Liquidity Skewness

by

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Bid-ask spreads have declined on average but have become increasingly right-skewed. Higher right-skewness is consistent with more competition among market makers; which inhibits their ability to cross-subsidize between periods of high and low asymmetric information, unlike a monopolistic market maker who can maintain a relatively constant spread. Confirming this intuition, differences in spreads between earnings announcements and normal periods have increased considerably. Skewness also is cross-sectionally related to information proxies such as institutional holdings and analyst following.

Introduction

Liquidity and trading activity are important features of financial markets. Their importance is magnified because trading costs affect required returns (Amihud and Mendelson, 1986, Amihud, 2002) and thus corporate costs of capital. In addition, understanding liquidity can improve exchange organization, regulation, and investment management. Given the recent financial crisis, a better comprehension of liquidity dynamics could help restore investor confidence in financial markets.

Despite its importance, we have yet to fully understand the behavior of trading costs over time. For example, while we know that bid-ask spreads have decreased dramatically in recent years (e.g., Jones, 2002, Chordia, Roll, and Subrahmanyam, 2008), we still do not know that much about fluctuations in spreads for a given firm has changed. Do they move about a central value more or less symmetrically? Or have they become more skewed in one direction or another? This issue has consequences for traders wishing to control trading costs. For example, agents who do not trade frequently could benefit from a better understanding of the distribution of trading costs. Would they be more likely to face relatively larger spread observations in the right tails? Or is it the case that spreads fluctuate within a narrow band about the smaller means? From an academic viewpoint, right- or left-skewed distributions, and shifts in these distributions, presumably would stimulate research that attempts to rationalize the observed pattern from an economic standpoint.

While there is no explicit model of the third moment of liquidity, Glosten (1989) and Glosten and Milgrom (1985) offer a few pointers on how one would expect liquidity skewness to change as the market maker faces more competition. The idea is that as the market maker faces an erosion of monopoly power, his ability to keep spreads low in periods of high asymmetric information (AI) declines. Basically, a monopolist is able to raise spreads in low AI periods to partially compensate for the increased losses to informed agents during high AI periods. Competition hinders this ability. Hence one may expect more large spreads (relative to the mean) during illiquid periods (possibly periods of high asymmetric information), and a clustering of observations in the left tail due to increased competition and a lowered tick size (Bessembinder, 2003) in recent years.

The previous argument relies on the optimizing behavior of the market maker. However, a related reason for shifts in the spread distribution is that other agents that act as competitors to the market maker, such as floor brokers, could step away from taking order flow during high AI periods, causing the market maker to be exposed during these periods. This could naturally cause unusually wide spreads during high AI periods. As mentioned above, since competition to the market maker has intensified over time, this phenomenon may also have become more apparent in the data.

Our analysis confirms these conjectures. We find that average annual skewness in bid-ask spreads has indisputably increased in recent years. The increase is apparent in NYSE/Amex as well as Nasdaq stocks, and for both small and large firms. The skewness increase is confirmed both for CRSP-based closing bid-ask quotes as well as TAQ data filtered for outliers. We also find that skewness is cross-sectionally related to information proxies such as return volatility and institutional holdings.

We examine a specific mechanism by which skewness may have increased in recent years. Our arguments suggest that as the market maker loses monopoly power, spreads in periods of high asymmetric information widen relative to those in normal periods. We show that the spread prior to earnings announcements has indisputably increased in recent years relative to the spread during other periods, supporting this reasoning.

To our knowledge, this is the first paper to consider skewness in trading costs; as such, it is largely descriptive in nature. We leave a detailed analysis of what types of events result in extreme illiquidity which, in turn, cause skewness, for future research. However, we believe the third moment captures important features of securities markets, particularly during episodes such as the recent liquidity crisis. Further analysis of macroeconomic conditions that influence liquidity skewness would be a worthwhile area of research.

I. An Example

We provide a stylized example of how spread skewness can increase as the minimum tick size is reduced and as the specialist loses monopoly power due to electronic networks ECNs) and off-floor trading (viz. Stoll, 2006). The example is inspired by the arguments of Glosten (1989) as well as the specialist's obligation to maintain a "fair and orderly market" (NYSE Rule 104.10).

Table 1 provides an example where there are eight periods (in chronological order). Five periods are "normal" and the other three are characterized by low, moderate, and high periods of asymmetric information (AI). The break-even (zero profit) spreads for each of these periods appear in the second column. The third column represents spreads that may prevail in a regime with a high (1/8) tick size and high monopoly power, and the last column represents the spreads that may exist in a regime with the opposite attributes. Since this is primarily an empirical investigation, we take the spreads as representing observed outcomes in the market and provide plausible economic justifications for these outcomes, as opposed to formally modeling the outcomes. However, the objective that yields the observed spread in the first regime is simply the notion that the specialist sets the lowest spread that ensures a non-negative cumulative profit across all periods to date. [The lowest spread restriction may be rationalized by the obligation to maintain a fair and orderly market.] In the second regime, competition requires that the spread be set to break even in each period.

In the first regime, the spread is 0.125 in the five normal periods, as well as in the period with low asymmetric information. In all of these periods the specialist charges more than the breakeven spread. The spread jumps to 0.25 in the period with moderate asymmetric information as that is the breakeven spread in this period. However, due to the ability to charge spreads greater than the breakeven level of the spread during normal periods, the specialist is able to quote a spread of 0.25 even in the high AI period. This allows him to meet an affirmative obligation to provide a fair and orderly market and earn positive profits across the eight periods.

The spread in the second regime behaves differently. The quoted spread is one penny for the five normal periods, and is at the breakeven level in the low and moderate AI periods. However, in the high AI period, the specialist sets the spread at the breakeven level of 0.70, since the cross-subsidy from spreads in normal periods is no longer available (this argument also appears in Glosten, 1989). As can be seen, regime 1 has a high mean and low skewness whereas regime 2 has the opposite attributes.

The basic hypothesis we test in the following sections begins with the observation that the market environment has more closely come to resemble regime 2, as opposed to 1. This implies that spreads (whose means are already known to have decreased) should also exhibit increased skewness in recent years.

II. Data and Summary Statistics

The data mainly come from CRSP end-of-day closing bid-ask quotes that are available from 1993 onwards. We use these data instead of ISSM or TAQ data because they are less prone to errors. However, we add a robustness check using filtered TAQ data. The data include NYSE/Amex and Nasdaq stocks, and the samples are sometimes stratified by market capitalization.

The bid-ask proportional spread is the difference between the ask and bid quotes divided by the mid-point of the quotes. All quotes with negative ask-bid spreads are dropped because they are probably data errors. No other filters are imposed on the CRSP data. While we principally use the proportional quoted spread, similar results are obtained with the raw spread.

A. Summary Statistics for the Full Sample

Table 2 presents annual equal-weighted averages of mean, standard deviation, and skewness of individual firm spreads within the year. The sample size starts at 8,126 firms, peaks at 9,927 in 1997 during the tech stock boom, and declines to 7,611 by 2007.

The average annual spread declined from over 3 percent to 0.35 percent over the sample period. This decline is fairly gradual, and not obviously related to specific events such as the changes in tick size in 1997 and 2001. The general decline in spreads has been documented earlier by Jones (2002) and Chordia, Roll, and Subrahmanyam (2008). On average, the standard deviation within a year of individual firm spreads has declined also (to roughly a third of its beginning value.) In contrast, skewness has increased substantially, from 0.53 to 3.54, which is almost a seven-fold increase. A simple difference in means test confirms that the growth from 1993 to 2007 is significant with a p-value of less than 1%.

Figure 1 plots the spread skewness and clearly shows how this quantity has increased on average over the past years. In Figure 2, we plot the frequency distribution of the spread for a sample stock, namely IBM, for the first and last years of the sample. The figure demonstrates how the mean spread has decreased simultaneously with increased skewness.

The remainder of this section stratifies this skewness-shift phenomenon by exchange and firm size. For convenience, from this point on, the term “skewness” should be understood as skewness in proportional quoted bid-ask spreads unless otherwise stated.

B. Liquidity Skewness by Exchange and Firm Size

It is conceivable that skewness may differ across exchanges, given differences in market making protocols. For example, an exchange like the NYSE confers monopoly power on specialists, which may give them flexibility to cross-subsidize spreads in conditions of low liquidity with higher spreads during conditions of high liquidity (Glosten, 1989).

To shed light on this issue, Panels A and B of Table 3 present the results separately for NYSE/Amex and Nasdaq stocks. The mean NYSE/AMEX spread declines from 1.57 cents to 0.24 percent, but the skewness of spreads increases quite dramatically from less than .03 to 3.6. Similarly the mean spread for Nasdaq decreased from 4.2 cents to 0.46 percent, but again, the skewness increased from 0.4 to 2.7. The increase in skewness is statistically significant on both exchanges with a p-value of less than 1%. Hence, the difference in exchange protocol does not appear to have much bearing on the skewness pattern. One must note that Nasdaq dealers often have some oligopolistic power to manage spreads (Christie and Schultz, 1994), which may bring their behavior closer to that of the NYSE specialist.

Lastly, we examine how liquidity skewness has changed across size quartiles. This is to check whether the results are driven by only a few small-cap companies experiencing extremely illiquid conditions on certain days. Stocks are assigned to four groups based on market capitalization as of the end of the previous year and cross-sectional average statistics are then computed for each group. The results appear in Table 4, which reveals that skewness has increased for every size quartile by a factor of about six or more, and all increases are statistically significant. Thus, the increase in skewness is not a phenomenon confined to small (or to large) stocks.

C. Liquidity Skewness Using TAQ Data

Up to this point, we mainly have used CRSP closing bid-ask quotes. We prefer these to standard TAQ data, because the latter have transcription errors that may be small as a percentage of the total number of data points but could still have a significant impact on the third moment. Nonetheless, as a quick robustness check, Table 5 presents the skewness of quoted and effective spreads extracted from TAQ/ISSM data from 1984 to 2005. Since these spreads are prone to data entry errors, additional error-detection filters are applied; (as detailed in Chordia, Roll, and Subrahmanyam, 2001).

The spreads are first averaged daily within each stock, and summary statistics are calculated as in Tables 2 to 4. Since the data extraction is intense, and we are only using the ISSM/TAQ data for a robustness check, the calculations are confined to NYSE/Amex stocks only. Results appear in Table 4 and indicate that the skewness of both quoted and effective spreads has increased significantly. There is more year-to-year variability in these numbers but the mean skewness for quoted spreads in the last five years of the sample is 1.8 and has almost doubled in comparison to the corresponding value of 0.99 in the first five years. The skewness in effective spreads has more than doubled from a mean of 0.55 in the first five years to a mean of 1.23 in the last five years. The increases in skewness for both quoted and effective spreads are statistically significant.

Figure 3 contains the plots of skewness obtained from these TAQ spreads. There are significant deviations from the general trend, especially in the earlier years, presumably due to lower data quality than in the later years. However, the overall trend is positive and is especially evident in the later years. Overall, the TAQ results confirm the increase in skewness for both quoted and effective spreads.

In the remainder of the paper we revert to the CRSP data on closing bid and ask quotes since these data are more likely to be free of errors than the intradaily TAQ data, which consist of billions of observations during the sample period.

III. Why Has Skewness Increased? Some Suggestive Evidence

The previous section indicates that the cross-sectional average of the annual skewness has increased over time. This implies that each successive annual time-series of spreads tends to have more extreme observations in the right tail. Why has this happened?

We conjecture that during periods of high asymmetric information, spreads may be higher relative to the mean in later years. This is consistent with the arguments of Glosten (1989), which suggest that as the market maker loses monopoly power and a minimum guaranteed profit per transaction by way of a large tick size, he also will lose the ability to cross-subsidize spreads in periods of high asymmetric information by charging higher spreads in periods of low asymmetric information. The loss of the ability to cross-subsidize should result in larger right-tail observations.

We propose that periods prior to earnings announcements are likely to be periods of high asymmetric information. Of course there are undoubtedly many other periods of high asymmetric information, but earnings announcement dates are in the public record and they assure numerous information events for most companies. Other public information events, such as merger announcements, could also be considered but are less numerous; we leave this for future research.

For each stock every year, an average spread is calculated over the five trading days ending on all earnings announcement dates. This average earnings announcement spread is then compared to the average spread on all other days during that year. The percentage difference of these two spreads is computed for each firm. Henceforth, we term this measure AI. We calculate the equally-weighted mean of AI along with its median and standard deviation are calculated across firms each year and reported in Table 6.

As can be seen, there is little doubt that pre-announcement spreads have increased relatively to spreads on other days during each year. The increase in the mean percentage difference, from 0.446 in 1993 to more than 10.5 in 2007, is significant at any conventional level. Note the exception to the general pattern in 2001, where spreads during earnings announcements are on average smaller than in normal periods. This oddity notwithstanding, it is reasonable to conclude that even though spreads in general have declined over this period, investors now pay relatively more to transact in periods of high asymmetric information, (as proxied by periods around earnings announcements.)

The results in Table 6 lend support to the notion that the spread skewness increase is due to a loss of market maker monopoly power, which results in relatively larger spreads during periods of high asymmetric information. It would be interesting to ascertain if this phenomenon is also present near other information events such merger announcements, and other significant corporate events such as the launch of a new product line, or a change in management.

As a check to ascertain the relation between skewness shifts and AI, we calculate the average skewness and average AI for each firm in the 1993 to 2000 period, and the same quantities for each firm in the 2001 to 2007 period. We then calculate the change in skewness and AI for each firm that was present in both samples. The cross-sectional correlation between the change in skewness and change in AI is 0.072, with a p-value of 2%.

We perform one more exercise to ascertain the causes of the skewness increase. Previous research (e.g., Chordia, Roll, and Subrahmanyam, 2001) indicates that liquidity is particularly low in down markets. This may happen because down markets affect market maker collateral requirements (Brunnermeier and Pedersen, 2009, Hameed, Kang, and Viswanathan, 2007). It may be that shifts in spread behavior within extreme down markets may have affected skewness. To address this, we perform the following exercise. For each stock in each year, we calculate the fifth percentile of the return. We then calculate the average proportional spread for all days in which the return is less than or equal to the fifth percentile. We then calculate the percentage difference between the spread on these days and the average spread on all other days. Let us term this quantity ER. While our initial prediction was that the aggregate ER would also generally be monotonically increasing through the sample period (as is AI), this is not the case. ER ranges from 19% in 1993 to 34% in 2001, and is at its low at about 11% in 2006.

This behavior of ER notwithstanding, it is still possible that in the cross-section, stocks with changes in ER may also have experienced corresponding changes in skewness. Thus, just as for AI above, we calculate the correlation as above between changes in ER and changes in skewness in the two subperiods (1993-2000 and 2001-2007). This cross-sectional correlation is 0.119 and is also significant. A cross-sectional regression of skewness shifts on AI shifts and ER shifts yields coefficients that are both significant with t-values of 2.42 and 4.00, respectively.

These two exercises indicate that that spread skewness shifts are at least partially due to shifts in how spreads behave around informational events and in extreme down markets. However, the correlations documented here are modest, which implies that more needs to be done to uncover the causes of increases in skewness.

IV. Cross-Sectional Determinants of Skewness

Proximate determinants of skewness across firms include such candidates as size, return volatility, analyst following, and institutional holdings. Brief arguments in their favor are given below.

There is some reason to believe that larger firms should have less asymmetric information. Conversely, larger return volatility could be associated with greater asymmetric information. When more analysts follow a firm, there is, presumably, less potential to uncover private information (Easley, O'Hara, and Paperman, 1998). This suggests that more analysts should be associated with less informed trading. On the other hand, agents with ill-founded but strong beliefs might be more tempted to trade in stocks that are more widely followed. In addition, if analysts disseminate valuable private information to favored institutional clients (Green, 2006) such clients may be tempted to exploit this information.

Analyst following is proxied by the number of IBES analysts making one-year earnings forecasts as of December of the previous year, while return volatility is the daily return standard deviation in the previous year.

Larger holdings by institutional investors could increase asymmetric information. Institutions often employ their own buy-side analysts, thereby increasing the potential for uncovering information. The role of institutions as information producers is discussed in Sarin, Shastri, and Shastri (1999) and Saar (2001). Thus, we include institutional holdings as an explanatory variable. We also include the Herfindahl index of institutional holdings to measure institutional concentration. The institutional holdings data, representing the percentage of outstanding shares held by institutions as of December of each year, are obtained from Thomson Financial for the years 1993 to 2007.

In addition to the previous variables, we include the AI and ER measures from the previous section, and an adaptation of asynchronicity measure of Hou and Moskowitz (2005), which we defined is one minus R^2 of the regression of individual stock returns on the value-weighted CRSP return index and the equal-weighted portfolio of stocks with the same 3-digit SIC code as the stock in question. We required each stock to have at least 30 observations per stock per year for computation of this measure. To control for any possible industry effects, we also include 47 industry dummies using the Fama/French (1997) industry categorizations, but the coefficients of these variables are not reported for brevity.

Finally, the mean spread during the previous year is also included as an explanatory variable, since the level of asymmetric information could be related to the spread itself. All explanatory variables are lagged one period to address endogeneity concerns, as well as the "lookahead" concern arising from the fact that some of the variables are measured at the end of the year, whereas skewness is measured throughout the year.

Table 7 provides summary statistics for these variables, and we run annual regressions whose results are reported in Panel A of Table 8. While many variables are not consistently significant, it is worth noting that holdings are positively related to skewness in recent years, whereas the opposite is true of analyst following and firm size. This is consistent with the notion that firms with greater information asymmetry have more extreme episodic events and spread skewness is greater for such firms. Also, AI and ER are not consistently significant, suggesting that the while the time-series shift in these variables may be relevant for explaining time-series changes in skewness, there is no reliable cross-sectional relation between the variables and skewness.

In Panel B of Table 8, we present a regression that uses averages of all variables for each stock. Interestingly, the measure of Hou and Moskowitz (2005) is negatively related to skewness for the full sample, which is a puzzling result deserving future study. Note that the table confirms the relation of skewness with holdings and analyst following pointed out in the discussion of Panel A.

The mean spread itself is negatively related to skewness. This goes against the usual presumption that more right-skewed distributions have large means (relative to medians). However, since the distribution here is cross-sectional, the usual intuition does not seem to apply. Apparently, after adjusting for the other control variables, firms with lower trading costs on average, which implies lower profits for market makers, experience much larger deviations of trading costs from the average when asymmetric information arrives.

VI. Conclusion

Bid-ask spreads have become increasingly right-skewed in recent years. This could indicate that as specialists and dealers face more competition, they are less able to equalize spreads across periods of high and low asymmetric information. Illiquidity skewness is cross-sectionally related to information proxies such as institutional holdings and analyst following, which are associated with the proportion of traders with privileged information.

Further research is required to pin down the causes of liquidity skewness. While we find that spreads during periods of high asymmetric information are larger relative to their mean in recent years, it remains to be known whether this is associated with high funding constraints for market maker inventories (Brunnermeier and Pedersen, 2009). Market makers constrained by competition may not be able to provide adequate liquidity during periods with high financing costs since they cannot recoup their losses in those periods by charging higher spreads during normal periods. This issue is worth exploring. It also is worth investigating whether co-skewness of individual stock spreads with aggregate spread is material for the cross-section of stock returns.

In closing, we are not asserting anything about investor welfare. While skewness in bid-ask spreads has increased, the mean spread has declined considerably, suggesting that on average, investors face better terms of trade. So the sign of the shift in overall welfare remains an open question and perhaps theoretical work would shed further light on the subject.

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Table 1: An Example of Changes in Spread Skewness Across Market Environments

Hypothetical spreads are presented across five normal periods and three periods corresponding to low, medium, and high asymmetric information. Regime 1 is characterized by a large minimum tick size and low competition, and Regime 2 has the opposite attributes.

Breakeven spread	Spread in Regime 1	Spread in Regime 2
0.01	0.125	0.01
0.01	0.125	0.01
0.01	0.125	0.01
0.01	0.125	0.01
0.01	0.125	0.01
0.05	0.125	0.05
0.25	0.250	0.25
0.80	0.250	0.80
Mean	0.156	0.144
Skewness	1.440	2.408

Table 2

Annual Quoted Proportional Spread Statistics, All stocks

Summary statistics for bid-ask proportional spreads[1] are calculated for all stocks listed on the CRSP database. The statistics are first calculated for each stock during each year. Then annual equally-weighted averages of the resulting individual firm statistics are computed and presented in the table.

Year	Mean	Std. Dev	Skewness	No. of firms
1993	0.0311	0.0110	0.5258	8126
1994	0.0294	0.0105	0.5483	8697
1995	0.0284	0.0105	0.4349	9089
1996	0.0254	0.0097	0.5629	9686
1997	0.0240	0.0105	0.6451	9927
1998	0.0234	0.0119	1.1925	9785
1999	0.0220	0.0107	1.1235	9453
2000	0.0200	0.0111	1.4082	9160
2001	0.0182	0.0130	2.1901	8441
2002	0.0140	0.0099	1.5388	7741
2003	0.0090	0.0066	1.6772	7304
2004	0.0047	0.0034	2.1914	7185
2005	0.0042	0.0030	2.4163	7246
2006	0.0033	0.0023	2.6364	7321
2007	0.0035	0.0031	3.5393	7611
2007-1993 (p-value)	-0.0276 (<0.001)	-0.0079 (<0.001)	3.0135 (<0.001)	

[1] (Ask-Bid)/[(Ask+Bid)/2]

Table 3

Summary statistics for proportional spreads, by exchange.

Summary statistics for bid-ask proportional spreads[2] are calculated for all stocks listed on the CRSP database. The statistics are first calculated for each stock during each year. Then annual equally-weighted averages of the resulting individual firm statistics are computed and presented in the table.

Panel A: Annual Proportional Spread Statistics, NYSE/AMEX

Year	Mean	Std. Dev	Skewness	No. of firms
1993	0.0145	0.0056	0.7001	3272
1994	0.0141	0.0054	0.7861	3460
1995	0.0170	0.0061	0.3729	3551
1996	0.0167	0.0064	0.6967	3733
1997	0.0184	0.0073	0.6877	3884
1998	0.0228	0.0086	1.0563	3951
1999	0.0265	0.0101	0.8534	3876
2000	0.0239	0.0102	1.0839	3821
2001	0.0161	0.0113	1.5697	3643
2002	0.0109	0.0078	1.5616	3577
2003	0.0067	0.0052	1.8816	3547
2004	0.0034	0.0023	2.8805	3643
2005	0.0030	0.0024	3.3249	3764
2006	0.0024	0.0018	3.6095	3892
2007	0.0025	0.0022	4.2296	4111
2007-1993 (p-value)	-0.0120 (<0.001)	-0.0031 (<0.001)	3.5295 (<0.001)	

[2] (Ask-Bid)/[(Ask+Bid)/2]

Table 3, continued

Panel B: Annual Proportional Spread Statistics, Nasdaq

Year	Mean	Std. Dev	Skewness	No. of firms
1993	0.0420	0.0144	0.4031	4936
1994	0.0393	0.0137	0.3872	5314
1995	0.0354	0.0131	0.4663	5638
1996	0.0304	0.0116	0.4724	6092
1997	0.0273	0.0124	0.6080	6175
1998	0.0238	0.0140	1.2677	5938
1999	0.0190	0.0110	1.3018	5662
2000	0.0172	0.0118	1.6268	5408
2001	0.0196	0.0142	2.6482	4841
2002	0.0165	0.0117	1.5117	4214
2003	0.0112	0.0078	1.4805	3789
2004	0.0061	0.0044	1.4761	3567
2005	0.0054	0.0037	1.4308	3508
2006	0.0041	0.0029	1.5168	3462
2007	0.0046	0.0040	2.6746	3455
2007-1993 (p-value)	-0.0374 (<0.001)	-0.0104 (<0.001)	2.2715 (<0.001)	

Table 4

Skewness in proportional spread, by market capitalization.

Skewness in bid-ask proportional spreads[3] is calculated for all stocks listed on the CRSP database after assigning each stock to a size quartile based on market capitalization at the end of the previous year. Skewness is first calculated for each stock during each year. Then annual equally-weighted averages of the resulting individual firm skewnesses are computed and presented in the table.

	Size quartile			
Year	Smallest	2	3	Largest
1993	0.5302	0.4507	0.5485	0.6544
1994	0.4834	0.4835	0.5816	0.7022
1995	0.5359	0.4030	0.2928	0.5275
1996	0.5605	0.4673	0.4898	0.8627
1997	0.6229	0.4289	0.4664	1.0682
1998	1.1150	1.1274	1.1416	1.4439
1999	1.0417	0.9980	1.0117	1.4432
2000	1.1622	1.1443	1.3534	1.9637
2001	1.8410	2.0817	2.2641	2.7036
2002	1.4633	1.6785	1.7967	1.2459
2003	1.4535	1.7854	1.9885	1.5500
2004	1.4499	1.6855	2.4564	3.3812
2005	1.5750	2.0895	2.6689	3.4982
2006	1.6910	2.2601	3.0788	3.7683
2007	3.0503	3.3425	3.7158	4.2618
2007-1993 (p-value)	2.5201 (<0.001)	2.8918 (<0.001)	3.1673 (<0.001)	3.6074 (<0.001)

[3] (Ask-Bid)/[(Ask+Bid)/2]

Table 5
Skewness from TAQ data

Spread skewness is calculated for all stocks in the ISSM/TAQ database. First, average daily proportional quoted and effective spreads are calculated for each firm using all quotes matched to a transaction in the database, after being filtered for errors. Next, spread skewness is calculated for the average daily spreads of each stock during each year. Then annual equally-weighted averages of the resulting individual firm skewnesses are computed and presented in the table.

Year	Proportional quoted spread	Proportional Effective spread
1984	0.489	1.091
1985	0.531	0.737
1986	0.503	1.201
1987	0.731	1.082
1988	0.496	0.812
1989	0.478	0.508
1990	0.406	0.851
1991	0.496	1.376
1992	0.496	0.882
1993	0.604	1.120
1994	0.636	1.201
1995	0.788	0.831
1996	0.817	0.651
1997	0.505	1.574
1998	0.710	1.917
1999	0.712	1.751
2000	0.691	1.555
2001	1.176	1.720
2002	1.177	1.673
2003	1.150	1.717
2004	1.294	2.125
2005	1.369	1.770
2005-1984 (p-value)	0.880 (<0.001)	0.679 (<0.001)

Table 6
Percentage differences between spreads just before earnings announcements and spreads on other days of the year.

For each stock every year, an average spread is calculated over the five trading days ending on all earnings announcement dates. This average earnings announcement spread is then compared to the average spread on all other days during that year. The percentage difference of these two spreads is computed for each firm. Finally, the equally-weighted mean of the percentage difference along with its median and standard deviation are calculated across firms each year.

Year	Mean	Median
1993	0.446	-0.532
1994	1.039	0.560
1995	2.197	1.206
1996	1.970	1.380
1997	1.901	1.222
1998	2.111	0.733
1999	2.564	0.787
2000	6.589	3.917
2001	-2.190	-3.459
2002	1.132	-1.842
2003	1.346	-1.482
2004	6.345	1.264
2005	9.663	3.982
2006	9.303	4.018
2007	10.499	2.696
2007-1993 (p-value)	10.053 (<0.001)	3.228 (<0.001)

Table 7: Summary Statistics for Cross-Sectional Determinants of Skewness

Possible determinants of liquidity skewness include institutional holdings, return volatility, analyst following, size, and information asymmetry proxies. This table provides summary statistics for these variables. For each calendar year, 1992-2006, HOLDINGS is the percentage of outstanding shares held by institutions in December, as reported by Thomson Financial. ANALYSTS is the number of IBES analysts making one-year earnings forecasts in December of the year. VOL is the daily return standard deviation during the previous year. SIZE is market capitalization at year end. HERF is the Herfindahl index of institutional concentration at year end. AI is the percentage difference in spreads around earnings announcements and other days. ASYNCH is the Hou and Moskowitz (2005) measure of information asymmetry during the year. ER is the percentage difference between spreads on extremely low return days and other days. A number with subscript k indicates that the number should be multiplied by 10^k, e.g., 1.30_{-2} is .0130.

	Mean	Std. Dev.
HOLDINGS	25.2	24.7
ANALYSTS	4.17	5.73
VOL	1.30_{-2}	1.20_{-2}
SIZE	1.90_{6}	9.09_{6}
HERF	1.20_{-2}	2.47_{-2}
AI	0.446	7.810
ASYNCH	0.416	0.337
ER	0.360	0.480

Table 8: Regressions for Cross-Sectional Determinants of Skewness

Individual firm spread skewness during a given year is related to institutional holdings, return volatility, analyst following, size, and information asymmetry proxies during or at the end of the previous year. HOLDINGS is the percentage of outstanding shares held by institutions in December, as reported by Thomson Financial. ANALYSTS is the number of IBES analysts making one-year earnings forecasts in December. VOL is the daily return standard deviation during the year. SIZE is market capitalization at year end. HERF is the Hefindahl index of institutional concentration at year end. AI is the percentage difference in spreads around earnings announcements and other days. ASYNCH is the Hou and Moskowitz (2005) measure of information asymmetry during the year. ER is the percentage difference between spreads on extremely low return days and other days. SPREAD is the proportional spread averaged over the year. Panel A presents annual coefficients, whereas Panel B presents regressions that use the averages of each variable for each firm in the sample. A number with subscript k indicates that the number should be multiplied by 10^k, e.g., 1.30_{-2} is .0130.

Panel A: Year-by-Year Cross-Sectional Regressions

Year	Firms	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
		HOLDINGS		ANALYSTS		VOL		SIZE		HERF		AI		ASYNCH		ER		SPREAD		Intercept	
1994	1616	1.28_{-4}	2.67	-2.96_{-3}	-0.57	0.738	0.32	-4.18_{-9}	-0.60	-0.462	-0.48	-2.76_{-3}	-1.19	0.173	0.92	-0.26	-1.23	-5.30_{-2}	-6.40	0.703	17.95
1995	1740	2.63_{-3}	2.02	1.15_{-2}	2.78	2.28	0.89	2.56_{-9}	0.44	8.99_{-2}	0.16	2.11_{-3}	1.08	-0.314	-1.57	0.144	0.84	-4.99_{-4}	-0.05	0.454	7.82
1996	1022	4.19_{-3}	1.35	5.19_{-3}	0.69	-8.55	-1.36	8.89_{-9}	1.40	0.618	0.49	1.50_{-3}	0.46	-0.162	-0.42	-4.51_{-2}	-0.14	-3.65_{-2}	-1.41	0.803	5.66
1997	1054	4.99_{-3}	0.83	1.53_{-2}	2.01	6.21	0.81	1.76_{-8}	3.60	1.29	1.14	-3.65_{-4}	-0.09	-0.419	-1.16	-0.364	-1.26	-0.2	-5.11	1.26	9.19
1998	1047	6.34_{-3}	1.70	1.18_{-2}	1.42	-4.35	-0.66	-2.96_{-9}	-0.76	-1.17	-1.05	1.36_{-3}	0.33	-0.509	-1.47	0.78	2.72	-0.121	-3.11	1.47	10.17
1999	983	-1.71_{-3}	-0.69	4.18_{-2}	4.24	6.54	1.21	1.03_{-8}	3.11	0.77	0.54	5.30_{-3}	1.27	-0.638	-1.71	-5.30_{-2}	-0.20	-8.99_{-2}	-2.75	1.47	9.23
2000	883	4.30_{-3}	0.75	2.57_{-2}	2.73	9.93	1.64	-1.21_{-9}	-0.48	-1.63	-1.01	1.77_{-3}	0.45	-1.18	-3.17	0.254	0.80	-0.209	-6.03	2.03	11.73
2001	831	3.91_{-3}	1.48	-9.11_{-3}	-0.85	-7.24	-1.09	-2.72_{-10}	-0.10	-0.748	-0.63	3.66_{-3}	1.04	0.618	1.50	0.936	3.42	-5.02_{-2}	-1.60	1.66	7.88
2002	822	-4.72_{-3}	-1.91	-2.72_{-2}	-3.72	-3.29	-0.75	8.36_{-10}	0.45	0.435	0.23	-1.70_{-3}	-1.16	0.333	1.38	8.95_{-2}	0.83	0.181	3.54	1.09	7.89
2003	838	-3.76_{-3}	-1.75	-3.31_{-2}	-4.73	4.79	1.51	1.27_{-10}	0.06	0.665	0.66	-3.01_{-4}	-0.21	0.526	2.43	0.353	2.84	0.113	2.55	1.59	14.24
2004	824	1.79_{-2}	5.35	-3.64_{-2}	-2.54	-7.18	-0.76	-1.68_{-8}	-4.49	-2.20	-0.98	2.83_{-3}	1.23	-0.613	-1.29	0.227	1.19	-0.728	-4.85	3.73	13.38
2005	871	8.37_{-3}	3.82	-7.02_{-2}	-6.90	-12.1	-1.20	-1.13_{-8}	-3.94	0.238	0.13	2.28_{-3}	1.17	0.409	1.04	-0.151	-1.24	-1.71	-9.60	4.6	25.94
2006	1502	2.08_{-2}	2.53	-4.88_{-2}	-3.75	-35.4	-3.05	-1.53_{-8}	-4.22	-0.201	-0.09	1.39_{-3}	0.73	0.454	1.02	0.272	1.80	-0.361	-2.87	1.99	20.65
2007	1798	9.47_{-3}	0.04	-2.17_{-2}	-1.63	-27.1	-3.59	2.46_{-10}	0.07	1.03	0.49	1.12_{-3}	0.50	-0.388	-0.97	0.250	1.53	-0.590	-3.83	3.38	29.76

Table 8, contd.

Panel B: Regressions using averages over all years. The dependent variable, liquidity skewness, is averaged for each firm over all available years, 1994-2007, while the explanatory variables are averages with a one-year lag over all available years, 1993-2006.

	Coefficient	T-Statistic
HOLDINGS	2.08_{-2}	11.4
ANALYSTS	-4.26_{-2}	-6.61
VOL	13.8	3.57
SIZE	8.46_{-9}	2.84
HERF	-2.44	-2.16
AI	-3.84_{-3}	-1.28
ASYNCH	-1.75	-9.85
ER	-0.386	-0.45
SPREAD	-0.254	-22.6
Intercept	2.759	3.25

Figure 1

Annual Quoted Proportional Spread Skewness

Skewness for bid-ask proportional spreads is calculated for all stocks listed on the CRSP database. The skewness is first calculated for each stock during each year. Then annual equally-weighted averages of the resulting values for individual firm skewness are computed and plotted in the figure.

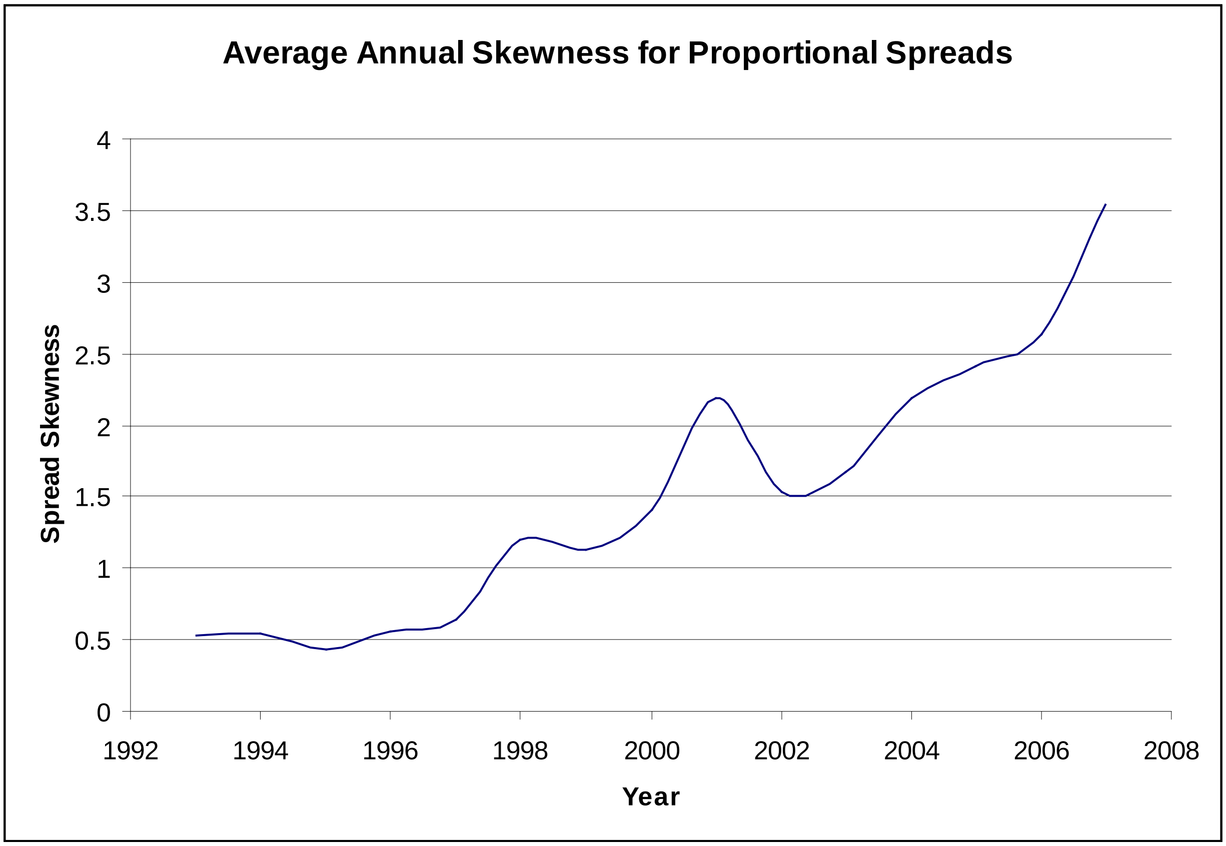
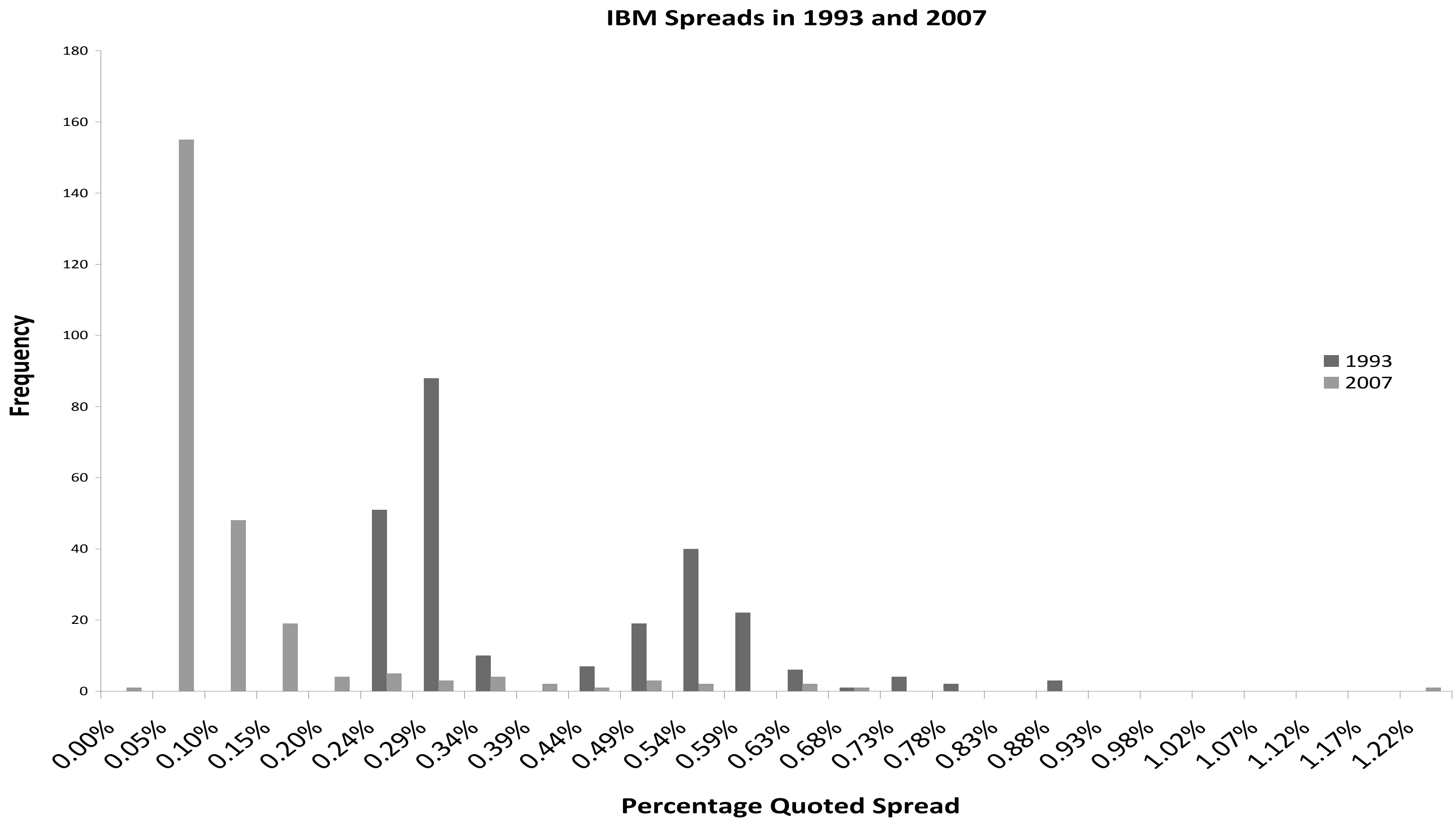


Figure 2
IBM Spreads, First and Last years of the Sample



This figure provides the frequency distributions of the daily proportional quoted spreads for IBM, in 1993 and 2007.

Figure 3

Annual Quoted and Effective Proportional Spread Skewness, TAQ Data

Spread skewness is calculated for all stocks listed on the CRSP database. First, average daily quoted and effective spreads are calculated using all quotes matched to a transaction in the TAQ database, filtered for errors. Next, spread skewness is calculated for each stock in each year. Then, annual equally-weighted averages of these statistics are computed and plotted by year.