \psi_2 e_{t-2} + \ldots \quad (5)$$

where e is a 2x1 vector of mean zero innovations with variance matrix Ω. Let $\psi(1)$ denote the sum of the moving average coefficients. By construction all rows in $\psi(1)$ are identical. Let ψ denote the common row vector in $\psi(1)$.

The total variance of the implicit efficient price changes is $\psi\Omega\psi'$ and if price innovations across markets are uncorrelated, then the information share of the futures market is given by:

$$Share_F = \frac{\psi_2^2 \Omega_{22}}{\psi \Omega \psi'} . \quad (6)$$

If the price innovations across markets are correlated, then one can only compute a range for information shares. The upper and lower bounds of the range are obtained by orthogonalizing the covariance matrix and trying all possible rotations. The models are estimated using one-second intervals, with polynomial distributed lags up to 5 minutes. Following Hasbrouck, information share bounds are computed each day for each stock using intraday transactions data. Daily data is then aggregated across time and stocks.

3. Results

3.1 Information share of the SSFs market

Based on previous theoretical and empirical work, we would expect trading in single stock futures to contribute to the price discovery in the underlying stock. Specifically, we would expect the information share of the futures market ($Share_F$) to be significantly greater than zero.

Table 2 presents the information share for the SSFs market on a stock-by-stock basis. We can see in this table that the lower (upper) bound of information shares averages 24.4 (24.6) percent across our sample of 137 securities. Based on the associated standard errors, both information share bounds averages are significantly different from zero at the 1 percent level. This suggests that SSFs play a significant role in price discovery for underlying stocks. Eighty-seven percent of the SSFs' estimated information shares are significantly different from zero with significant values ranging from 5.3 percent (Lowes) to 62.0 percent (Occidental).

To put this result in perspective, consider those reported in Hasbrouck (1985) and Chakravarty, Gulen, and Mayhew (2004) who also analyze the information shares for competitors of the primary exchange. Specifically, Hasbrouck examines the contribution of other stock markets to information revelation in NYSE-listed stocks while Chakravarty et al. do the same for option markets. Hasbrouck reports that the average contribution from non-NYSE trades is 8.7 percent with values ranging from 1.1 to 23.9 percent. The corresponding figures in Chakravarty et al. for the lower (upper) bound of information share are 17.46, 11.8 and 23.3 (18.29, 12.20 and 23.5) percent, respectively. Our results for information share show that SSFs, on average, contribute more to information revelation than do either of non-NYSE trades or option markets.

Table 3 provides a breakdown of the SSFs market's information share by exchange listing of the underlying stock. This distinction is interesting because a number of previous studies report significant differences in the market microstructure of stocks listed on the NYSE and the NASDAQ.[14] This would suggest that the impact of single stock futures may be different across the two markets.

The information share of SSFs does not appear to depend on the listing exchange of the underlying stock since the average information share is not significantly different across exchanges. Specifically, the mid-point of the information share is 24.3 percent for NASDAQ and the corresponding figure for the NYSE is 24.7 percent. This result indicates that the information share generated by the futures market is independent of the exchange mechanism, either the dealer-driven NASDAQ or the order-driven NYSE, on which the underlying assets trade. Collectively, the results presented in Tables 2 and 3 provide strong evidence that futures markets, in particular the SSFs market, greatly benefit the price discovery process for underlying stocks. We next turn to a cross-sectional analysis of SSFs information share.

3.2 Cross-sectional analysis of SSFs information share

[14] See Coughenour and Shastri (1999) for a review of this evidence.

It was argued earlier that the existence of SSFs will have an impact on information revelation since SSFs are a superior vehicle to exploit information asymmetries. This suggests that improvements in the trading environment for SSFs should result in an increase in the information share of the futures market. We proxy for the quality of the trading environment with two variables: the ratio of the effective spreads in the futures and underlying stock market and the ratio of the trading volume in the two markets. We postulate that the trading environment for SSFs improves if the spread ratio decreases and/or if the volume ratio increases. Therefore, we would expect the information share of the futures market to be negatively related to the spread ratio and positively related to the volume ratio.

Panel A of Table 4 presents the results of a cross-sectional regression of a logit transformation of the mid-point of the lower and upper bounds of the information share on the ratio of trading volumes in the futures and stock markets, the ratio of percentage effective spreads, and the volatility of the underlying stock. The variables are averaged over time thus resulting in a single observation per stock. We use a measure of the volatility of the underlying stock returns in the regression since one can argue that increased volatility may be a result of more information asymmetry, and thus result in more opportunities for informed trading. In this context, one expects a positive coefficient on the volatility variable. On the other hand, if the information share of the futures market is high there is less price revelation in the underlying stock market resulting in lower stock volatility. Thus the sign of the volatility coefficient is an empirical question.

The results in Panel A indicate that the information share in the futures market is unrelated to any of the independent variables considered. However, one problem with the regression in Panel A is that it may fail to capture the effect of time-series variation in the variables under consideration by using variables averaged over time. Panels B and C of Table 4 present two additional regressions that attempt to address this potential problem.

Panel B of Table 4 repeats the cross-sectional regression on a month-by-month basis and reports the time-series average of the monthly coefficients (e.g., Fama and MacBeth, 1973). The t-statistics are based on the standard errors of the time-series of the coefficient estimates. The average monthly estimates in Panel B indicate that SSFs information share increases in the ratio of trading volumes and decreases in the ratio of spreads. These average estimates are significant at the 1 and 5 percent levels, respectively. Volatility of the underlying stock returns is unrelated to the information share of SSFs.

Table 4 Panel C reports the results of pooled cross-sectional daily time-series regressions. In these models, stock volatility is measured as the squared excess return on the underlying stock relative to the S&P 500 index. The two models in Panel C differ in that the first regression forces the same intercept for all stocks while the second regression is a fixed effects model. The results in panel C are mostly consistent with those in panel B. Specifically, information share is positively related to the trading volume ratio, although not significantly so, and is negatively related to the ratio of spreads and stock volatility.

The results in Table 4 provide support for the conclusion that informed traders are attracted to the futures market when trading volume is higher and spreads are lower in the futures market relative to the underlying stock market and when volatility is low in the underlying stock market. These conditions lead to increased information share for the futures market in the price discovery process of underlying stocks.

The results in Table 4 indicate that the spread ratio is negatively related to the information share in the futures market. This implies that informed traders are attracted to the futures market when the spreads in that market are low relative to the stock market. Thus far we have established the level and some of the determinants of the information share attributable to the SSFs market. In the next section we attempt to directly measure the impact the SSFs market has on the underlying stock market.

3.3 Impact of SSFs trading on the underlying stock market

In this section we consider measures of stock market quality before and after listings on the SSFs market and also during periods with and without trading in the SSFs market. We expect that measures of stock market quality improve with the introduction of the SSFs market and during active trading periods for the SSFs market.

Table 5 presents monthly averages in listing time for the 12 months prior to the SSFs listing and the 12 months following the SSFs listing. The mean percentage quoted (effective) spread decreases by an economically significant 20.2 (18.6) percent following the introduction of the SSFs market. The reduction in quoted (effective) spreads is statistically significant at the 1 percent level and provides direct evidence that the stock market benefits from the SSFs market. The average volatility in the underlying stock market also drops significantly following the listing of SSFs, however the pre- and post-SSFs averages for share volume and number of trades are not statistically different. Consistent with the belief that large trades are more likely to be informed trades, the reduction in trade size is consistent with informed traders moving from the stock market to the futures market.

A more precise test of this hypothesis can be done by examining the adverse selection component of the spread. The bid-ask spread for a stock is generally thought to be comprised of three components: (1) order processing, (2) inventory holding, and (3) adverse selection costs. The adverse selection component (referred to as lambda) captures the information asymmetry faced by dealers and is intended to compensate them for their losses to informed traders.[15] If informed traders are indeed being drawn to the SSFs market, then we should expect the adverse selection component of stock dealers' quotes to decrease after SSFs get listed. The results of this test are reported in Table 5. As can be seen from this table, the adverse selection component of the spread decreases from a mean (median) value of 12.3 (11.9) percent in the pre-SSFs listing

[15] Lambda is estimated using Lin, Sanger, and Booth's (1995) methodology. The natural logarithm of the change in the quote midpoint from t to $t+1$ is regressed on the signed natural logarithm of one-half the effective spread at t (z_t). The coefficient estimate of z_t is an estimate of lambda. See Clarke and Shastri (2000) for a comparison of different lambda estimates. Clarke and Shastri show that the Lin, Sanger, and Booth lambda is a better measure of information asymmetry than others.

period to 10.2 (10.4) percent in the post-SSFs listing period with the change being significantly different from zero at the 1 percent level.

Whereas Table 5 considers the pre- and post-SSFs market impact on the stock market, Table 6 considers the impact of days with trading in the SSFs market to days without trading in the futures market on the underlying stock market. If one compares the quoted spreads on SSFs on days when there is no trading in the futures market to those on days with trading, one would expect the average spread to be wider for the non-trading periods. The result of this test is presented in Panel A of Table 6. As can be seen from this table, the mean (median) quoted spread for SSFs is 56.7 (27.1) basis points when there is no trading on futures contracts. On the other hand, on days with non-zero trading volume the spread is 28.4 (20.1) basis points, which is significantly lower with an associated p-value of less than 1 percent.

If there is no trading in SSFs, then the information share of the futures market is zero. This implies that during periods of no trading in SSFs, information asymmetry should be higher in the stock market, thus resulting in wider spreads. To test this hypothesis, we run regressions of the percentage effective spread in the stock market on stock market trading intensity (proxied by volume, number of trades, or trade size), stock volatility, and a SSFs market trade/no trade dummy. The trade/no trade dummy takes a value of one on days when SSFs trade and zero on days when there is no trading in SSFs. Our hypothesis that the futures market serves as a trading venue for informed traders would suggest that the dummy variable coefficient should be negative. The results presented in Panel B of Table 6 are consistent with this prediction. In particular, the percentage effective spread in the stock market is positively related to all three measures of trading intensity and volatility, and negatively related to the trade/no trade dummy.

Again, a more precise test of this hypothesis can be done by examining the adverse selection component of the spread. If informed traders are indeed being drawn to the SSFs market, then we should expect the adverse selection component of stock dealers' quotes to decrease on days when trading takes place in the SSFs market.

In Panel C of Table 6 we regress the underlying stock's lambda (the adverse selection component of the bid-ask spread) on the same right-hand-side variables as in Panel B. The results in Panel C show that lambda is similarly related to the explanatory variables with the exception of the number of trades, which has a negative association with lambda.

The results presented in this section suggest that the SSFs market contributes significantly, both statistically and economically, to the underlying stock market. We next consider how this benefit develops over time.

3.4 Calendar-time and listing-time behavior of SSFs information share

Anecdotal evidence suggests that there is a learning curve associated with new markets or securities. Specifically, it can be argued that when a new market first begins or a new security is first listed, the trading parameters will be inefficient (i.e., a wide bid-ask spread) due to a lack of familiarity with the market and/or security. In this situation, we would expect that as participants learn more about the market structure and its securities, the trading environment would improve. In this section we provide direct tests of this hypothesis by examining the time trends of SSFs information shares, bid-ask spreads, and trading volumes. We conduct these tests in a couple of ways – in calendar time and in listing time.

Calendar time provides a test of market-level learning, whereas listing time (event time) provides a test of security-level learning. Learning at the market level benefits all securities, in particular new listings since they will start on par with existing listings. On the other hand, security-level learning only benefits the individual listing since it requires new listings to learn certain things from scratch. Market-level learning captures the macro aspects of a market environment, whereas security-level learning captures the micro aspects that pertain to the particular security.

Table 7 shows SSFs information share by calendar month aggregated across days and then stocks for the month. In addition, the table presents a similarly aggregated number for percentage effective spreads and volumes. Time series plots of the information share bounds and of the percentage effective spreads are provided in Figure 2. The table indicates that the monthly lower and upper bounds of SSFs information shares average 24.6 and 24.7 percent across the 31 months in our sample, respectively. The range for the monthly lower bound is 16.3 to 31.9 percent, while the corresponding figures for the upper bound are 16.4 and 32.1 percent. At first glance there does not appear to be a time trend in the information share, since the lower (upper) bound averages 25.3 (25.5) percent over the first sixteen months in comparison to 23.8 (23.9) percent over the last fifteen months. However, closer inspection reveals that the volatility of the monthly information share midpoint falls significantly (p-value of 4.7 percent). From the first half of the sample period to the second half there is a 60 percent reduction in the volatility of the monthly information share midpoint. The latter finding is consistent with the SSFs market as a whole becoming more efficient at price discovery over time.

In contrast to the level of monthly information share, the average monthly spread for SSFs does display a time trend. Across all 31 months, the average SSFs percentage effective spread is 18 basis points with a range of 13 to 31 basis points. The futures spread averages 19 basis points over the first sixteen months and drops to 16 basis points over the last fifteen months. Meanwhile, the volatility decreases by 76.4 percent. The differences in averages and volatilities are significant at the 1 percent level.

A nearly identical pattern of change is present for the stock market percentage effective spread, whose average (volatility) decreases by 18.7 (74.2) percent (both differences are significant at the 1 percent level). Based on the coincidence of change among both the futures and stock spreads, it appears that learning in SSFs market translates into efficiency gains in the stock market.

As is the case with the information share, the SSFs average monthly share volume is not significantly different across the two periods. Average share volume in the first sixteen months is 8,282 while that in the last fifteen months is 8,693. Surprisingly, the volatility of share volume increases dramatically (an increase of 160 percent) and is different across the two periods at the 4 percent significance level. Although the SSFs share volume remains largely unchanged across the two periods, the average stock market share volume drops off considerably. Average stock market share volume decreases by 23.1 percent from the first sixteen months of SSFs trading to the last fifteen months of trading. The corresponding decrease in share volume volatility is 72.5 percent with both decreases significant at the 1 percent level.

Overall, Table 7 supports the idea that the SSFs market as a whole is learning, but it does not address the issue of whether individual SSFs listings experience a learning curve. Table 8 and Figure 3 provide analysis in listing time. Specifically, we track the information share bounds, percentage effective spreads, and share volumes over monthly-event time by analyzing the cross-sectional averages of these values starting in the listing month ($t = 0$). For example, the results for event month t are calculated based on the SSFs that have trade data for month t.

The results in Table 8 indicate that the average mid-point of the information share bounds for event months 0 to 15 is 25.4 percent. The corresponding average for event months 16 to 30 is 23.2 percent. The t-statistic for the difference in means test is 1.66 suggesting that the change in the monthly average information share is only marginally significant at the 10 percent level. Again, as with the calendar time results, the volatility of the information share falls significantly in the last fifteen months (p-value of 6.1 percent).

Further evidence of security-level learning is provided by a 19.4 percent drop in the average percentage effective spread for SSFs from the first 16 months of listing to the next 15 months of listing. The average percentage effective spread for SSFs is 19.8 basis points in the initial period and falls to 15.9 basis points in the latter period. The t-statistic for the difference in means test is 3.61 suggesting that the percentage effective spread does decrease over listing event time. This provides support for our hypothesis that market participants are learning over time about SSFs. It is also worth noting that average percentage effective spread for the underlying stock falls from 5.6 to 4.5 basis points, and represents a statistically significant 19.9 percent decrease.

Finally, there is no listing-time trend in trading volume for SSFs since the average volume in the first sixteen listing months is 8,497 while that in the next fifteen listing months is 8,602. In contrast to the results on information share and effective spreads, the volatility of trading volume is not different across the two periods. The stock market share volume also fails to show any evidence of a time trend over listing months.

There does appear to be some measure of security-level learning based on the event-time trends in information share and percentage effective spread. Collectively, calendar time results from Table 7 and the listing time results from Table 8 indicate that there exists both market- and security-level learning. The market-level learning likely relates to the systematic market features and as such securities, in particular new securities, benefit from past learning. The security-level learning likely captures the idiosyncratic security features and as such the accumulation of listing time can be a valuable determinant of price discovery.

In Tables 7 and 8, we presented univariate evidence in support of learning in the futures market. Table 9 examines this issue using multivariate tests. Panel A of Table 9 reports the results of a regression of the information share on the ratio of volumes, ratio of spreads, ratio of the number of trades in the two markets, squared excess return on the stock (volatility), and event month. Based on arguments made previously and the results reported above, we would expect the coefficients of the volume ratio and trade ratio to be positive and those on the spread ratio and volatility to be negative. If there is learning over time, the coefficient of the event month should be positive. Our results indicate that the coefficients of volume ratio, spread ratio, and volatility are consistent with our expectations, and significantly different from zero. Finally, the event month coefficient is not significant indicating that there is no time trend in information share.

Panel B of Table 9 reports the results of a regression of the percentage effective spread in the SSF market on the volume ratio, trade size ratio, stock volatility, and event month. Based on the market microstructure literature, we would expect the coefficient of volume to be negative and the coefficients of trade size and volatility to the positive. The event month coefficient should be negative if the SSFs percentage effective spread narrows over time. Our results are consistent with the time trend in the percentage effective spreads exhibiting a learning curve.

4. Conclusions

This paper examines whether and to what extent single stock futures contribute to price discovery in their underlying stocks. We find that SSFs account for a significant 24 percent of the price discovery for underlying stocks. This is higher than the 17.9 percent found for equity options by Chakravarty, Gulen, and Mayhew (2004). This difference is consistent with SSFs having a lower cost of trading than options. The information share of SSFs is greater on days when there is greater volume in the futures market relative to the underlying stock market, when spreads are narrower in the futures market relative to the underlying stock market, and when the volatility is higher in the underlying stock. Collectively, the results suggest that the SSFs market plays an important role in the price discovery for underlying stocks.

There is clear evidence that the underlying stock market benefits from the presence of the SSFs market. The informativeness of the underlying stocks improves substantially following the introduction of the SSFs market. Moreover, underlying stock market quality is greater on days with futures trading vis-à-vis days with no futures trading.

It is possible that market participants go through a learning period when first trading SSFs since they represent a new type of security. We expect a learning phase to appear as a trend or change over time in information share and effective spreads. The evidence suggests that there exists to some extent both market-level and security-level learning in the SSFs market which lead to greater efficiency over time. Based on this evidence we conclude that a liquid futures market makes a significant contribution to the price discovery process for underlying securities.

References

Aggarwal, Reena, 1988, Stock index futures and cash market volatility, *Review of Futures Markets* 7, 290–299.

Amin, Kaushik I., and Charles M. C. Lee, 1997, Option trading, price discovery, and earnings news dissemination, *Contemporary Accounting Research* 14, 153–192.

Antoniou, Antonios, and Phil Holmes, 1995, Futures trading, information and spot price volatility: Evidence for the FTSE–100 stock index futures contract using GARCH, *Journal of Banking and Finance* 19, 117–129.

Antoniou, Antonios, Phil Holmes, and Richard Priestley, 1998, The effects of stock index futures trading on stock index volatility: An analysis of the asymmetric response of volatility to news, *Journal of Futures Markets* 18, 151–166.

Back, Kerry, 1993, Asymmetric information and options, *Review of Financial Studies* 6, 435–472.

Baldauf, Brad, and G. J. Santoni, 1991, Stock price volatility: Some evidence from an ARCH model, *Journal of Futures Markets* 11, 191–200.

Bansal, Vipul K., Stephen W. Pruitt, and John K. C. Wei, 1989, An empirical reexamination of the impact of CBOE option initiation on the volatility and trading volume of the underlying equities: 1973-1986, *Financial Review* 24, 19–29.

Bessembinder, Hendrik, and Paul J. Seguin, 1992, Futures-trading activity and stock price volatility, *Journal of Finance* 47, 2015–2034.

Black, Fischer, 1975, Fact and fantasy in the use of options, *Financial Analysts Journal* 31, 36–41, 61–72.

Blume, Lawrence, David Easley, and Maureen O'Hara, 1994, Market statistics and technical analysis: The role of volume, *Journal of Finance* 49, 153–181.

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

Butterworth, Darren, 2000, The impact of futures trading on underlying stock index volatility: The case of the FTSE Mid 250 contract, *Applied Economic Letters* 7, 439–442.

Cao, Charles, Zhiwu Chen, and John M. Griffin, 2005, Informational content of option volume prior to takeovers, *Journal of Business* 78, 1073–1109.

Chakravarty, Sugato, Huseyin Gulen, and Stewart Mayhew, 2004, Informed trading in stock and option markets, *Journal of Finance* 59, 1235–1257.

Chan, Kalok, Peter Y. Chung, and Wai-Ming Fong, 2002, The informational role of stock and option volume, *Review of Financial Studies* 15, 1049–1075.

Chatrath, Arjun, Sanjay Ramchander, and Frank Song, 1996, The role of futures trading activity in exchange rate volatility, *Journal of Futures Markets* 16, 561–584.

Choi, Hong, and Avanidhar Subrahmanyam, 1994, Using intraday data to test for effects of index futures on the underlying stock markets, *Journal of Futures Markets* 14, 293–322.

Clarke, Jonathan, and Kuldeep Shastri, 2000, On information asymmetry metrics, Working paper, University of Pittsburgh.

Conrad, Jennifer, 1989, The price effect of option introduction, *Journal of Finance* 44, 487–498.

Coughenour, Jay, and Kuldeep Shastri, 1999, Symposium on market microstructure: A review of empirical research, *Financial Review* 34, 1–27.

Damodaran, Aswath, 1990, Index futures and stock market volatility, *Review of Futures Markets* 9, 442–457.

Damodaran, Aswath, and Joseph Lim, 1991, The effects of option listing on the underlying stocks' return processes, *Journal of Banking and Finance* 15, 647–664.

Damodaran, Aswath, and Marti G. Subrahmanyam, 1992, The effects of derivative securities on the markets for the underlying assets in the United States: A survey, *Financial Markets, Institutions and Instruments* 1, 1–21.

Darrat, Ali F., Shafiqur Rahman, and Maosen Zhong, 2002, On the role of futures trading in spot market fluctuations: Perpetrator of volatility or victim of regret?, *Journal of Financial Research* 25, 431–444.

Detemple, Jerome, and Philippe Jorion, 1990, Option listing and stock returns: An empirical analysis, *Journal of Banking and Finance* 14, 781–801.

Easley, David, Maureen O'Hara, and P. S. Srinivas, 1998, Option volume and stock prices: Evidence on where informed traders trade, *Journal of Finance* 53, 431–465.

Edwards, Franklin R., 1988a, Does futures trading increase stock market volatility? *Financial Analysts Journal* 44, 63–69.

Edwards, Franklin R., 1988b, Futures trading and cash market volatility: Stock index and interest rate futures, *Journal of Futures Markets* 8, 421–439.

Ely, David P., 1991, Derivative securities and cash market stability, *Applied Economics* 23, 391–402.

Fama, Eugene F., and James D. MacBeth, 1973, Risk, return, and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607–636.

Figlewski, Stephen, 1981, Futures trading and volatility in the GNMA market, Journal of *Finance* 36, 445–456.

Gulen, Huseyin, and Stewart Mayhew, 2000, Stock index futures trading and volatility in international equity markets, *Journal of Futures Markets* 20, 661–685.

Harris, Lawrence, 1989, S&P 500 cash stock price volatilities, *Journal of Finance* 44, 1155–1175.

Hasbrouck, Joel, 1995, One security, many markets: Determining the contributions to price discovery, *Journal of Finance* 50, 1175–1199.

Hodgson, Allan, and Des Nicholls, 1991, The impact of index futures markets on Australian sharemarket volatility, *Journal of Business Finance and Accounting* 18, 267–279.

Jegadeesh, Narasimhan, and Avanidhar Subrahmanyam, 1993, Liquidity effects of the introduction of the S&P 500 index futures contract on the underlying stocks, *Journal of Business* 66, 171–187.

Jochum, Christian, and Laura Kodres, 1998, Does the introduction of futures on emerging market currencies destabilize the underlying currencies?, *International Monetary Fund Staff Papers* 45, 486–521.

John, Kose, Apoorva Koticha, Ranga Narayanan, and Marti G. Subrahmanyam, 2003, Margin rules, informed trading in derivatives, and price dynamics, Working paper, New York University.

Jones, Travis, and Robert Brooks, 2005, An analysis of single stock futures trading in the U.S., *Financial Services Review* 14, 85–95.

Kamara, Avraham, Thomas W. Miller, Jr., and Andrew F. Siegel, 1992, The effect of futures trading on the stability of Standard and Poor 500 returns, *Journal of Futures Markets* 12, 645–658.

Kan, Andy C. N., and Gordon Y. N. Tang, 1999, The impact of index futures trading on the betas of the underlying constituent stocks: The case of Hong Kong, *Journal of International Financial Markets, Institutions and Money* 9, 97–114.

Klemkosky, Robert C., and Terry S. Maness, 1980, The impact of options on the underlying securities, *Journal of Portfolio Management* 6, 12–18.

Kraus, Alan, and Maxwell Smith, 1996, Heterogeneous beliefs and the effect of replicatable options on asset prices, *Review of Financial Studies* 9, 723–756.

Kumar, Raman, Atulya Sarin, and Kuldeep Shastri, 1998, The impact of options trading on the market quality of the underlying security: An empirical analysis, *Journal of Finance* 53, 717–732.

Lin, Ji-Chai, Gary C. Sanger, and G. Geoffrey Booth, 1995, Trade size and components of the bid-ask spread, *Review of Financial Studies* 8, 1153–1183.

Mayhew, Stewart, Atulya Sarin, and Kuldeep Shastri, 1995, The allocation of informed trading across related markets: An analysis of the impact of changes in equity-option margin requirements, *Journal of Finance* 50, 1635–1653.

McKenzie, Michael D., Timothy J. Brailsford, and Robert W. Faff, 2001, New insights into the impact of the introduction of futures trading on stock price volatility, *Journal of Futures Markets* 21, 237–255.

Moriarty, Eugene, and Paula Tosini, 1985, Futures trading and price volatility of GNMA certificates-further evidence, *Journal of Futures Markets* 5, 633–641.

Nandi, Saikat, 1999, Asymmetric information about volatility: How does it affect implied volatility, option prices and market liquidity?, *Review of Derivatives Research* 3, 215–236.

Pan, Jun, and Allen M. Poteshman, 2006 The information in option volume for stock prices,*Review of Financial Studies* 19, 871-908.

Powers, Mark J., 1970, Does futures trading reduce price fluctuations in the cash markets? *American Economic Review* 60, 460–464.

Robinson, Gary, 1994, The effect of futures trading on cash market volatility: Evidence from the London stock exchange, *Review of Futures Markets* 13, 429–452.

Shastri, Kuldeep, Jahangir Sultan, and Kishore Tandon, 1996, The impact of the listing of options in the foreign exchange market, *Journal of International Money and Finance* 15, 37–64.

Skinner, Douglas J., 1989, Options markets and stock return volatility, *Journal of Financial Economics* 23, 61–78.

Skinner, Douglas J., 1997, Do options markets improve informational efficiency?, *Contemporary Accounting Research* 14, 193–201.

Sorescu, Sorin M., 2000, The effect of options on stock prices: 1973 to 1995, *Journal of Finance* 55, 487–514.

Stephan, Jens A., and Robert E. Whaley, 1990, Intraday price change and trading volume relations in the stock and stock option markets, *Journal of Finance* 45, 191–220.

Stoll, Hans R., and Robert E. Whaley, 1987, Program trading and expiration day effects, *Financial Analysts Journal* 43, 16–28.

Trennepohl, Gary L., and William P. Dukes, 1979, CBOE options and stock volatility, *Review of Business and Economic Research* 14, 49–60.

Watt, Wing H., Pradeep K. Yadav, and Paul Draper, 1992, The impact of option listing on underlying stock returns: The UK evidence, *Journal of Business Finance and Accounting* 19, 485–503.

Whiteside, Mary M., William P. Dukes, and Patrick M. Dunne, 1983, Short term impact of option trading on underlying securities, *Journal of Financial Research* 6, 313–321.

Table 1
Single Stock Futures Listings on the OneChicago Exchange

This table presents descriptive statistics for 137 single stock futures listed on OneChicago from November 2002 to July 2005. New SSFs listings is the number of new SSFs to list for the given month. Market capitalization of underlying stocks as of the SSFs listing date is in millions of October 2002 dollars.

Month	New SSFs Listings	Cumulative SSFs Listings	Market Capitalization of Underlying Stocks in Millions	Cumulative Market Capitalization of Underlying Stocks in Millions
Nov-02	43	43	$3,062,737	$3,062,737
Dec-02	39	82	$1,355,736	$4,418,473
Jan-03	3	85	$28,263	$4,446,736
Feb-03	0	85	-	$4,446,736
Mar-03	0	85	-	$4,446,736
Apr-03	1	86	$9,656	$4,456,391
May-03	3	89	$75,289	$4,531,681
Jun-03	1	90	$84,264	$4,615,945
Jul-03	0	90	-	$4,615,945
Aug-03	0	90	-	$4,615,945
Sep-03	3	93	$19,373	$4,635,317
Oct-03	0	93	-	$4,635,317
Nov-03	0	93	-	$4,635,317
Dec-03	1	94	$2,651	$4,637,968
Jan-04	0	94	-	$4,637,968
Feb-04	1	95	$1,531	$4,639,499
Mar-04	0	95	-	$4,639,499
Apr-04	0	95	-	$4,639,499
May-04	0	95	-	$4,639,499
Jun-04	11	106	$348,713	$4,988,212
Jul-04	0	106	-	$4,988,212
Aug-04	16	122	$191,956	$5,180,168
Sep-04	0	122	-	$5,180,168
Oct-04	2	124	$14,278	$5,194,445
Nov-04	1	125	$2,059	$5,196,504
Dec-04	2	127	$34,089	$5,230,593
Jan-05	0	127	-	$5,230,593
Feb-05	0	127	-	$5,230,593
Mar-05	17	144	$468,304	$5,698,897
Apr-05	27	171	$567,869	$6,266,766
May-05	13	184	$254,120	$6,520,886
Jun-05	1	185	$15,337	$6,536,223
Jul-05	19	204	$189,949	$6,726,173
Number of Stocks with SSFs by Exchange				
NASDAQ	49			
NYSE	155			
Market Capitalization of Underlying Stocks in Millions				
Mean	Median	Minimum	Maximum	
$32,971	$16,829	$471	$299,455	

Table 2
Daily Averages for Single Stock Futures and Underlying Stocks

This table contains the lower and upper bound for the information share of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The information shares are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day. Information share bounds are time series averages of daily estimates. The table also contains the average daily percentage effective spread and the average daily trading volume for the single stock futures contract and its corresponding underlying stock and the stock's volatility. Volumes are in number of shares. Price volatility is the square root of the annualized average squared daily return. For the futures market, daily returns are calculated using the midpoint of the last quoted offer and bid prices. For the stock market, daily returns are calculated using the last trade price. Significance of means is tested using the t-test and significance of medians is tested using the signed rank test. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	SSFs Information Share		Daily Average Percentage Effective Spread		Daily Average Share Volume Spread		Price Volatility	
Company Name	Lower Bound	Upper Bound	Futures Market	Stock Market	Futures Market	Stock Market	Futures Market	Stock Market
3M Co	0.224***	0.225***	0.095	0.023	3,494	1,935,857	0.161	0.188
A T & T Corp	0.165***	0.170***	0.241	0.069	3,733	13,491,050	1.567	1.401
Abbott Laboratories	0.232	0.233	0.129	0.030	1,700	10,188,500	0.680	0.656
Advanced Micro Devices Inc	0.222***	0.223***	0.315	0.060	5,858	8,932,167	0.829	0.856
Alcoa Inc	0.281***	0.282***	0.130	0.043	5,445	4,089,997	0.488	0.461
Allstate Corp	0.227***	0.228***	0.066	0.027	8,710	1,785,347	0.161	0.164
Altera Corp	0.192***	0.194***	0.169	0.064	12,067	4,150,389	0.469	0.488
Amazon Com Inc	0.235***	0.238***	0.115	0.045	4,160	3,948,891	0.504	0.511
American Express Co	0.240***	0.241***	0.127	0.037	3,456	3,581,200	0.205	0.224
American International Group Inc	0.215***	0.216***	0.132	0.034	7,400	7,246,535	0.385	0.389
Amgen Inc	0.264***	0.267***	0.069	0.035	9,756	5,176,197	0.281	0.298
Apple Computer Inc	0.204***	0.206***	0.103	0.035	7,740	11,578,323	0.980	0.481
Applied Materials Inc	0.183***	0.184***	0.259	0.063	6,811	17,085,304	0.459	0.455
B B & T Corp	0.000	0.000	0.094	0.033	2,000	2,368,900	0.324	0.282
Bank Of America Corp	0.314***	0.316***	0.078	0.023	8,689	4,938,750	1.390	0.314
Bank One Corp	0.202***	0.203***	0.083	0.034	4,656	4,698,994	0.515	0.480
Bed Bath & Beyond Inc	0.236***	0.238***	0.091	0.050	5,519	1,295,691	0.346	0.348
Best Buy Company Inc	0.182***	0.184***	0.176	0.040	16,256	3,451,800	0.585	0.610
Biogen Idec Inc	0.221***	0.223***	0.124	0.051	5,472	3,018,238	0.813	0.769
Biogen Inc	0.232***	0.233***	0.192	0.072	3,288	3,067,629	0.615	0.621
Boeing Co	0.241***	0.242***	0.128	0.033	2,465	2,712,532	0.240	0.238
Boston Scientific Corp	0.279***	0.282***	0.168	0.043	2,933	4,889,400	0.492	0.360
Bristol Myers Squibb Co	0.279***	0.279***	0.230	0.052	4,995	5,510,930	0.221	0.208
Broadcom Corp	0.204***	0.206***	0.131	0.050	6,079	4,602,618	0.482	0.500
Brocade Communications Sys Inc	0.351***	0.351***	0.576	0.173	3,965	7,059,178	0.741	0.616
Carnival Corp	0.027	0.027	0.194	0.032	3,400	2,986,350	0.729	0.505
Caterpillar Inc	0.179***	0.182***	0.174	0.032	4,669	2,141,591	0.320	0.322
Cephalon Inc	0.290***	0.291***	0.213	0.076	2,800	1,497,693	0.458	0.411
Check Point Software Techs Ltd	0.275***	0.276***	0.205	0.092	5,660	2,447,442	0.670	0.577
Chevrontexaco Corp	0.227***	0.228***	0.097	0.023	4,521	2,353,400	0.157	0.165
Chicago Mercantile Exch Hldg Inc	0.101***	0.102***	0.368	0.065	1,175	914,344	0.696	0.757
Cisco Systems Inc	0.198***	0.201***	0.268	0.058	12,696	35,402,101	0.385	0.380
Citigroup Inc	0.210***	0.211***	0.111	0.034	5,089	9,989,538	0.255	0.247
Coca Cola Co	0.222***	0.223***	0.180	0.032	1,644	5,930,381	0.303	0.268
Colgate Palmolive Co	0.280	0.280	0.187	0.025	2,000	964,600	0.124	0.090
Computer Associates Intl Inc	0.312**	0.314**	0.083	0.043	3,756	1,769,733	0.281	0.286
Comverse Technology Inc	0.269***	0.270***	0.162	0.081	5,414	1,778,899	0.522	0.583
Conocophillips	0.339***	0.340***	0.089	0.028	2,020	2,843,160	0.253	0.294
Dell Inc	0.218***	0.220***	0.113	0.040	16,550	12,780,614	0.359	0.375

Table 2 – Continued

Disney Walt Co	0.150**	0.154**	0.143	0.054	4,200	6,227,075	0.262	0.263
Dow Chemical Co	0.305***	0.305***	0.083	0.036	1,700	2,172,636	0.204	0.192
Du Pont E I De Nemours & Co	0.341***	0.343***	0.096	0.033	9,933	2,142,667	0.125	0.147
E M C Corp Ma	0.250**	0.253**	0.286	0.085	850	12,642,680	0.477	0.478
Eastman Kodak Co	0.328***	0.331***	0.443	0.054	68,645	4,487,709	0.786	0.753
Ebay Inc	0.198***	0.200***	0.082	0.035	6,809	5,151,551	0.694	0.396
Elan Plc	0.222***	0.223***	0.542	0.173	12,307	12,391,227	2.355	2.406
Electronic Data Sys Corp New	0.125**	0.126**	0.140	0.066	6,311	4,145,511	0.543	0.501
Emulex Corp	0.227**	0.227**	0.415	0.097	17,373	2,242,720	0.385	0.411
Exxon Mobil Corp	0.225***	0.230***	0.112	0.024	5,269	10,131,800	0.229	0.208
Federated Dept Stores Inc Del	0.113***	0.114***	0.089	0.036	3,238	2,578,100	0.456	0.435
Fifth Third Bancorp	0.010	0.010	0.190	0.039	12,933	2,372,151	0.534	0.503
Ford Motor Co Del	0.465***	0.465***	0.357	0.092	2,529	10,060,014	0.413	0.454
General Electric Co	0.186***	0.188***	0.194	0.041	33,140	16,891,956	0.216	0.234
General Motors Corp	0.298***	0.302***	0.253	0.033	50,700	3,879,371	0.131	0.167
Genzyme Corp	0.212***	0.213***	0.130	0.066	5,935	1,799,761	0.469	0.479
Goldman Sachs Group Inc	0.240***	0.241***	0.066	0.027	4,688	2,694,235	0.201	0.193
Google Inc	0.187***	0.190***	0.113	0.032	4,499	5,105,725	0.445	0.453
Halliburton Company	0.286***	0.287***	0.126	0.039	17,103	3,629,625	0.289	0.280
Hewlett Packard Co	0.227**	0.230**	0.193	0.064	2,290	17,168,730	0.988	1.027
Home Depot Inc	0.329***	0.330***	0.184	0.051	1,750	8,835,450	0.225	0.266
Honeywell International Inc	0.138	0.139	0.200	0.043	2,457	3,552,200	0.183	0.385
I D E C Pharmaceuticals Corp	0.197***	0.198***	0.246	0.085	3,866	3,085,476	0.402	0.397
Intel Corp	0.249***	0.251***	0.182	0.044	6,515	28,714,615	0.401	0.382
International Business Machs Cor	0.204***	0.206***	0.088	0.026	4,409	5,000,060	0.265	0.265
International Paper Co	0.155**	0.156**	0.161	0.037	4,293	2,076,021	0.302	0.304
Jetblue Airways Corp	0.359**	0.359**	0.349	0.086	6,100	1,196,232	0.701	0.605
Johnson & Johnson	0.264***	0.265***	0.102	0.034	14,033	5,976,813	0.246	0.252
Jpmorgan Chase & Co	0.240***	0.241***	0.151	0.042	5,942	8,048,488	0.340	0.331
Juniper Networks Inc	0.222***	0.223***	0.160	0.047	5,967	5,638,890	0.482	0.529
K L A Tencor Corp	0.235***	0.237***	0.089	0.038	6,534	3,261,363	0.350	0.352
Kohls Corp	0.195***	0.196***	0.090	0.034	4,555	2,388,425	0.236	0.266
Krispy Kreme Doughnuts Inc	0.020	0.020	1.072	0.064	1,500	1,420,250	0.336	0.329
Lennar Corp	0.179***	0.180***	0.109	0.045	6,225	2,971,877	0.417	0.412
Lilly Eli & Co	0.206***	0.208***	0.125	0.029	3,107	3,037,453	0.368	0.335
Limited Brands Inc	0.140	0.141	3.054	0.048	7,333	1,678,800	0.265	0.066
Linear Technology Corp	0.224***	0.226***	0.098	0.048	8,023	2,309,781	0.339	0.315
Lockheed Martin Corp	0.161	0.162	0.140	0.021	2,500	1,929,100	0.032	0.012
Lowes Companies Inc	0.053*	0.053*	0.141	0.040	26,000	4,240,529	0.345	0.236
Marathon Oil Corp	0.555*	0.556*	0.162	0.042	1,533	1,767,133	0.265	0.281
Maxim Integrated Products Inc	0.242***	0.244***	0.103	0.046	6,837	2,847,235	0.350	0.359
Mcdonalds Corp	0.227***	0.229***	0.304	0.044	5,114	5,283,119	0.383	0.352
Merck & Co Inc	0.174***	0.176***	0.081	0.031	11,971	3,791,750	0.233	0.199
Merrill Lynch & Co Inc	0.212***	0.213***	0.125	0.034	6,265	5,222,062	0.309	0.318
Micron Technology Inc	0.403***	0.405***	0.269	0.081	5,605	7,947,564	0.519	0.523
Microsoft Corp	0.211***	0.214***	0.167	0.041	36,586	33,386,334	0.687	0.283
Morgan Stanley Dean Witter & Co	0.208***	0.210***	0.098	0.032	1,751	3,998,841	0.298	0.305
Motorola Inc	0.218***	0.220***	0.200	0.061	6,238	11,028,462	0.418	0.398
Newmont Mining Corp	0.145***	0.147***	0.121	0.035	4,638	3,351,963	0.322	0.319
News Corp Ltd	0.263	0.263	0.109	0.046	51,750	1,447,325	0.204	0.205
Nextel Communications Inc	0.211***	0.214***	0.129	0.051	2,598	5,319,903	0.373	0.373
Nokia Corp	0.212***	0.212***	0.331	0.067	4,650	14,424,439	0.912	0.884
Northrop Grumman Corp	0.279***	0.280***	0.129	0.030	5,032	1,129,042	0.275	0.246
Novellus Systems Inc	0.215***	0.217***	0.158	0.052	4,505	3,070,230	0.468	0.449
Nvidia Corp	0.195***	0.196***	0.174	0.068	5,123	3,858,733	0.835	0.828
Occidental Petroleum Corp	0.620**	0.620**	0.138	0.031	5,700	1,336,867	0.234	0.239
Oracle Corp	0.282***	0.291***	0.289	0.084	12,114	26,890,370	0.574	0.591
P M C Sierra Inc	0.283***	0.284***	0.256	0.107	4,021	2,896,894	0.618	0.588

Table 2 – Continued

Peoplesoft Inc	0.228***	0.231***	0.157	0.082	3,396	6,725,226	0.692	0.634
Pepsico Inc	0.212***	0.213***	0.116	0.030	3,617	3,351,578	0.272	0.283
Pfizer Inc	0.297***	0.300***	0.109	0.036	13,733	15,047,622	0.227	0.200
Phelps Dodge Corp	0.155***	0.157***	0.099	0.038	5,676	1,813,066	0.378	0.395
Philip Morris Cos Inc	0.261***	0.262***	0.153	0.035	4,711	6,911,960	0.389	0.343
Procter & Gamble Co	0.296***	0.298***	0.108	0.025	14,634	3,224,615	0.129	0.133
Qlogic Corp	0.209***	0.210***	0.116	0.052	4,399	2,563,723	0.463	0.471
Qualcomm Inc	0.219***	0.222***	0.099	0.040	5,560	6,635,225	0.372	0.376
Research In Motion Ltd	0.164***	0.166***	0.123	0.040	6,851	4,103,943	0.574	0.546
Reynolds American Inc	0.270	0.271	0.623	0.028	4,000	222,500	0.106	0.058
S B C Communications Inc	0.230**	0.232**	0.155	0.045	2,631	6,814,919	0.252	0.221
Sandisk Corp	0.258***	0.259***	0.144	0.069	4,921	3,065,772	0.655	0.657
Schering Plough Corp	0.300*	0.301*	0.187	0.054	206,860	6,596,920	0.397	0.310
Schlumberger Ltd	0.205***	0.206***	0.072	0.027	6,757	2,776,141	0.223	0.212
Siebel Systems Inc	0.404***	0.411***	0.788	0.112	6,100	9,965,140	0.612	0.594
Sirius Satellite Radio Inc	0.366***	0.371***	0.545	0.167	10,400	28,235,468	0.446	0.436
St Paul Travelers Cos Inc	0.558	0.558	0.090	0.035	5,800	1,343,600	0.020	0.118
Starbucks Corp	0.223***	0.224***	0.121	0.051	9,702	1,799,985	0.317	0.334
Sun Microsystems Inc	0.414***	0.417***	0.585	0.242	13,484	26,167,367	0.639	0.589
Suncor Energy Inc	0.223	0.229	0.193	0.040	2,300	977,450	0.505	0.345
Symantec Corp	0.179***	0.181***	0.154	0.055	3,887	5,564,650	1.060	0.556
T I B C O Software Inc	0.479***	0.479***	0.542	0.154	8,210	1,989,363	0.675	0.593
Target Corp	0.320***	0.323***	0.068	0.030	5,500	2,600,800	0.173	0.181
Tenet Healthcare Corp	0.166	0.166	0.338	0.094	5,000	2,554,900	0.663	0.649
Texas Instruments Inc	0.304***	0.307***	0.198	0.049	16,590	12,036,352	0.583	0.584
Time Warner Inc New	0.215***	0.219***	0.147	0.060	3,940	15,619,000	0.286	0.286
Tyco International Ltd New	0.087*	0.087*	0.162	0.054	20,767	14,999,450	0.597	0.473
U S Bancorp Del	0.338**	0.339**	0.131	0.037	5,457	3,547,500	0.240	0.209
United Parcel Service Inc	0.130**	0.130**	0.161	0.019	22,000	1,506,700	0.061	0.015
United Technologies Corp	0.208***	0.210***	0.081	0.028	7,520	1,539,572	0.187	0.190
Veritas Software Corp	0.188***	0.189***	0.140	0.064	5,086	4,877,873	0.538	0.515
Verizon Communications	0.217***	0.219***	0.122	0.042	12,860	5,440,270	0.254	0.273
Viacom Inc	0.656	0.656	0.029	0.037	300	4,599,500	0.070	0.027
Wal Mart Stores Inc	0.231***	0.233***	0.102	0.029	11,036	6,883,624	0.240	0.230
Washington Mutual Inc	0.420	0.427	0.085	0.036	3,550	2,012,750	0.170	0.244
Wells Fargo & Co New	0.209***	0.210***	0.086	0.023	4,100	3,314,692	0.181	0.153
Weyerhaeuser Co	0.416	0.419	0.161	0.032	3,200	507,000	0.177	0.161
Williams Cos	0.445	0.445	0.157	0.066	967	3,216,133	0.343	0.374
Xilinx Inc	0.242***	0.244***	0.172	0.055	4,401	5,273,738	0.437	0.456
Yahoo Inc	0.253***	0.255***	0.161	0.045	5,263	7,860,589	0.443	0.450
Mean	0.244***	0.246***	0.207	0.052	9,320	6,066,907	0.432	0.400
Median	0.225***	0.228***	0.143	0.042	5,269	3,858,733	0.373	0.352
Standard Deviation	0.102	0.103	0.285	0.032	19,405	6,406,721	0.296	0.267

Table 3
Information Share of Single Stock Futures Market by Stock Listing Exchange

This table contains the cross-sectional average of lower and upper bounds for the information share of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The sample is stratified by the exchange listing of the underlying stock. The information shares are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day.

	Information Share		
Exchange	Lower Bound	Upper Bound	N
NASDAQ	0.242	0.244	46
NYSE	0.246	0.247	91

Table 4
Determinants of the Information Share of the Single Stock Futures Market

This table contains regressions of a logit transformation of the mid-point of the lower and upper bounds for the information share of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The information shares are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day. Panels A and B report the coefficients and corresponding t-statistics for the regression:

Information Share = $b_0 + b_1$Volratio + b_2Spratio + b_3Volatility

where Volratio is the ratio of trading volume of the futures contract to that of the underlying stock, Spratio is the ratio of the percentage effective bid-ask spread of the futures contract to that of the underlying stock and Volatility is the square root of the annualized average squared daily stock return. The regression in panel A is cross-sectional while the one in Panel B is a time series average of monthly estimates. Panel C reports the coefficients and the corresponding t-statistics for the pooled cross-sectional time-series regression:

Information Share = $b_0 + b_1$Volratio + b_2Spratio + b_3Exret^2

where Exret^2 is the square of the excess return on the underlying stock relative to the S&P 500 index and other variables are as defined above. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Panel A. Cross-Sectional Regression				
	Intercept	VOLRATIO	SPRATIO	VOLATILITY
Estimate	-1.267***	9.636	-0.017	-0.066
t-Statistic	-4.363	0.589	-0.672	-0.126

Panel B. Time-Series Average of Monthly Cross-Sectional Regressions				
	Intercept	VOLRATIO	SPRATIO	VOLATILITY
Estimate	-1.933***	84.066***	-0.064**	0.628
t-Statistic	-9.015	2.721	-2.018	1.534

Panel C. Panel Regressions				
	Intercept	VOLRATIO	SPRATIO	EXRET^2
Estimate	-2.733***	5.272	-0.026***	-13.256**
t-Statistic	-50.268	1.375	-2.610	-2.203
Firm Fixed Effects: No Intercept				
Estimate		4.256	-0.020*	-15.101**
t-Statistic		1.070	-1.890	-2.450

Table 5
Stock Market Liquidity Pre and Post the Single Stock Futures Market

This table compares liquidity measures for the stock market pre and post the SSFs market. Month 0 is the month in which an SSFs was listed on OneChicago. Each month is assumed to have 21 trading days. All liquidity measures are cross-sectional averages of daily averages for a given month. Percentage quoted spread is the difference between the quoted offer and bid prices divided by the midpoint of the quoted offer and bid prices. Percentage effective spread is two times the absolute difference between the trade price and the midpoint of the quoted offer and bid prices divided by the midpoint of the quoted offer and bid prices. Share volume is the daily average number of shares traded in the stock market. Number of trades is the daily average number of transactions in the stock market. Trade size is the daily average number of shares traded in each transaction in the stock market. Volatility is the square root of the annualized average squared daily stock return. Lambda (a measure of information asymmetry) is estimated by regressing the natural logarithm of the change in the quote midpoint from t to $t+1$ on the signed natural logarithm of one-half the effective spread at t (z_t). The coefficient estimate of z_t is lambda (see Lin, Sanger, and Booth (1995) for a more detailed discussion). Difference in means is tested using a t-test and difference in medians is tested using a Wilcoxon test. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	Listing Month	Percentage Quoted Spread	Percentage Effective Spread	Share Volume	Number of Trades	Trade Size	Volatility	Lambda
	-12	0.090	0.070	4,990,845	5,128	1,272	0.343	13.806
	-11	0.091	0.070	5,042,420	5,159	1,320	0.327	13.586
	-10	0.091	0.070	5,468,656	5,413	1,356	0.356	13.254
	-9	0.087	0.067	5,213,686	4,931	1,300	0.340	12.925
	-8	0.083	0.065	4,794,820	4,467	1,303	0.334	12.223
	-7	0.084	0.066	5,113,453	4,773	1,252	0.360	11.876
	-6	0.089	0.070	5,162,660	4,933	1,287	0.369	11.734
	-5	0.097	0.076	5,797,204	5,313	1,410	0.433	11.862
	-4	0.094	0.075	5,438,521	5,091	1,344	0.399	11.495
	-3	0.090	0.072	5,230,152	4,988	1,252	0.379	11.971
	-2	0.090	0.072	5,934,753	5,602	1,304	0.414	11.687
	-1	0.085	0.066	5,919,984	5,967	1,213	0.380	11.042
	0	0.073	0.057	3,383,634	3,855	1,006	0.294	9.690
	1	0.078	0.061	5,434,949	5,860	1,191	0.346	9.723
	2	0.075	0.060	5,073,377	5,748	1,114	0.295	9.287
	3	0.074	0.059	5,439,680	5,811	1,136	0.321	10.347
	4	0.074	0.059	5,822,296	5,990	1,213	0.338	10.508
	5	0.070	0.056	5,206,447	5,472	1,184	0.315	9.998
	6	0.073	0.060	5,936,020	5,788	1,291	0.339	10.517
	7	0.072	0.059	5,233,061	5,319	1,242	0.325	10.537
	8	0.069	0.056	4,814,649	4,779	1,203	0.296	10.445
	9	0.065	0.053	4,835,170	4,822	1,220	0.298	10.398
	10	0.065	0.053	4,470,825	4,609	1,173	0.272	10.444
	11	0.063	0.050	4,479,657	4,381	1,169	0.261	10.484
Pre-SSFs Listing	Mean	0.089	0.070	5,342,263	5,147	1,301	0.370	12.288
	Median	0.090	0.070	5,221,919	5,110	1,301	0.364	11.924
Post-SSFs Listing	Mean	0.071	0.057	5,010,814	5,203	1,179	0.308	10.198
	Median	0.073	0.058	5,139,912	5,395	1,188	0.306	10.421
p-Value of Difference	Mean	0.0001***	0.0001***	0.1626	0.8121	0.0001***	0.0001***	0.0001***
	Median	0.0001***	0.0001***	0.3123	0.6650	0.0002***	0.0002***	0.0001***

Table 6
Stock Market Quality for Trade and No Trade Days on the Single Stock Futures Market

This table compares liquidity measures from the SSFs and stock markets on days when there are trades on the SSF market to those on days where there are no trades on the SSF market. Panel A compares the mean percentage quoted spread on trade and no trade days. Percentage quoted spread in the SSF market is the difference between the quoted offer price and quoted bid price on the SSF market divided by the mid-point of the quoted offer and bid prices. Panels B and C report the coefficients and corresponding t-statistics for the pooled cross-sectional time-series regression:

Liquidity Measure = $b_0 + b_1$Trading Intensity + b_2Exret^2 + b_3Dummy

where Liquidity Measure is either the daily average percentage effective spread in the stock market (Panel B) or the daily lambda in the stock market (Panel C), Trading Intensity in the underlying stock is proxied by either the natural logarithm of daily volume in number of shares (Ln Volume), natural logarithm of daily number of trades (Ln Number of Trades), or natural logarithm of average daily trade size in the stock market (Ln Trade Size). Exret^2 is the square of the excess return on the underlying stock relative to the S&P 500 index. Dummy is one on days with non-zero trading volume on the single stock futures market (Trade/No Trade Dummy). Percentage effective spread is two times the absolute difference between the transaction price and the mid-point of the prevailing offer and bid prices at the time of trade divided by the mid-point of the prevailing offer and bid prices at the time of trade. Lambda (a measure of information asymmetry) is estimated by regressing the natural logarithm of the change in the quote midpoint from *t* to *t+1* on the signed natural logarithm of one-half the effective spread at *t* (z_t). The coefficient estimate of z_t is lambda (see Lin, Sanger, and Booth (1995) for a more detailed discussion). Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Panel A. Percentage Quoted Spread in SSFs Market

	No Trade	Trade	p-Value of Difference
Mean	0.567	0.284	0.0001***
Median	0.271	0.201	0.0001***

Panel B. Percentage Effective Spread in Stock Market

	Intercept	Ln Volume	Ln Number of Trades	Ln Trade Size	Exret^2	Trade/No Trade Dummy
Estimate	-0.014***	0.004***			1.229***	-0.002***
t-Statistic	-6.963	32.775			26.284	-9.040
Estimate	0.015***		0.005***		1.285***	-0.004***
t-Statistic	10.913		26.823		27.466	-13.313
Estimate	0.032***			0.003***	1.329***	-0.0005*
t-Statistic	25.163			15.826	28.335	-1.824

Panel C. Lambda in Stock Market

	Intercept	Ln Volume	Ln Number of Trades	Ln Trade Size	Exret^2	Trade/No Trade Dummy
Estimate	1.159*	0.572***			77.023***	-3.095***
t-Statistic	1.701	12.527			4.860	-35.111
Estimate	52.272***		-5.340***		191.152***	-0.155*
t-Statistic	119.804		-98.352		12.881	-1.784
Estimate	-37.391***			6.813***	3.327	-1.155***
t-Statistic	-96.687			122.705	0.232	-14.319

Table 7
Information Share of the Single Stock Futures Market by Calendar Time

This table contains the cross-sectional average of lower and upper bounds for the information share of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The sample is stratified by calendar time. The information shares are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day. The table also contains the average daily percentage effective spread and the average daily trading volume for the single stock futures contract and its corresponding underlying stock. Volumes are in number of shares. Significance of means is tested using the t-test and significance of medians is tested using the signed rank test. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	Information Share		Percentage Effective Spread		Share Volume		
Month	Lower Bound	Upper Bound	Futures Market	Stock Market	Futures Market	Stock Market	N
Jan-03	0.282***	0.284***	0.260	0.067	6,717	11,751,911	51
Feb-03	0.234***	0.236***	0.206	0.066	6,578	10,290,527	45
Mar-03	0.319***	0.321***	0.305	0.067	7,641	9,933,878	51
Apr-03	0.305***	0.308***	0.182	0.061	4,663	10,579,693	39
May-03	0.213***	0.214***	0.232	0.059	9,619	9,484,781	52
Jun-03	0.202***	0.203***	0.165	0.063	11,091	6,705,060	26
Jul-03	0.163***	0.164***	0.157	0.056	5,966	8,286,325	62
Aug-03	0.268***	0.271***	0.184	0.058	10,188	6,586,523	59
Sep-03	0.260***	0.261***	0.174	0.057	20,655	6,527,992	45
Oct-03	0.254***	0.256***	0.189	0.052	4,834	6,299,594	51
Nov-03	0.253***	0.255***	0.142	0.051	5,385	3,796,039	45
Dec-03	0.196***	0.198***	0.184	0.056	12,970	6,636,795	45
Jan-04	0.268***	0.270***	0.163	0.051	5,430	7,428,513	41
Feb-04	0.287***	0.289***	0.194	0.061	7,716	7,209,443	41
Mar-04	0.302***	0.303***	0.190	0.051	6,912	6,077,099	54
Apr-04	0.241***	0.243***	0.183	0.044	6,146	6,059,042	46
May-04	0.261***	0.263***	0.189	0.051	2,845	4,975,629	49
Jun-04	0.241***	0.243***	0.148	0.047	9,601	5,206,355	77
Jul-04	0.207***	0.208***	0.132	0.046	4,095	6,009,659	70
Aug-04	0.238***	0.240***	0.177	0.050	2,519	4,879,574	55
Sep-04	0.271***	0.272***	0.172	0.050	13,128	5,263,029	90
Oct-04	0.217***	0.219***	0.186	0.046	5,798	4,790,355	75
Nov-04	0.208***	0.209***	0.140	0.043	12,053	6,262,233	68
Dec-04	0.235***	0.237***	0.154	0.047	8,365	7,338,677	72
Jan-05	0.300***	0.302***	0.143	0.044	6,223	5,776,377	54
Feb-05	0.208***	0.209***	0.194	0.049	5,375	8,936,538	58
Mar-05	0.209***	0.210***	0.174	0.047	29,428	5,911,201	64
Apr-05	0.216***	0.218***	0.167	0.050	7,576	5,854,392	62
May-05	0.253***	0.256***	0.150	0.045	11,089	7,065,942	59
Jun-05	0.248***	0.250***	0.148	0.048	5,583	5,603,043	68
Jul-05	0.251***	0.252***	0.142	0.038	6,725	5,251,405	58
Mean	0.246***	0.247***	0.178	0.052	8,481	6,863,794	56
Median	0.248***	0.250***	0.174	0.051	6,725	6,299,594	56
Standard Deviation	0.037	0.037	0.036	0.008	5,324	1,910,729	13

Table 8
Information Share of the Single Stock Futures Market by Listing Event Time

This table contains the cross-sectional average of lower and upper bounds for the information share of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The sample is stratified by listing event time. The information shares are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day. The table also contains the average daily percentage effective spread and the average daily trading volume for the single stock futures contract and its corresponding underlying stock. Volumes are in number of shares. Significance of means is tested using the t-test and significance of medians is tested using the signed rank test. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

	Information Share		Percentage Effective Spread		Share Volume		
Month	Lower Bound	Upper Bound	Futures Market	Stock Market	Futures Market	Stock Market	N
0	0.243***	0.245***	0.256	0.057	8,803	5,111,801	38
1	0.267***	0.269***	0.218	0.062	5,561	9,547,009	76
2	0.263***	0.265***	0.242	0.061	6,625	7,298,608	83
3	0.331***	0.332***	0.252	0.062	6,751	9,117,617	73
4	0.226***	0.228***	0.242	0.061	4,302	8,214,976	64
5	0.275***	0.276***	0.198	0.055	5,428	6,693,092	61
6	0.187***	0.188***	0.183	0.057	12,030	7,940,534	69
7	0.204***	0.205***	0.175	0.058	4,788	6,550,926	76
8	0.239***	0.241***	0.185	0.058	24,259	6,563,606	75
9	0.221***	0.223***	0.167	0.056	10,341	6,196,115	68
10	0.277***	0.279***	0.215	0.054	4,712	4,863,602	61
11	0.292***	0.294***	0.139	0.051	5,115	4,874,757	54
12	0.167***	0.169***	0.163	0.052	15,405	6,075,987	47
13	0.284***	0.286***	0.181	0.056	5,520	7,510,969	44
14	0.298***	0.300***	0.161	0.053	6,956	6,680,297	44
15	0.277***	0.279***	0.185	0.048	9,355	5,685,744	47
16	0.206***	0.207***	0.198	0.047	3,502	6,520,378	50
17	0.273***	0.275***	0.157	0.048	4,945	5,588,563	51
18	0.231***	0.233***	0.175	0.049	10,837	5,052,423	67
19	0.205***	0.207***	0.133	0.048	2,865	6,239,538	68
20	0.226***	0.228***	0.174	0.044	3,486	5,708,916	58
21	0.222***	0.224***	0.160	0.047	13,772	5,436,802	61
22	0.246***	0.249***	0.152	0.050	5,567	6,663,559	47
23	0.233***	0.234***	0.144	0.043	10,062	6,600,684	44
24	0.209***	0.211***	0.151	0.040	14,438	7,842,300	49
25	0.261***	0.262***	0.139	0.046	6,116	8,590,648	42
26	0.287***	0.289***	0.179	0.041	15,633	5,995,259	42
27	0.202***	0.204***	0.192	0.042	9,210	8,739,859	43
28	0.257***	0.259***	0.175	0.048	7,378	8,736,933	34
29	0.224***	0.225***	0.135	0.041	15,626	7,183,267	36
30	0.186***	0.187***	0.126	0.042	5,597	6,860,337	39
Mean	0.243***	0.244***	0.179	0.051	8,548	6,796,294	55
Median	0.239***	0.241***	0.175	0.050	6,751	6,600,684	51
Standard Deviation	0.038	0.038	0.035	0.007	4,821	1,293,331	14

Table 9
Time Trend in Information Share and Percentage Effective Spread in Listing Event Time

This table presents regressions of logit transformation of the mid-point of the lower and upper bounds for the information shares and percentage effective spreads in listing event time of the single stock futures market for a sample of 137 stocks that have futures listed on OneChicago. The information shares and percentage effective spreads are for the shortest maturity futures contract. Futures contracts are included in the sample only if they have at least 3 trades and two price changes in a trading day. Panel A reports the coefficients and corresponding t-statistics for the pooled cross-sectional time-series regression:

$$\text{Information Share} = b_0 + b_1\text{Volratio} + b_2\text{Spratio} + b_3\text{Trratio} + b_4\text{Exret}^2 + b_5\text{Event month}$$

where Information Share is the mid-point of the lower and upper bounds of the information share of the single stock futures, Volratio is the ratio of trading volume of the futures contract to that of the underlying stock, Spratio is the ratio of the percentage effective bid-ask spread of the futures contract to that of the underlying stock, Trratio is the ratio of number of trades in the single stock futures market to that in the underlying stock market, Exret^2 is the square of the excess return on the underlying stock relative to the S&P 500 index, and Event month takes a value of zero for the listing month and increases by one for each month subsequent to the listing month. Panel B reports the coefficients and corresponding t-statistics for the pooled cross-sectional time-series regression:

$$\text{Spratio} = b_0 + b_1\text{Volratio} + b_2\text{Trratio} + b_3\text{Exret}^2 + b_4\text{Event month}$$

where all variables are as defined above. Respectively, ***, **, and * indicate significance at the 1%, 5%, and 10% level.

Panel A. Time Trend in Information Share

	Intercept	VOLRATIO	SPRATIO	TRRATIO	EXRET^2	Event Month
Estimate	-2.653***	6.970*	-0.026***	-26.534**	-13.058**	-0.002
t-Statistic	-28.477	1.777	-2.605	-2.012	-2.170	-0.312

Panel B. Time Trend in Percentage Effective Spreads in SSF Market

	Intercept	VOLRATIO	TRRATIO	EXRET^2	Event Month
Estimate	0.172***	0.042	0.367	3.782***	-0.003***
t-Statistic	33.071	0.182	0.471	10.625	-8.568

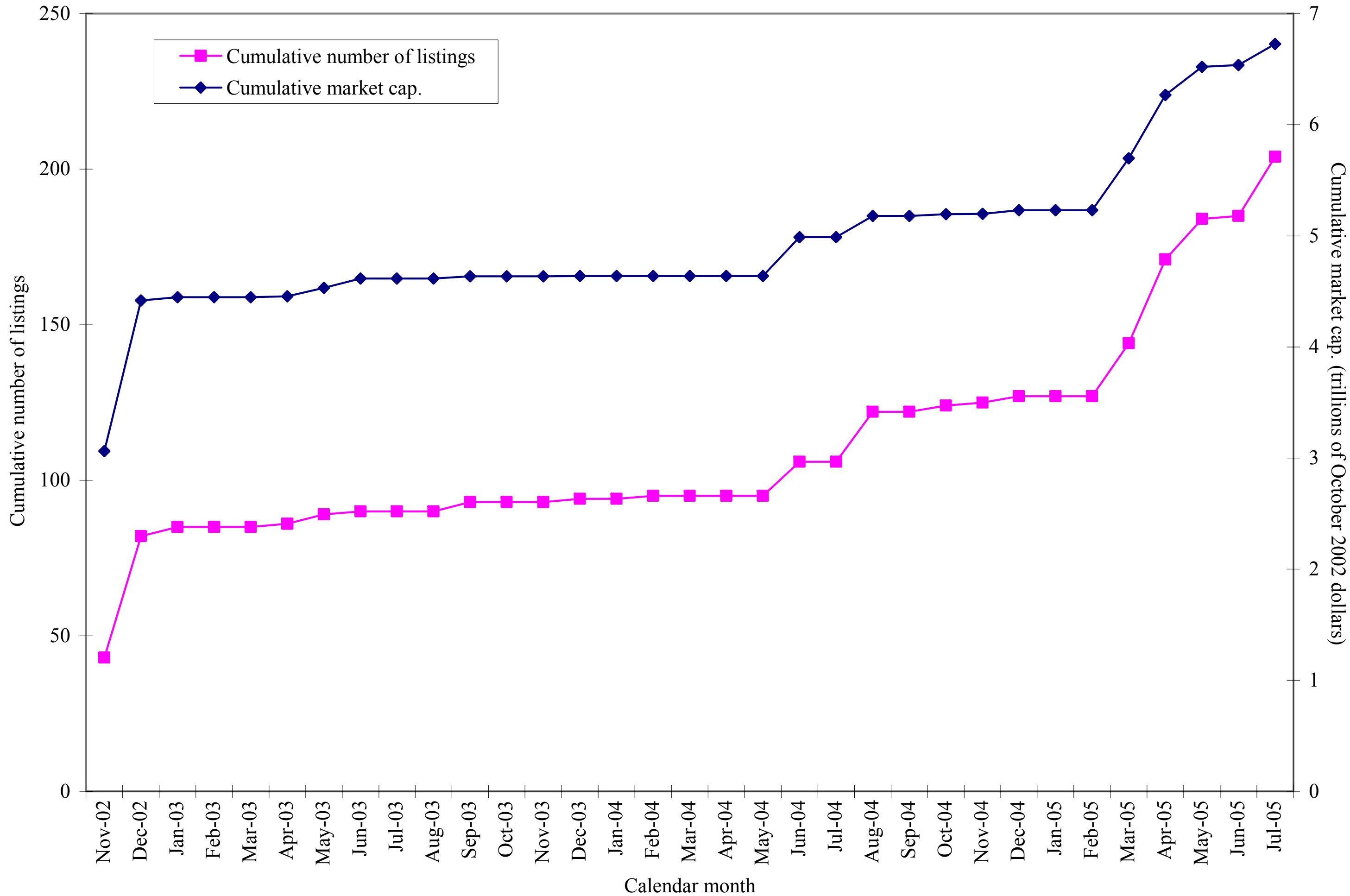

Figure 1
Time Series Plot of the Cumulative Number and Market Capitalization for Single Stock Futures Listings on the OneChicago Exchange

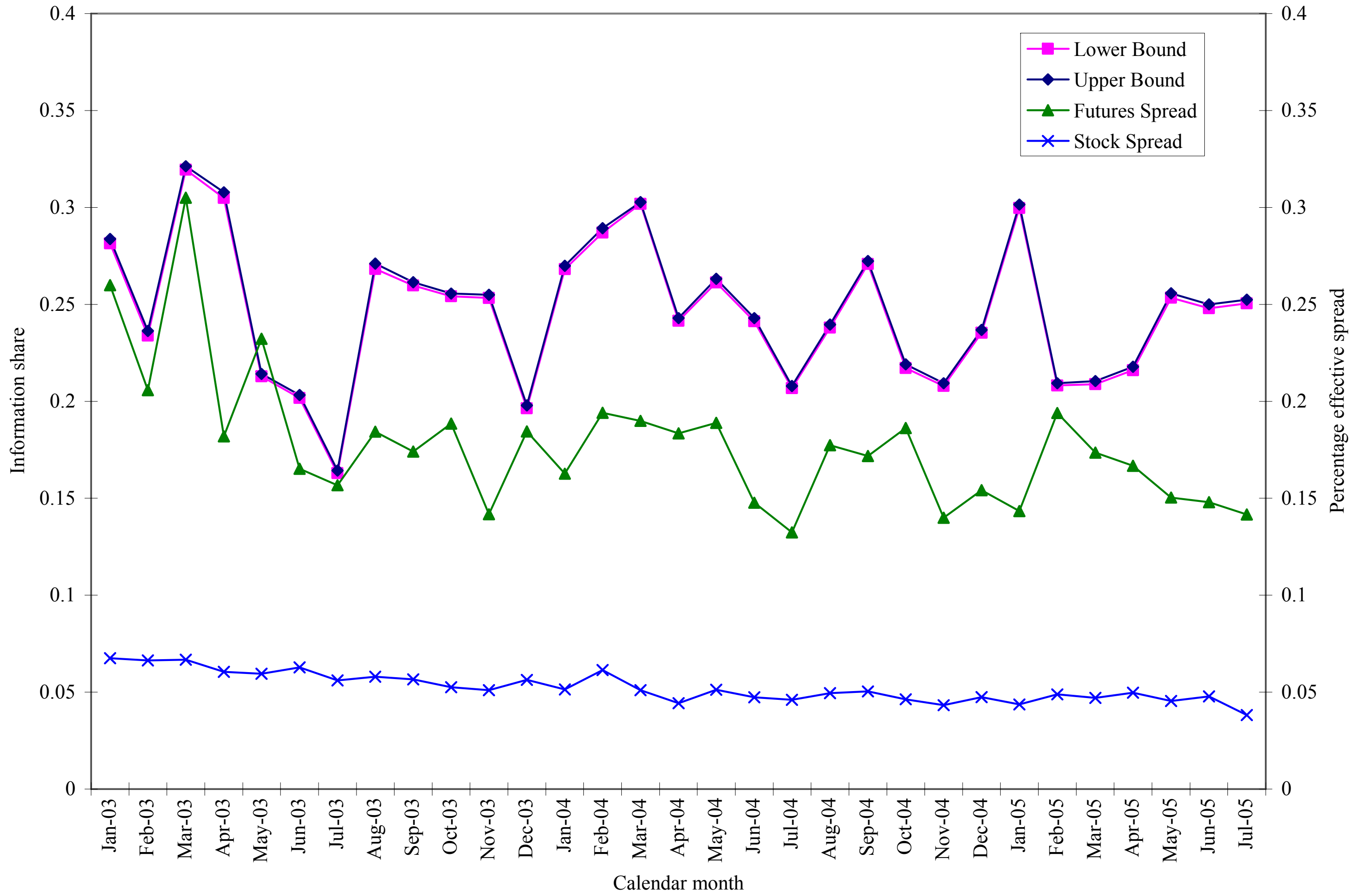

Figure 2
Time Series in Calendar time of the Information Share and Effective Spread for Single Stock Futures and the Effective Spread for the Underlying Stock

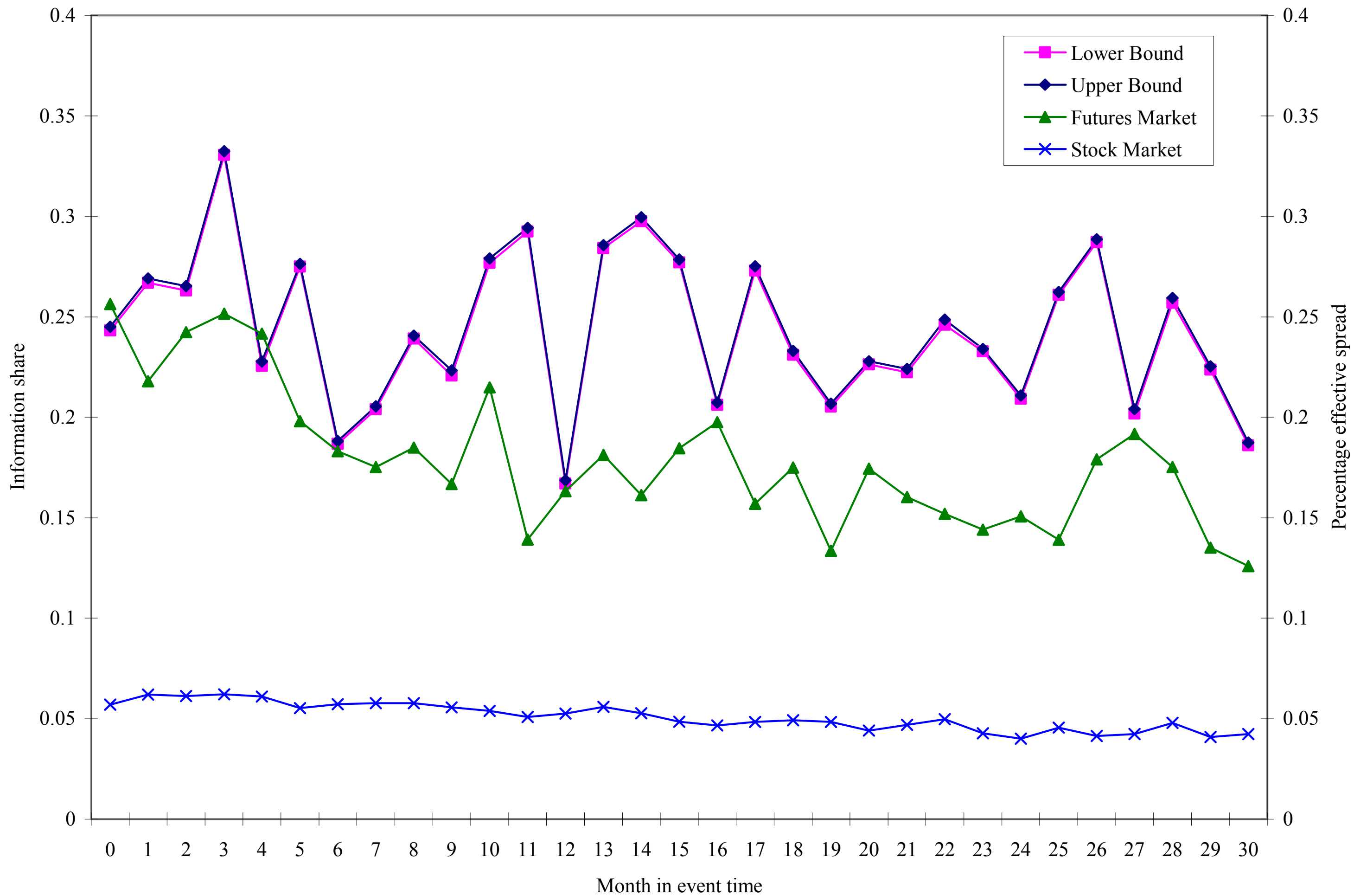

Figure 3
Time Series in Listing Event time of the Information Share and Effective Spread for Single Stock Futures and the Effective Spread for the Underlying Stock