Dispersion of Opinions, Limits to Arbitrage, and Overnight Returns

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Abstract

Using nine years of intraday data for the largest 3,000 U.S. stocks, we find a strong tendency for positive returns during the overnight period followed by reversals during the subsequent trading day. This behavior is driven by an opening price that is high relative to intraday prices. Consistent with the theory of Miller (1977) and other disagreement models, we find this behavior is limited to stocks with high dispersion of opinions measured near the daily open, as well as over the entire trading day. Furthermore, the magnitude of these overnight returns and trading day reversals is progressively greater among finer subsamples of stocks subject to greater limits to arbitrage, embodied in more binding short sale constraints and high transaction costs.

JEL Classification: D82, G14, G19.
Key Words: market efficiency, limits to arbitrage, short sale restrictions, institutional ownership, transaction costs, dispersion of opinions, disagreement, opening price, overnight return.

1. Introduction

Recent theoretical work attempts to explain the joint empirical behavior of stock prices, trading volume, and return volatility. Hong and Stein (2007) argue that the class of disagreement models – in which dispersion of beliefs plays a major role – holds the greatest promise for success in this area. A central prediction of these models is that high disagreement results in high trading volume and stock return volatility and, when combined with binding short sale constraints, this behavior leads to overpricing and low future returns.[1]

Most empirical work in this area focuses on either the presence of disagreement or of short sale constraints, and examines whether overpriced stocks (i.e., stocks subject to high disagreement and/or binding short sale constraints) have low future returns over long periods. For example, Jones and Lamont (2002), and Chen et al. (2002) find that stocks with severe short sale constraints have temporarily high prices but underperform over the following quarters. Diether et al. (2002) focus on disagreement, showing that stocks with high dispersion across analysts' earnings forecasts have low returns over the following months. Similarly, Ang et al. (2006) find that stocks with high volatility have low future returns, while Brennan et al. (1998) show that stocks with high trading volume have low future returns over the following months.

Combining both perspectives, Boehme et al. (2006) find that stocks with binding short sale constraints and high dispersion of opinions underperform over the following months. Similarly, Nagel (2005) shows that stocks with both low institutional ownership (his proxy for binding short sale constraints) and high values of three proxies for disagreement (share turnover, volatility, and analyst forecast dispersion) have significant price declines over the following year.

1 See Chen et al. (2002), Harrison and Kreps (1978), Hong et al. (2006), Miller (1977), Morris (1996), and Scheinkman and Xiong (2003). In contrast, Diamond and Verrecchia (1987) and Hong and Stein (2003) hold that rational traders take into account short sale constraints so that, on average, prices are not biased.

Some recent work documents evidence of overpricing that is corrected over a shorter time frame around earnings announcements, which are important events that reduce differences of opinion. Berkman et al. (2009) find that price corrections for stocks with high disagreement and low institutional ownership are concentrated in the days around earnings announcements. LaPorta et al. (1997) find similar evidence around earnings announcements of glamour stocks.

In this study we analyze whether the economic forces behind disagreement models operate over yet a shorter time frame in a manner that leads to high daily opening prices, positive overnight returns, and trading day reversals. During the overnight hours, evolving information does not flow as freely into prices as it does during trading hours. There is a decline in liquidity and an accumulation of new information during the overnight period that might result in relatively high disagreement at the start of the trading day.[2] For stocks characterized by high disagreement at the start of the trading day, combined with binding short sale constraints, disagreement models predict that prices will be high at the open relative to the close and the rest of the day, as optimistic investors buy at the open while pessimists are kept out of the market. Such a high opening price would result in a tendency for positive overnight returns followed by negative trading day reversals, especially for stocks that are already prone to overpricing.

This paper examines how these factors associated with disagreement models affect prices at the open relative to the close and the rest of the trading day. We analyze abnormal (market-adjusted) overnight and trading day returns, based on quote midpoints at the open and close, for the 3,000 largest U.S. stocks over the period, 1996-2004.[3] In our descriptive analysis of all

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2 Consistent with this view, Amihud and Mendelson (1987), Cliff et al. (2008), and Stoll and Whaley (1990) find that open-to-open returns are more volatile than close-to-close returns. Stoll and Whaley conclude that the greater volatility in open-to-open returns is “attributable to private information revealed in trading and to temporary price deviations induced by specialist and other traders. The implied cost of immediacy at the open is significantly higher than at the close.”

3 Reliance on midquotes ensures that our results are not due to bid-ask bounce. In Table 7 we show that these results are robust when we use trade prices at the open and close to measure overnight and trading day returns.

stocks, we find significant positive average overnight returns and negative trading day reversals. We also explore whether these tendencies are due to a high opening price, or a low closing price, or both. Consistent with the implications of disagreement models, we find the opening price is significantly greater than the mean intraday price, when averaged over the entire sample, and the open is further above the intraday mean for subsamples with more binding short sale constraints. In contrast, there is no tendency for the closing price to decline below the mean intraday price.

These descriptive results are consistent with evidence provided in two papers that were developed simultaneously with ours. Branch and Ma (2008) find a negative correlation between the overnight return and the subsequent trading day return for stocks traded on the NYSE, AMEX, and NASD. They argue that this tendency relates to the microstructure of how specialists and market-makers behave at the open. Cliff et al. (2008) find robust evidence that the U.S. equity premium over the last decade is solely due to positive overnight returns. In contrast, they show that average trading day returns have been flat or negative. They emphasize that such evidence of negative daytime reversals "present(s) a serious challenge to traditional asset pricing models from the standpoint that these models do not predict negative average returns." They explore the pattern of intraday prices, and find the tendency for positive overnight returns is to some degree related to high opening prices. They also examine a number of potential causes for this phenomenon, by regressing the difference between the overnight and trading day returns on numerous variables. They find this overnight return difference is greater for stocks that are smaller, less illiquid, more volatile, and have greater dollar volume. Both studies emphasize this behavior represents a surprising new anomaly, and call for further efforts to find an explanation.

We show that disagreement models offer a unifying explanation for this evidence of positive overnight returns and trading day reversals. In particular, we proceed to examine how this behavior is related to short sale constraints and dispersion of opinions at the open versus the rest of the day. We focus on low institutional ownership as a proxy for binding short sale constraints.[4] In addition, we examine intraday movements in share turnover and stock return volatility to construct two daily proxies for "relative" dispersion of opinions at the open versus the rest of the trading day: (i) the percentage difference between share turnover during the first hour of trading and turnover per hour during the rest of the trading day, and (ii) the difference between return volatility during the first hour of trading and volatility during the rest of the day.[5]

Our first test applies a portfolio approach in which we independently double-sort the stocks each day into terciles, according to their recent institutional ownership (at the end of the previous quarter) and relative dispersion of opinions at the open (averaged over the previous twenty days). We then compute the mean overnight and trading day returns for the resulting 3 x 3 scheme of portfolios sorted along these two dimensions. In contrast with the evidence in Branch and Ma (2008) and Cliff et al. (2008), this approach reveals that most portfolios in this 3 x 3 scheme do not have significant positive overnight returns and negative trading day reversals. Instead, this behavior is concentrated among stocks with high relative dispersion of opinions at the open, and is magnified further for stocks that also have low institutional ownership. The resulting subsample of stocks most prone to overpricing (i.e., with both low institutional ownership and high relative dispersion) has the largest positive overnight returns that average close to +10 basis points (bp) per day, and trading day reversals at around -20 bp per day.

Prior research uses daily data on share turnover and stock return volatility to measure "absolute" dispersion of opinions over the entire trading day. These studies find that stocks

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4 Prior work that uses low institutional ownership to proxy for binding short sale constraints includes Almazan (2004), Asquith et al. (2005), D'Avolio (2002), Geczy et al. (2002), Jones and Lamont (2002), Nagel, (2005), and Ofek et al. (2004).
5 Studies that use daily data on share turnover or stock return volatility to proxy for dispersion of opinions include Berkman et al. (2009), Boehme et al. (2006), and Nagel (2005).

subject to high disagreement measured at a daily frequency tend to underperform over longer periods, especially if they are also subject to binding short sale constraints.[6] An interesting empirical question is whether such high disagreement stocks are more prone to display the short term overpricing behavior at the open, documented in our first test. Thus, we consider two proxies for a stock's absolute dispersion of opinions over the entire day: (i) daily turnover as a percent of shares outstanding, and (ii) daily volatility, both averaged over the previous twenty trading days. Note that we refer to absolute dispersion of opinions when turnover and volatility are measured at daily frequencies. In contrast, we refer to relative dispersion at the open when we compare turnover or volatility in the first hour with that during the rest of the trading day.

In our second set of tests, we begin by limiting the analysis to the one third of stocks each day with the highest absolute dispersion of opinions throughout the day. We then double-sort this limited sample of high disagreement stocks each day into finer terciles, according to institutional ownership and relative dispersion of opinions at the open. Nearly all portfolios in the resulting 3 x 3 scheme have significant positive mean overnight returns and negative trading day reversals. In addition, the absolute magnitude of these returns increases for portfolios with more binding short sale constraints and higher relative dispersion of opinions near the open. Now the finer subsample of these stocks most prone to overpricing has mean overnight returns around +20 bp per day, and trading day reversals in excess of -30 bp per day. Furthermore, we find that the subsample of stocks omitted from this second test – with low or medium absolute dispersion of opinions – does not have significant positive overnight returns and negative trading day reversals. This result provides further evidence that the behavior documented here does not apply to stocks in general, as suggested in Branch and Ma (2008) and Cliff et al. (2008), but instead is limited to high disagreement stocks (i.e., with high absolute dispersion of opinions).

6 For example, see Berkman et al. (2009), Boehme et al. (2006), and Nagel (2005).

Importantly, while these average overnight returns and trading day reversals are large in economic terms, they remain within transaction costs. For example, a mean abnormal overnight return of +20 bp per day accumulates to 1% per week and 52% per annum. However, the mean daily spread at the open is 98 bp, which exceeds these overnight returns.

Therefore, in our third test we examine the role of transaction costs as an additional limit to arbitrage that may exacerbate the overpricing hypothesized in disagreement models (e.g., see Lesmond, 2007, and Sadka and Scherbina, 2007). Here we begin by selecting: (i) the 50% of stocks each day with the highest effective half spread, and (ii) the one third of these stocks with the highest absolute dispersion throughout the day. We then examine the behavior of finer subsamples with high relative dispersion at the open, combined with low institutional ownership. These finer subsamples now have mean abnormal overnight returns (and trading day reversals) that are larger still, at around +30 (and -40) bp per day. This evidence suggests that high transaction costs act as an additional limit to arbitrage which exacerbates overpricing at the open.

As a fourth test, we combine both limits to arbitrage embodied in transaction costs and more binding short sale constraints, by investigating: (i) the 50% of stocks each day with the highest effective half spread, (ii) the 20% of these stocks with the highest relative short interest, and (iii) the one third of these stocks with the highest absolute dispersion of opinions.[7] We then consider finer subsamples based on institutional ownership and relative dispersion of opinions. For the subsample most prone to overpricing, we now find larger overnight returns that average around +40 bp per day, and trading day reversals that range from -57 to -78 bp per day.

Our results are robust across different methodologies, including a portfolio approach and a regression approach that both control for firm size. These return patterns remain when we use

7 Asquith et al. (2005) show that stocks with, both, low institutional ownership and high relative short interest are subject to more binding short sale constraints that lead to a greater upward price bias and larger negative returns.

median returns, when we use trade prices to measure returns, and when we exclude low-price stocks. This behavior is also ubiquitous across small stocks, large stocks, NASD stocks, and NYSE stocks, although there is a larger mean overnight return and trading day reversal for small stocks and NASD stocks. In addition, we find this behavior regardless of a firm's degree of information asymmetry or overnight liquidity risk. We also document that these patterns are robust across subperiods before and after the crash of March, 2000, and are stable across years.

Finally, we compare the overnight return behavior for different samples that are subject to overnight periods of different lengths. First, we find that Mondays have a higher opening price and thus a larger (weekend) overnight return and trading day reversal than other days of the week. In addition, we examine the intraday price patterns for ADRs traded in the U.S. We find the amount of the upward price bias at the U.S. open depends upon the duration of the overnight period extending from the close in the ADR's home country until the open in the U.S. In particular, for ADRs in Canada and Latin America, the intraday price pattern is nearly identical to that for U.S. stocks. In contrast, the relatively high prices near the U.S. open are substantially lower (i.e., closer to intraday prices) for ADRs located in the Asia / Pacific region, and are lower still for ADRs from European time zones. These results indicate that the optimism bias near the U.S. open is reduced for ADRs with a shorter overnight period between the close in the home market and the U.S. open. This evidence cannot be explained by any structural microstructure-based rationale related to the opening of trading in the U.S., and thereby lends more credence to the implications of disagreement models as an explanation for this overnight return behavior.

This article proceeds as follows. Section 2 describes our sample selection and variable construction. Section 3 reports descriptive statistics. Section 4 presents the empirical analysis. Section 5 provides extensions and robustness tests, and section 6 summarizes and concludes.

2. Sample Selection and Variable Construction

2.1 Sample Selection and Daily Return Measures

Our sample period covers the nine years from 1996 through 2004. We select the 3,000 largest firms each year according to their market capitalization on July 1. We calculate daily returns using dealer quotations from TAQ.[8] The opening price on day t ($open_t$) is the midpoint of the first valid bid and ask quotes after 9:30 a.m.[9] The closing price on day t ($close_t$) is the midpoint of the last valid bid and ask quotes before 4:00 p.m.[10] We adjust these daily opening and closing prices for stock splits and cash dividends, before computing daily returns. Actual raw returns are measured as the log of the price relative over each time frame considered:

Daily Open-to-Open Return = raw_oto = $\log(open_t / open_{t-1})$;
Daily Close-to-Close Return = raw_ctc = $\log(close_t / close_{t-1})$;
Overnight, Close-to-Open Return = raw_cto = $\log(open_t / close_{t-1})$;
Trading Day, Open-to-Close Return = raw_otc = $\log(close_t / open_t)$.

Note that raw_ctc = raw_cto + raw_otc. We then construct market-adjusted abnormal returns by subtracting the market return over the same time frame, where the market return over each time frame is constructed as the value-weighted average daily return across all stocks in the sample:

Daily Open-to-Open Abnormal Return = oto = raw_oto - market_oto;
Daily Close-to-Close Abnormal Return = ctc = raw_ctc - market_ctc;
Overnight, Close-to-Open Abnormal Return = cto = raw_cto - market_cto;
Trading Day, Open-to-Close Abnormal Return = otc = raw_otc - market_otc.

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8 TAQ's consolidated quotation file is an aggregation of dealer quotes within each market venue. It represents a set of "top of book" records for each venue. In order to identify market-wide best prices, we calculate an inside market across all venues. For the NYSE, this almost never improves upon the NYSE specialist's price. However, in NASD issues, ECNs often improve on the NASD's reported best price.

9 By "the first valid quotes" we mean the first quotes after 9:30 a.m. for which there is non-zero trade size on both the bid and the ask. For NYSE issues, selection of the open is straightforward since the opening cross is easily identified and begins the trading day. For NASD issues, selection of the open is not so straightforward. Although technically the NASD opens at 9:30 a.m., it is often several minutes before valid market-maker quotes appear. If the midquote precisely at 9:30 a.m. is used as the open, these quotes will often be flagged as "closed" by the market participant, or may have zero size associated with the prices. In either case the price does not represent a firm commitment to trade. This behavior of the NASD open motivates our choice of the first valid quotes after 9:30 a.m. as the opening quotes. Our results are robust when we take the midquote precisely at 9:30 a.m. as the open.

10 Occasionally, the final quotes before 4:00 p.m. have zero shares available to trade on one or both sides, or the quote is flagged as closed. For this reason, we select the last valid quote before 4:00 p.m. As shown in section 5.1, we find robust results when we use the first and last trade prices each day to measure overnight returns.

Finally, consistent with prior work, we screen the data for errors and extreme observations.[11]

2.2 Variable Construction

For each stock, we estimate two proxies for absolute dispersion of opinions throughout the entire trading day. Our first measure, Abs_TURN_t, is daily share turnover (i.e., the daily number of shares traded as a percentage of shares outstanding). Our second measure, Abs_VOL_t, is the standard deviation across all 30-minute returns throughout the trading day.[12]

Next, we use intraday data on share turnover and stock returns to construct two daily proxies for relative dispersion of opinions near the open versus the rest of the trading day. Our first measure is relative turnover (Rel_TURN_t), which is the difference between turnover during the first hour of trading and turnover per hour during the rest of the trading day, as a percent of turnover per hour during the entire trading day. Our second measure is relative volatility (Rel_VOL_t), which is the difference between the standard deviation across 30-minute returns during the first hour of trading and the standard deviation across 30-minute returns during the rest of the trading day. Note that our tests focus on the recent behavior of these daily measures of relative and absolute dispersion, averaged over the previous twenty trading days.

Following Asquith et al. (2005), the two proxies for short sale constraints used in this study are institutional ownership and relative short interest. Data on institutional holdings are taken from CDA Spectrum 13F filings. For each quarter, we calculate the percentage of institutional ownership ($INST_t$) for every firm as aggregate shares held by institutions scaled by

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11 Quotes are dropped from our analysis if their "mode" designation indicates that they are not normal quotes, or if the reported ask price is greater than 1.5 times the reported bid price. Similarly, trade prices are deleted if they are more than $1.00 outside of the inside market. In addition, we omit the daily return if the bid-ask spread is negative, or if the opening or closing spread is greater than $5.00 or 30% of the midpoint quote, or if the effective half spread is greater than $2.50 or 15% of the midpoint quote, or if the daily open is more than 25% greater (or less) than both the previous close and the subsequent close.

12 We have also measured Abs_VOL_t using the standard deviation across all midquotes throughout the trading day, or the standard deviation across recent close-to-close returns or open-to-open returns, with robust results.

total shares outstanding. If a stock is available in CRSP but has no information on institutional holdings from the 13F filings data, we assume this stock has zero institutional ownership (see Asquith et al., 2005, Gompers and Metrick, 2001, and Nagel, 2005). A more detailed description of this variable appears in Appendix A. Our second proxy for short sale constraints is relative short interest (RSI_t), measured by the number of shares sold short as a percent of total shares outstanding, using monthly data on short interest from the NYSE and the Nasdaq.

Finally, we use three measures of transaction costs: the percentage spread at the open ($SPR(open)_t$), at the close ($SPR(close)_t$), and the percentage effective half spread ($Spread_t$).[13]

3. Descriptive Statistics and Intraday Price Patterns

3.1 Descriptive Statistics for Overnight and Trading Day Returns

In Panel A of Table 1 we report the mean and median values for overnight returns, trading day returns, and 24-hour returns across all firms and days in the sample. Note that the average number of firms each day varies from 2,491 to 2,585 across the different measures of daily returns considered. This is less than the 3,000 largest U.S. stocks used as the initial sample, because daily quotes are typically unavailable for 400 to 500 of the smaller stocks.

Standard t-tests applied to these mean returns could be biased upward due to cross-correlation of daily returns across firms on the same date (Bernard, 1987). In all our analyses, we conduct tests that are not affected by this bias. Specifically, for each of the 2,267 trading days in our nine-year sample period, we first compute the mean (or median) overnight and trading day returns across all stocks in the sample. We then average these cross-sectional mean (or median) returns across all trading days in the sample period. The corresponding t-statistics are based on

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13 For every trade, the percentage effective half spread is defined as the absolute difference between the trade price and the quote midpoint, as a percent of the quote midpoint. Trades are matched to quotes with a lag of one second, and then averaged to get the day's percentage effective half spread. Our choice of a one-second lag is taken from the NASD Economic Research Office, which argues this lag is optimal to match trades and quotes in its automated electronic system. Our results are not affected by this choice (see Lee and Ready, 1991, and Bessembinder, 2003).

the standard errors of the time-series average across daily means, and thus do not suffer from any potential bias associated with cross-sectional clustering on the same day (see Bernard, 1987).

Results on the left side of Panel A in Table 1 indicate a significant positive raw overnight return (raw_cto) of 8.0 basis points (bp) per day, and a significant negative raw trading day reversal (raw_otc) of -4.9 bp per day, when averaged across all firms and days in the sample. As a result, the average daily return on a strategy that is long the sample stocks during the overnight period and short the same stocks during the subsequent trading day (raw_DIFF) equals 13.0 bp, before deducting transaction costs. However, note that the return on this strategy is swamped by transaction costs. When we subtract the average bid-ask spread at the daily open and close, we obtain a significant negative mean difference after transaction costs (raw_DIFF-TC) of -76.6 bp.

The right side of Panel A reveals similar but diminished results when we deduct the value-weighted market return over each time frame, to obtain abnormal overnight and trading day returns. This result reflects the fact that the overnight return pattern is attenuated for larger stocks. Still, after subtracting the value-weighted market return for each time frame, we find a significant positive mean abnormal overnight return of 2.0 bp per day, and a significant negative mean abnormal trading day reversal of -6.8 bp per day. These results lead to a significant mean difference between abnormal overnight and trading day returns of 8.8 bp, that is again swamped by transaction costs. In order to reduce the impact of market-wide price changes on our return measures during the overnight or trading day periods, we focus on abnormal returns throughout our analysis. Our conclusions are unaffected when we use raw overnight and trading day returns.

Note that the median values of raw and abnormal overnight returns in Panel A of Table 1 (raw_cto and cto) are smaller than their respective means. On the other hand, the median trading day returns in Panel A (raw_otc and otc) are nearly identical to their respective means.

3.2 Descriptive Statistics for the Main Variables

Panel B of Table 1 provides descriptive statistics for the main variables in the study. First consider our two proxies for absolute dispersion of opinions throughout the day: (i) average daily turnover (Abs_TURN) is 0.72 percent of total shares outstanding, while (ii) the average standard deviation across all 30-minute returns during the trading day (Abs_VOL) is 0.61 percent.

Second consider our two proxies for relative dispersion of opinions near the open versus the rest of the trading day: (iii) average share turnover during the first hour of trading (Rel_TURN) is 39 percent greater than turnover per hour during the rest of the trading day, while (iv) the average standard deviation across 30-minute returns (Rel_VOL) is .014 percent greater during the first hour of trading than during the rest of the day.

Third consider the measures of short sale constraints. Mean institutional ownership (INST) is 45.6 percent of shares outstanding. This number is higher than the 34 percent reported in Nagel (2005), as our sample is limited to larger firms. Relative short interest averages 3.0% of shares outstanding across all stocks and days in the sample, similar to Asquith et al. (2005).

Fourth consider our transaction cost variables. The average spread at the open is 0.98% of the quote midpoint, while the average spread at the close is 0.78%, and the mean effective half spread is 0.21%. Finally, the average firm has a market capitalization of $4.45 Billion. Note that the medians for most variables in Panel B of Table 1 are smaller than their corresponding means. This result indicates some degree of positive skewness for these firm attributes, as expected.

3.3 Correlations across the Main Variables

In Panel C of Table 1 we report the average Spearman correlation across each pair of variables.[14] These correlations are generally consistent with our expectations.

14 Spearman correlations are applied to reduce the influence of outliers. Pearson correlations yield similar results.

First, note that Abs_TURN and Abs_VOL have a significant positive correlation of 45 percent, consistent with prior work (see Nagel, 2005). Likewise, the remaining correlations across the four measures of absolute and relative dispersion of opinions are also significantly positive, although smaller in magnitude. This outcome suggests that these proxies capture similar, though not identical, information about dispersion of opinions.

Second, all four dispersion measures are positively correlated with the overnight return (cto), and three of the four measures (Abs_VOL, Rel_TURN, and Rel_VOL) are negatively correlated with the trading day return (otc). This evidence is consistent with an upwardly biased opening price for stocks that are subject to higher absolute and relative dispersion of opinions, in accord with the implications of disagreement models.

Third, consider the association between our proxies for short sale constraints and stock returns during the overnight versus the trading day period. The percent of institutional ownership (INST) is significantly negatively correlated with the overnight return (cto) and positively correlated with the trading day return (otc), while the opposite tendencies are apparent for relative short interest (RSI). Thus, stocks subject to more binding short sale constraints (with lower institutional ownership or higher short interest) tend to have larger overnight returns and trading day reversals. This result is also consistent with the predictions of disagreement models.

Fourth, the spread measures tend to be positively correlated with cto and negatively correlated with otc, indicating a tendency for larger overnight returns and trading day reversals for stocks with higher transaction costs. This evidence suggests that transaction costs operate as a further limit to arbitrage that could allow overpricing at the open to persist. In addition, the spread measures are negatively correlated with firm size and institutional holdings, as expected.

Finally, firm size is positively correlated with institutional ownership, reinforcing the need to control for size when we analyze the influence of institutional ownership in our analysis (see Nagel, 2005). In addition, firm size is negatively related to overnight returns (otc), but positively related to trading day returns (cto). This outcome suggests that smaller firms have a tendency for larger positive overnight returns and trading day reversals.

3.4 The Intraday Price Pattern across All Stocks and Days

The descriptive statistics in Table 1 raise several questions. For example, is this average positive overnight return and negative trading day reversal due to a high opening price or a low closing price, or both? Furthermore, do these patterns hold for the entire sample of stocks, or are they more dramatic for subsamples with high disagreement and more binding short sale constraints?

To address these issues, we examine the intraday pattern in prices. For each stock, we collect data on intraday midquotes at 30-minute intervals for every trading day. In addition, we gather the midquotes at 5-minute intervals for the first and last 30 minutes of the trading day. Next we compute the average across all intraday midquotes during the day, omitting the quotes in the first and last 30 minutes. Then, at each 5-minute or 30-minute interval (T), we construct the ratio of the midquote at that time to the day's average intraday midquote. We then find the average of each intraday price ratio across all stocks every day. Finally we compute the time series mean of these cross-sectional average price ratios for all days in the sample.

In this analysis we limit the sample to all firms each day that open precisely at 9:30am, and thus have a complete set of price ratios throughout the trading day. This limitation ensures that the price ratios taken at successive 5-minute intervals following 9:30am truly reflect the behavior of prices at these time frames *after* the market opens. This screen excludes a number of smaller firms each day whose open is delayed past 9:30am by the specialist or market-maker. As a result, the average sample size for this analysis of intraday price ratios is 1,929 firms per day, which is less than the roughly 2,500 firms per day anlayzed throughout the rest of the study.

Figure 1 plots the intraday pattern in this ratio of the midquote at time T to the average intraday midquote, across all stocks and days in the sample, along with the 95% confidence interval about a ratio of one. Results indicate that the opening price is significantly higher than the average intraday price (i.e., the opening ratio > 1.0). After the open, the price declines during the first 60 minutes of trading toward the average intraday price. Intraday prices then continue to decline below the intraday average in the middle of the day, before rising again during the last few minutes of trading. The closing price ends above the average intraday price, although not significantly so. This intraday pattern is consistent with the implications of disagreement models, indicating that the opening price tends to be high relative to the average intraday price.[15]

3.5 The Intraday Price Pattern and Short Sale Constraints

Figure 2 further explores the implications of disagreement models, by examining how this intraday price pattern varies across subsamples stratified by the degree of short sale constraints. We partition the sample stocks each day into quintiles according to the percent of institutional ownership, and plot the intraday pattern in price ratios for each subsample, along with the 95% confidence interval about 1.0 that applies to the first quintile with low institutional ownership.[16]

All quintiles reveal a similar intraday pattern, in which the opening price is significantly higher than the intraday average, then the price declines below the intraday average in the middle of the day, and the closing price rises back near the intraday average. However, the bottom two quintiles with lower institutional ownership reveal an opening price that is higher, and a closing

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15 In contrast, these results do not support the implications of liquidity risk theory applied to the overnight period. Based on liquidity risk theory, the daily *closing* price should be lower than the average intraday price to compensate for overnight liquidity risk. We provide further evidence on this issue in our robustness tests in Table 7.

16 The quintile with low institutional ownership has the largest standard errors of the mean price ratio throughout the day, and thus reveals the widest 95 percent confidence interval about 1.0 for any group of stocks in Figure 2.

price that is lower, than the three quintiles with higher institutional ownership. Furthermore, as we move to the three quintiles with higher institutional ownership (and less binding short sale constraints), the intraday price pattern twists in a counter-clockwise fashion so that the opening price ratio decreases toward 1.0, while the closing price ratio increases above 1.0. This evidence suggests a greater upward price bias at the open, larger overnight returns, and larger trading day reversals, when there are more binding short sale constraints. These results provide further support for the implications of disagreement models.[17]

4. Empirical Tests

4.1 Portfolio Approach Applied to All Stocks

In our first set of tests, we apply a double-sorting scheme in which we compare average overnight and trading day returns across portfolios of firms that are independently partitioned along two dimensions, institutional ownership and relative dispersion of opinions near the open, while controlling for firm size. In this approach we consider each trading day as a separate event. For each day, we control for firm size by initially sorting all firms into size terciles based on the firm's mean market capitalization over the previous twenty trading days. Then, within each size tercile, we form three finer portfolios by independently sorting based on: (i) the mean values of our proxies for relative dispersion of opinions near the open (Rel_TURN or Rel_VOL) over the previous twenty trading days, and (2) the percentage of institutional ownership (INST) at the end of the previous quarter. The result is two 3 x 3 schemes of portfolios, sorted by size-adjusted institutional ownership and each proxy for relative dispersion of opinions.[18]

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17 Analogous results not presented here similarly indicate greater upward price bias at the open for subsamples with higher values of absolute or relative dispersion of opinions, or higher relative short interest.

18 It is important to control for firm size in this partitioning scheme, given the well-documented association of size with both institutional ownership and dispersion of opinions (Ang et al., 2006, Boehme et al., 2006, Brennan et al., 1998, Diether et al., 2002, and Nagel, 2005). Still, results are robust when we do not control for size in this partitioning scheme. We also find similar results when we apply this partitioning scheme based on firm size, institutional ownership, and dispersion of opinions measured over the previous ten or thirty trading days.

Finally, we test the implications of disagreement models by comparing mean abnormal overnight and trading day returns across portfolios wthin each 3 x 3 scheme, with different levels of relative dispersion of opinions and institutional ownership. If the tendency for positive overnight returns and negative trading day reversals is not due to the optimism bias hypothesized in disagreement models, then we would expect no differences in mean overnight or trading day returns across portfolios with different levels of relative dispersion or short sale constraints. On the other hand, if this overnight return behavior is attributable to such optimism bias, then we would expect greater positive (negative) overnight (trading day) returns for portfolios with high relative dispersion of opinions near the day's open, combined with low institutional ownership.

Once again, we conduct statistical tests that are not affected by potential cross-sectional correlation in abnormal returns on the same day. Specifically, for each day, we first allocate stocks to one of the double-sorted portfolios in the 3 x 3 scheme. We then compute the cross-sectional mean overnight and trading day abnormal returns for all stocks with the same attributes (i.e., within each of the double-sorted portfolios). Finally, we average the cross-sectional mean returns for each of these double-sorted portfolios across all trading days in the sample period. The corresponding t-statistics are based on the standard errors of these time series means.

Panel A of Table 2 presents the mean overnight returns for two different 3 x 3 schemes of double-sorted portfolios using turnover and volatility, respectively, to proxy for relative dispersion of opinions at the open. On average, there are 280 stocks in each of the nine portfolios within every double-sorted partitioning scheme in Table 2. Observe that the significant positive overnight returns in each 3 x 3 scheme of Panel A are largely confined to the tercile with high relative dispersion near the open, in the bottom row. Mean difference t-tests provided at the bottom of every column indicate that stocks with high relative dispersion significantly outperform stocks with low relative dispersion during the overnight period. In addition, the left column of each scheme contains the largest element in every row, indicating that stocks with more binding short sale constraints tend to have larger overnight returns. Finally, the bottom left cell contains the largest mean in each scheme, indicating that stocks with both high relative dispersion and low institutional ownership have the greatest abnormal overnight returns, which average close to +10 basis points (bp) per day.

Panel B of Table 2 provides the analogous results for trading day returns, and reveals that the significant negative mean trading day returns are concentrated among stocks with medium or high relative dispersion near the open. Now the mean difference t-test at the bottom of every column shows that stocks with high relative dispersion significantly underperform stocks with low relative dispersion, during the trading day. In addition, the bottom left cell of every 3 x 3 scheme now contains the largest negative mean trading day reversal, at around -20 bp.

4.2 Portfolio Approach Applied to Subsamples of Stocks

4.2.1 Subsample with High Absolute Dispersion of Opinions throughout the Trading Day

In our second set of tests we limit the analysis to the one third of stocks each day with the highest size-adjusted absolute dispersion of opinions throughout the day. We then double-sort this subsample of high disagreement stocks each day into finer terciles, according to their size-adjusted levels of institutional ownership and relative dispersion of opinions at the open.

Once again, Panel A of Table 3 presents the results for overnight returns, while Panel B gives trading day returns. Likewise, the 3 x 3 scheme on the left (right) side of each Panel in Table 3 presents the mean abnormal returns for each finer subsample using turnover (volatility) to proxy for absolute and relative dispersion of opinions. On average, there are now 95 stocks in each of the nine portfolios within every 3 x 3 scheme in Table 3.

First, observe that all but one of the portfolios within the two 3 x 3 schemes of Panel A have significant positive overnight returns, while all portfolios in both 3 x 3 schemes of Panel B have significant negative trading day reversals. This result indicates that the subsample of high disagreement stocks – with high absolute dispersion throughout the day – displays an overwhelming tendency toward this overnight return behavior, regardless of the level of institutional ownership or relative dispersion of opinions near the open.

This evidence contrasts sharply with the analogous tendencies for the stocks omitted from this analysis – with low or medium absolute dispersion of opinions throughout the day. In tests not reported here for brevity, we find these alternative subsamples of low disagreement stocks have mean overnight returns and trading day reversals that are insignificant, or of much smaller magnitude than those in Table 3. This outcome indicates that the overnight return behavior documented here, as well as in Branch and Ma (2008) and Cliff et al. (2008), is limited to high disagreement stocks (i.e., stocks with high absolute dispersion of opinions throughout the day).

Second, consider the behavior of the positive overnight returns within each 3 x 3 scheme of Panel A in Table 3. As we move down every column within each 3 x 3 scheme, toward the portfolio with high relative dispersion near the open, the mean overnight return tends to increase. The mean difference t-test at the bottom of each column shows that stocks with high relative dispersion significantly outperform stocks with low relative dispersion during the overnight period. Alternatively, as we compare columns within every 3 x 3 scheme, we find the left column of every scheme contains the largest positive mean overnight return in any given row. This result indicates that stocks with more binding short sale constraints tend to have greater overnight returns. Finally, the bottom left cell contains the largest mean overnight return in both

3 x 3 schemes of Panel A, at approximately +20 basis points per day. This average overnight return is large in economic terms, accumulating to 1% per week or 52% per year.

Third, consider the mean trading day returns provided in Panel B of Table 3. These results mirror those in Panel A, with the tendency for increasingly positive overnight returns being replaced by a tendency for increasingly negative trading day reversals, for stocks that are more prone to overpricing (with higher relative dispersion and lower institutional ownership). First, now the mean trading day return becomes smaller (i.e., larger negative) as we move down each column to stocks with higher relative dispersion near the open. Now the bottom row has the largest negative trading day reversal in each column, and the mean difference t-test indicates that stocks with high values of relative dispersion significantly underperform stocks with low values during the day. Also, this trading day reversal is largest in magnitude for the bottom left cell of each 3 x 3 scheme in Panel B, averaging more than -30 basis points per day. Once again, these trading day reversals are large in economic terms for this subsample of stocks most prone to overpricing, accumulating to approximately -1% every three days, and -75% per annum.

Finally, it is no coincidence that the magnitudes of the negative trading day reversals within each 3 x 3 scheme of Panel B exceed the analogous positive overnight returns within each 3 x 3 scheme of Panel A. Combining these two effects implies an average 24-hour return that is negative for the stocks analyzed in Table 3.[19] This result is expected, since these stocks have been shown to be overpriced over longer periods (see Berkman et al., 2009, and Nagel, 2005).

The results in Table 3 uniformly support the implications of disagreement models. Stocks with high absolute dispersion of opinions throughout the day have significant positive overnight returns that are dominated by larger subsequent trading day reversals. Furthermore, these

19 In tests not reported here, we find the sum across corresponding cells in the bottom row of each 3 x 3 scheme from Panels A and B is significantly negative. This outcome demonstrates that the trading day reversal dominates.

overnight return patterns are progressively larger in magnitude for finer subsamples with greater relative dispersion of opinions near the open. Finally, these patterns are largest for the still finer subsample subject to binding short sale constraints in the form of low institutional ownership.

4.2.2 Subsample with High Levels of Transaction Costs and Absolute Dispersion of Opinions

While Table 3 indicates that average overnight returns and trading day reversals for overpriced stocks are large in economic terms, they are consistently dominated by transaction costs.[20] Thus, in our next application of the portfolio approach, we examine the role of transaction costs as a further limit to arbitrage that may exacerbate the overpricing behavior at the open, documented above. Here we reproduce the analysis in Table 3, but we further constrain this analysis by first limiting the sample each day to the 50% of firms with the highest effective half spread.

Results are provided in Table 4. On average, there are now 47 stocks in each portfolio within every double-sorted partitioning scheme in Panels A and B. As expected, the abnormal overnight and trading day returns display similar relations with relative dispersion of opinions and institutional ownership. However, they now tend to be larger in absolute magnitude than the analogous results from Table 3, especially for the subsample of overpriced stocks. In particular, the bottom left cell in the two 3 x 3 schemes in Panel A of Table 4 is now close to +30 bp, while the analogous average abnormal trading day reversal in Panel B now ranges from -40 to -49 bp.

These results indicate that overpriced firms – with high dispersion of opinions and low institutional ownership – tend to have positive overnight returns and trading day reversals that are larger in magnitude when transaction costs are high. This evidence reinforces a growing body of evidence that documents the importance of both short sale constraints and transaction costs as limits to arbitrage that affect overpricing (see Lesmond, 2007, and Sadka and Scherbina, 2007).

20 Panel A of Table 1 shows that the mean daily spread at the open exceeds the mean overnight return and trading day reversal, when averaged across all stocks and days in the sample. This result also applies to the subsamples of overpriced stocks in Table 3, with high absolute and relative dispersion of opinions and low institutional ownership.

4.2.3 *Subsample with High Levels of Transaction Costs, Short Interest, and Absolute Dispersion*

Our final application of the portfolio approach appears in Table 5. Here we examine the extent to which high transaction costs and high short interest operate together, to reflect greater limits to arbitrage that exacerbate the overpricing behavior documented above. This Table reproduces the analysis in Table 3, but further limits the sample each day to: (i) the 50% of firms with the highest effective half spread, (ii) the 20% of these stocks with highest relative short interest, and (iii) the 33% of these firms with the highest absolute dispersion of opinions. On average, there are now 9 stocks in each portfolio within every double-sorted partitioning scheme in Table 5.

As expected, the abnormal returns in Table 5 tend to be still larger in magnitude than the analogous results from Tables 3 and 4, especially for the overpriced portfolio with low institutional ownership and high relative dispersion of opinions. For example, the bottom left cell from each scheme in Panel A of Table 5 contains a mean overnight return that averages around +40 bp, while the analogous cell from the schemes in Panel B contains a mean trading day reversal that ranges from -57 to -78 bp. These results reinforce the view that overpriced firms tend to have positive overnight returns and trading day reversals that are larger in magnitude when transaction costs are high and short sale constraints are more binding, and they further corroborate the above support for disagreement models.

4.3 *Cross-Sectional Regression Approach*

In our next set of tests we use regression analysis to investigate how overnight or trading day returns are associated with institutional ownership and our measures of relative and absolute dispersion of opinions, while including firm size as an explanatory variable, as follows:

$$\begin{aligned}\text{Return (cto or otc)} \;=\; & b_0 + b_1\,\text{Rel\_Disp} + b_2\,\text{Abs\_Disp} + b_3\,\text{INST} \\ & + b_4\,(\text{INST} * \text{Rel\_Disp}) + b_5\,(\text{INST} * \text{Abs\_Disp}) + b_6\,\text{Size} + \varepsilon\,. \qquad (1)\end{aligned}$$

Controlling for firm size in this framework offers a robustness check on the methodology of our earlier portfolio approach that utilizes the size-adjusted partitioning scheme. The variable, INST, refers to institutional ownership from the previous quarter. Rel_Disp, is our proxy for relative dispersion of opinions at the open (Rel_TURN or Rel_VOL); Abs_Disp is absolute dispersion of opinions (Abs_TURN or Abs_VOL); and Size is the firm's market capitalization. These latter variables are taken as the average daily values over the previous twenty trading days.

Other studies address outliers and potential nonlinearities in this type of regression model by estimating rank regressions, in which they first transform the explanatory variables into decile ranks (each day) and then scale the decile ranks to range from 0.0 to 1.0.[21] This transformation allows us to interpret the slope coefficient for each explanatory variable (b_1, b_2, b_3, or b_6) as the *spread* in abnormal returns between the largest and smallest deciles sorted by that variable. However, this scaling leads to biased coefficients in the presence of multiplicative interaction terms (see Mendenhall, 2004). We therefore adopt the modification of this procedure used by Affleck-Graves and Mendenhall (1992), in which we subtract 0.5 from each scaled explanatory variable. This modification re-scales the decile ranks of each independent variable to range from -0.5 to +0.5. Now: (i) the intercept reflects the average abnormal return (cto or otc) for a hypothetical median firm between the two middle deciles for each explanatory variable; (ii) the slope coefficients retain the interpretation described above; and (iii) the interaction terms also have a straightforward interpretation, as discussed below.[22]

The interaction terms allow us to test whether the relation between abnormal returns (cto or otc) and each measure of dispersion is different for stocks with different degrees of short sale constraints. Re-scaling the explanatory variables to range between -0.5 to +0.5 enables the

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21 For example, see Bernard and Thomas (1990), Bartov et al. (2000), Bhushan (1994), and Nagel (2005).
22 Our conclusions are unaffected when we estimate this model using the natural logs of the independent variables.

coefficient on each interaction term to be interpreted as the *change in the spread* in abnormal returns (cto or otc) between stocks with high versus low dispersion (Rel_Disp or Abs_Disp), for firms in the highest versus lowest decile by institutional ownership.

Table 6 provides the mean Fama-MacBeth regression coefficients obtained from estimating 2,267 different daily cross-sectional regressions on the entire sample of stocks, over the 9-year period from 1996 through 2004. Once again, the time series standard error of each mean regression coefficient is used to construct the t-ratio, to guard against any potential bias from cross-sectional correlation across stock returns on the same day (Bernard, 1987). The left two columns of results in Table 6 present the mean coefficients from the models that use turnover to proxy for relative and absolute dispersion of opinions. The right two columns provide the analogous results using volatility to proxy for dispersion of opinions.

First note that firm size (b_6) is negatively related to the overnight return (cto), regardless of the proxy used to measure relative and absolute dispersion of opinions. In contrast, firm size is positively related to trading day returns (otc) when turnover is used to proxy for dispersion. This evidence suggests that smaller firms tend to have a larger overnight return and trading day reversal, after controlling for variation due to absolute and relative dispersion of opinions, institutional ownership, and their interactive effects.

Second, observe that the coefficients for relative and absolute dispersion (b_1 and b_2) are significantly positive in the regressions involving overnight returns, and significantly negative in the regressions involving trading day returns. This result implies that greater relative or absolute dispersion of opinions is consistently associated with larger overnight returns and trading day reversals, supporting the implications of disagreement models.

Third, note that the coefficient of institutional ownership (b_3) is significantly negative in the regressions involving overnight returns, and significantly positive in the regressions involving trading day returns. This outcome indicates that firms with lower institutional ownership (i.e., more binding short sale constraints) tend to have larger overnight returns and trading day reversals, reinforcing our earlier results from the portfolio approach.

Fourth, the coefficients on the interaction terms between INST and the two dispersion measures (b_4 and b_5) are generally significant and of the opposite sign to the coefficients of the dispersion measures themselves (b_1 and b_2). This result means that the relation between the return and each dispersion measure is *attenuated* for firms with *higher* institutional ownership. Put another way, this implies that the relation between the return and each dispersion measure is *exacerbated* for firms with *lower* institutional ownership (i.e., with more binding short sale constraints). This outcome further supports the implications of disagreement models.

The economic significance of these regression results can be illustrated by examining the first and second columns of Table 6, for the regressions using turnover to proxy for relative and absolute dispersion of opinions. Consider the first column of Table 6, which presents the model analyzing overnight returns (cto). For this model, the coefficients of Rel_Disp and Abs_Disp are $b_1 = +.14$ ($t = 14.3$) and $b_2 = +.13$ ($t = 8.1$), respectively. These results imply that, for the hypothetical median INST group, moving from the lowest to the highest decile of stocks by relative (or absolute) dispersion of opinions is associated with an average increase in the overnight return of +14 (or +13) basis points.

The coefficients of the interaction terms for this model are $b_4 = -.07$ ($t = -6.3$) and $b_5 = -.05$ ($t = -5.2$), respectively. These negative coefficients indicate that the positive relation between overnight returns and Rel_Disp (or Abs_Disp) is attenuated for firms with higher institutional ownership. Specifically, the spread between the overnight returns of stocks with high versus low Rel_Disp (or Abs_Disp) is reduced by -7 (or-5) basis points for firms with high institutional ownership relative to firms with low institutional ownership.

Analogous implications hold for the second column of Table 6, for the regressions involving trading day returns (otc). Here the coefficients of Rel_Disp and Abs_Disp are b_1 = -.17 (t = -11.6) and b_2 = -.15 (t = -4.6), respectively. These negative coefficients imply that, for the median INST group, moving from the lowest to the highest decile by relative (or absolute) dispersion of opinions is associated with an average decrease in the trading day return of -17 (or -15) basis points. Furthermore, the coefficients of the interaction terms are now b_4 = +.14 (t = 8.6) and b_5 = -.01 (t = -0.3). The first interaction coefficient, b_4, indicates that the spread between the trading day returns of stocks with high versus low Rel_Disp is reduced by +14 basis points, for firms with high institutional holdings relative to firms with low institutional holdings. The second interaction term indicates that there is no significant difference in the spread between the trading day returns of stocks with high versus low Abs_Disp, for firms with high institutional holdings relative to firms with low institutional holdings

It is noteworthy that the coefficients of the interaction terms in Table 6 generally indicate that the positive (negatve) relation between overnight (trading day) returns and each dispersion measure is attenuated for firms with higher institutional holdings. This result provides further evidence that the behavior documented in this study does not apply to stocks in general, as suggested in Branch and Ma (2008) and Cliff et al. (2008), but instead is limited to stocks that are subject to high disagreement and/or binding short sale constraints.

The economic magnitudes of these regression results from Table 6 are most comparable to the results of the portfolio approach in Table 2, since these two sets of analyses are applied to the entire sample of stocks each day. In tests not reported here for brevity, we have also applied this regression analysis to subsamples comprised of: (i) the 50% of stocks each day with high transaction costs, and (ii) the 20% of these stocks with high relative short interest. Results reveal that the regression coefficients on Rel_Disp and Abs_Disp (b_1 and b_2), and their interactions with institutional ownership (b_4 and b_5), are consistently of the same sign as those reported in Table 6, and become substantially larger in magnitude as we progress to analyze subsamples with higher transaction costs and more binding short sale constraints.

This regression analysis reinforces the results of our portfolio approach in Tables 2-5. This evidence indicates significantly greater overnight returns and trading day reversals for stocks with higher levels of relative and absolute dispersion of opinions, and more binding short sale constraints. Together, this evidence provides consistent, corroborating support for the implications of disagreement models as an explanation for this overnight return behavior.

5. Extensions and Robustness Tests

5.1 Alternative Return Measures and Subsamples of U.S. Stocks

In Table 7 we apply the main analysis from our portfolio approach of Table 3, but we base this analysis on alternative return measures or subsamples of stocks. For each test, the four columns on the left side of Table 7 report results for average overnight returns (cto), while the four columns on the right side present analogous results for trading day returns (otc).

In all of these robustness tests, we focus on the difference between the cells in the bottom versus the top rows of each 3 x 3 scheme. Specifically, we analyze the abnormal overnight and trading day returns of zero-cost hedge portfolios that are long the tercile with high values of relative dispersion of opinions and short the tercile with low values, conditional on institutional ownership (the column). For brevity, within each 3 x 3 scheme we only report these hedge portfolio results for the terciles (i.e., columns) based on low and high institutional ownership.

The base-case provided at the top of Table 7 reproduces the analogous mean difference t-tests from Table 3. In every subsequent robustness test (row) of Table 7, we change only one aspect of the analysis to facilitate comparison with the base case.

5.1.1 Using Median Returns, Trade Prices, and Excluding Low-Price Stocks

The results of our first robustness test of Table 7 appear in row 1, just below the base case. Here we use the median return across stocks in each subsample every day, rather than the mean, and we then compute the time series mean of these median returns across all days in the sample period. Results are similar to the base case. One implication is that our mean results are not attributable to outliers. Another implication is that half of the sample stocks experience overnight returns and trading day reversals that exceed the medians provided in row 1 of Table 7.

Our next robustness test is provided in the second row of Table 7, and uses the first and last trade prices of the day to compute overnight and trading day returns, rather than midquotes. Results are virtually identical to the base case using midquote returns. Together, the evidence in the base case and this robustness test indicate that our results reflect the behavior of both trade prices and midquotes, and are not attributable to bid-ask bounce.

Our third robustness test excludes stocks each day whose average daily closing price is below $5 during the previous three months. This exclusion yields hedge portfolio returns that are again similar to the base case, indicating that our results are not due to low-price stocks.

5.1.2 NASD versus NYSE Stocks

The fourth and fifth tests provided in Table 7 reproduce the analysis in Table 3 for the subsamples of NASD and NYSE stocks, respectively. There are reasons to expect potentially divergent behavior across NASD and NYSE stocks at the day's open and close. The NYSE specialist system is substantively different from the NASD trading regime based on market makers. These two markets have important structural differences in opening and closing mechanisms, order routing, and linkages that reduce fragmented trading. In addition, the NASD market evolves from a telephone-mediated market to a fully automated electronic limit order book in several jarring transformations during our nine-year sample period. These factors can create frictions in opening and closing prices. Finally, the bulk of NASD stocks are smaller firms with higher transaction costs and greater information asymmetries. These divergent features of NASD versus NYSE stocks lead us to expect greater mispricing at the open, and thus larger overnight returns and trading day reversals, for NASD stocks.[23]

These expectations are born out in our fourth and fifth tests of Table 7. While we find both NYSE and NASD stocks have significant positive overnight hedge portfolio returns and negative trading day reversals that depend on dispersion of opinions and short sale constraints, these hedge returns are substantially larger in magnitude for NASD stocks. On the other hand, this evidence reveals that this overnight return behavior is not limited to NASD stocks, but also characterizes NYSE stocks, albeit in smaller magnitudes.

5.1.3 Small versus Large Stocks

The sixth and seventh tests of Table 7 pursue a similar line of inquiry by examining subsamples of stocks in the smallest and largest quintiles by market capitalization each day. This analysis reveals that mean overnight hedge returns and trading day reversals are larger in magnitude for small firms than for large firms. However it is noteworthy that, while this evidence documents a strong size effect in overnight returns and trading day reversals, firm size is not the sole cause of

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23 These issues also emphasize the importance of proper identification of opening and closing prices (see Gerety and Mulherin, 1994, Harris, 1989, Rogalski, 1984, Smirlock and Starks, 1986, and our footnotes 8-11 above).

our results in Tables 2 - 5. In all these analyses we examine how overnight returns and trading day reversals are related to absolute and relative dispersion of opinions, short sale constraints, and transaction costs, after first controlling for size. Thus, while small stocks tend to experience larger overnight returns and trading day reversals, this behavior is not limited to small stocks.

5.1.4 Information Asymmetry and the Probability of Information Trading

Previous work indicates that a risk premium is demanded for stocks with greater information asymmetry (e.g., see Easley et al., 2002). Extending this work to our setting, the behavior of overnight returns and trading day reversals may be related to the degree of a stock's information asymmetry. According to the model of Hong and Wang (2000), the lack of trading overnight may give rise to increased information asymmetry during the overnight period, which is reversed when trading resumes after the open (see also Odders-White and Ready, 2008). If information asymmetry is relatively high at the open, and is priced in the market, then the opening price should tend to be low relative to intraday prices. After the open, as information is processed through trading, we would expect declining information asymmetry and rising stock prices, as a smaller premium is demanded on the stock throughout the trading day.

This theory suggests we should find a tendency for lower opening prices, negative overnight returns and positive trading day reversals, which are larger in magnitude for stocks with greater information asymmetry. Our evidence in Tables 1-6 and Figures 1-2 is inconsistent with these predictions based on information asymmetry. Still, we investigate the implications of these theories by examining whether a stock that is subject to greater information asymmetry tends to have lower opening prices, negative overnight returns and positive trading day reversals.

In this analysis, we construct a quarterly proxy for a stock's degree of information asymmetry by estimating the probability of information trading (PIN), using transaction data from all trading days over the previous quarter (Easley et al., 2002). Then we apply the portfolio approach of Table 3 to the quintiles of stocks each day with the lowest and highest PIN, respectively. Results are provided in our eighth and ninth tests in Table 7. We find significant positive overnight hedge returns and negative trading day reversals, which are somewhat larger for stocks with high PIN. This evidence is inconsistent with the theoretical predictions of information asymmetry theory applied to the overnight period (Hong and Wang, 2000).

5.1.5 Liquidity Risk Theory, Overnight Liquidity Risk, and the Closing Price

In this section we explore the implications of liquidity risk theory applied to the overnight period as an alternative explanation for the overnight returns and trading day reversals documented in this study.[24] According to liquidity risk theory, if the overnight period represents a reduced liquidity regime, then investors will require a premium to bear this overnight liquidity risk as the daily close approaches. As a result, the closing price should tend to decline relative to intraday prices. This theory also suggests that stocks with greater overnight liquidity risk (i.e., greater sensitivity to overnight changes in market-wide liquidity) should have lower closing prices relative to the intraday average, along with greater overnight returns and trading day reversals.

Note that this theory implies a closing price that is low relative to intraday prices. This contrasts sharply with the implications of disagreement models, which imply an opening price that is high. Recall that Figures 1 and 2 reveal intraday price patterns in which the stock price is relatively high at both the open and the close. This behavior is contrary to the implications of liquidity risk theory applied to the overnight period. However, to further explore the implications of liquidity risk theory, we need to examine how this intraday price pattern varies across subsamples of stocks sorted according to the firm's degree of overnight liquidity risk.

24 For related work in the literature on liquidity premiums, see Chordia et al. (2000 and 2001), Hasbrouck and Seppi (2001), Huberman and Halka (2001), Longstaff (1995), Pastor and Stambaugh (2003), and Watanabe and Watanabe (2009).

We measure a firm's degree of overnight liquidity risk by hypothesizing that 24-hour changes in its liquidity (proxied by close-to-close changes in the bid-ask spread) depend on changes in market liquidity during the overnight period and the subsequent trading day period:

$$(SPR(close)_{it} - SPR(close)_{it-1}) = \alpha_i + \beta_{ctoi} (SPR_{o\,mt} - SPR_{c\,mt-1}) + \beta_{otci} (SPR_{c\,mt} - SPR_{o\,mt}) + \varepsilon_i , \quad (2)$$

where $SPR(close)_{it}$ = closing bid-ask spread of firm i on day t, as a percent of the midquote,

$SPR_{o\,mt}$ = value-weighted average opening percent market spread, across firms on day t,

$SPR_{c\,mt}$ = value-weighted average closing percent market spread, across firms on day t,

$(SPR_{o\,mt} - SPR_{c\,mt-1})$ = overnight (close-to-open) change in percent market spread on day t,

$(SPR_{c\,mt} - SPR_{o\,mt})$ = trading day (open-to-close) change in percent market spread on day t.

In this specification the coefficient, β_{ctoi}, measures the sensitivity of daily (ctc) changes in the i^{th} firm's liquidity to overnight (cto) changes in market liquidity.

We estimate model (2) for each stock across all days during every quarter. We restrict the analysis to stock quarters with data for at least 44 trading days during the quarter. For each stock, the result is a quarterly time series of regression coefficients, β_{ctoi}, that reflect quarterly measures of the sensitivity of the firm's daily liquidity changes to overnight changes in market liquidity. This series provides our measures of overnight liquidity risk for each stock.[25]

In Figure 3 we plot how the average intraday price pattern varies across quintiles stratified each day by the degree of overnight liquidity risk. This Figure shows that the two quintiles with the lowest and highest degrees of overnight liquidity risk have the highest average opening prices. However, after the open, all quintiles reveal a similar intraday pattern in which the high opening price declines until it is significantly below the intraday average during the

25 This measure is similar to the measures proposed in Acharya and Pederson (2007), Hasbrouck and Seppi (2001), Pastor and Stambaugh (2003), and Watanabe and Watanabe (2009). We have also examined the difference in sensitivities, $(\beta_{ctoi} - \beta_{otci})$, as an alternative measure of a firm's overnight liquidity risk. In addition, we have estimated alternative specifications of (2) that include: (i) putting *open-to-open* or *close-to-open* changes in the firm's percent spread on the left-hand-side, and/or (ii) adding close-to-open and open-to-close market *returns* on the right-hand-side. We have also estimated (2) over monthly and yearly time frames. Partitioning stocks by any of these alternative measures of a firm's overnight liquidity leads to similar patterns in overnight returns.

middle of the day, before rising back near the intraday average at the close. The key result in Figure 3 is that the closing price reveals no tendency to decline near the end of the trading day below the intraday average price, for any quintile, let alone for quintiles with greater overnight liquidity risk. We conclude that this evidence is inconsistent with the implications of liquidity risk theory applied to the overnight period.

We further investigate the potential relation between a firm's overnight liquidity risk and the magnitude of its overnight returns and trading day reversals, with our tenth and eleventh robustness tests in Table 7. Here we reproduce the analysis in Table 3 for the two quintiles of stocks with the lowest and highest degrees of overnight liquidity risk. Results for both quintiles are generally similar to each other and to the base case. Importantly, there is little evidence in the last two rows of Table 7 to suggest systematically greater overnight returns for stocks with greater overnight liquidity risk. Thus we find no evidence to support the implications of liquidity risk theory applied to the overnight period. Instead, throughout all of our analyses we find consistent, corroborating support for the implications of disagreement models.

5.2 The Stability of Overnight and Trading Day Returns over Different Subperiods

In Table 8 we investigate the stability of this behavior over time. The first two rows below the base case in Table 8 present the hedge portfolio returns for the two subperiods before and after the crash of March, 2000. Results indicate that significant positive overnight hedge returns and negative trading day reversals are apparent for both subperiods.

As an additional robustness check, we estimate the hedge portfolio returns for each year of the sample period, separately. Results are provided in the last nine rows of Table 8. Results on the left (right) side of Table 8 reveal significant positive overnight (negative trading day) hedge portfolio returns for 22 (21) out of the possible 36 cells. Most importantly, for every year the nature of any statistically significant results is in line with the predictions of disagreement models. That is, significant overnight hedge returns are always positive, while significant trading day hedge returns are always negative. In addition, these significant hedge portfolio returns are consistently larger in magnitude for the subsample with low institutional ownership. Together these results indicate that the overnight return behavior documented in this study is robust before and after the crash of March, 2000, and is fairly stable across years.

5.3 The Length of the Overnight Period and Overnight Returns

In this section we examine the behavior of overnight and trading day returns for subsamples that are subject to overnight periods of different lengths.

5.3.1 Monday versus Other Days of the Week

Cliff et al. (2007) find the recent behavior of overnight and trading day returns between Friday's close and Monday's close has reversed from that prevailing before the mid-1990's, so that now the opening price on Monday tends to be greater than the closing price on Friday.[26] In line with the view that uncertainty increases more over the weekend, we conjecture that the opening price on Monday should be subject to greater optimism bias, so that the magnitude of overnight returns and trading day reversals for Monday should exceed that for other days of the week.

Panels A and B of Table 9 compare overnight and trading day returns, respectively, for the subsample of Mondays versus other weekdays. We reconstruct the 3 x 3 schemes from Table 3 for both subsamples, using the top 33% of stocks each day by absolute dispersion of opinions. Results in Panel A (B) indicate that overnight (trading day) returns for these high disagreement stocks are uniformly larger in absolute magnitude for Mondays than for other weekdays.

26 For other recent work on the weekend effect, see Harris (1986), Jain and Joh (1988), Kamara (1997), Rogalski (1984), Schwert (2003), Smirlock and Starks (1986), and Wang et al. (1997).

At the bottom of Panels A and B, we formally test the null hypothesis that each cell in the bottom row of every 3 x 3 scheme for Mondays is no different than the analogous cell for other weekdays. In Panel A, we find the mean overnight return for Mondays is significantly larger than that for other weekdays, for three of these six high disagreement portfolios at the .05 level (and for five of the six portfolios at the .10 level). Likewise, Panel B indicates that the mean trading day reversal for Mondays is significantly larger than that for other weekdays, for all six high disagreement portfolios at the .01 level.

In tests not reported here, we analyze subsamples of: (i) the 50% of stocks each day with high transaction costs, and (ii) the 20% of these stocks with high relative short interest. Once again, as we progress to subsamples subject to greater limits to arbitrage, we find consistent evidence that overnight returns and trading day reversals become larger on both Mondays and other weekdays. Furthermore, the mean difference between overnight returns or trading day reversals on Mondays versus other weekdays also becomes larger and more significant.

Finally, Figure 4 provides additional evidence by plotting the intraday price pattern across all stocks on Mondays versus other days of the week. Results show that the source of the larger weekend overnight return and trading day reversal includes, both, a higher mean opening price and a lower mean closing price on Mondays. Here we plot the 95% confidence interval that applies to the subsample of Mondays, since this subsample has larger standard errors and thus a wider confidence interval throughout the day. Importantly, while the mean price ratios for other days of the week generally fall within this confidence interval applicable to Mondays, they are still significantly greater than 1.0 through the first 30 minutes of trading, when compared to their own 95% confidence interval. Thus, while the optimism bias at the open on Mondays exceeds that on other weekdays, the optimism bias on other weekdays is still statistically significant.[27]

5.3.2 The Intraday Price Patterns for ADRs from Different Regions of the World

We attribute our robust evidence of overnight returns and trading day reversals to the observation that dispersion of opinions tends to be relatively high at the open. We posit that this tendency is due to the overnight period of reduced trading or non-trading. Alternatively, these results could reflect some structural microstructure-based issues that might be related to the opening of trading (see Branch and Ma, 2008, and Cliff et al., 2008). In this section, we distinguish between these alternative hypotheses by examining the intraday price patterns for ADRs traded in the U.S.

Once again, according to the theory of disagreement models applied to the overnight period, the optimism bias near the open should be attenuated if there is a shorter period between the close in the ADR's home market and the open in the U.S. We examine this possibility by analyzing the intraday price patterns for the sample of all ADRs traded in the U.S. available in the TAQ database between 1996 and 2004. Since ADRs from Asia or Europe are traded in their home markets during the normal overnight period for U.S. stocks, their effective overnight non-trading period is shorter than that for U.S. stocks. As a result, any increase in dispersion of opinions due to non-trading overnight should be smaller for these ADRs than for U.S. stocks.

In Figure 5 we reproduce the intraday price pattern for all U.S. stocks from Figure 1. In addition, we provide the analogous intraday patterns for U.S. trading in three different groups of ADRs from countries: (i) in U.S. time zones whose home market opens concurrently with or later than the U.S. market (i.e., Canada and Latin America), (ii) in the Asia / Pacific region, and (iii) in European time zones. As in our earlier analysis of intraday patterns, we limit the sample

27 In tests not reported here, we also find the mean closing price on Friday is not significantly lower than that on other weekdays. This result suggests that investors do not demand a greater liquidity premium at Friday's close.

each day to all ADRs that open their U.S. trading precisely at 9:30am E.S.T., and thus have a complete set of price ratios throughout the U.S. trading day. In Panel C of Table 9 we formally compare these intraday patterns across subsamples, using mean difference t-tests across the different groups of stocks for price ratios taken during the first 30 minutes of the trading day.

Results provide further support for the implications of disagreement models. First, Figure 5 reveals that the intraday price pattern for ADRs from U.S. time zones is similar to that for U.S. stocks. In particular, the mean price ratios near the U.S. open are relatively high, and are nearly identical for these two groups of stocks. In support of this observation, the mean difference t-tests in Panel C of Table 9 indicate no significant differences between the price ratios for U.S. stocks and ADRs from U.S. time zones, over the first 30 minutes of trading.[28]

In contrast, the intraday price pattern begins the day lower for ADRs from the Asia / Pacific region, and lower still for ADRs from European time zones. In support of this observation, the mean difference t-tests in Panel C of Table 9 indicate that the mean price ratios are significantly higher for U.S. stocks than for ADRs from European time zones, at all 5-minute intervals throughout the first 30 minutes of trading. Likewise, the mean price ratios for ADRs from U.S. time zones are also significantly higher than for ADRs from European time zones, as well as for ADRs from the Asia / Pacific region, for some time intervals during the first 30 minutes of trading. Finally, while the intraday price pattern for ADRs from the Asia / Pacific region begins the trading day somewhat higher than that for ADRs from European time zones, the mean difference in price ratios for these two groups is never statistically significant.

The evidence in this section provides further corroboration supporting the implications of disagreement models as an explanation for the overnight return patterns documented throughout

28 The mean difference t-tests for the remaining intraday price ratios each day, after the first 30 minutes of trading, are not reported in Panel C, for brevity. They also indicate no significant differences across the intraday price patterns of U.S. stocks versus ADRs from U.S. time zones.

this study. These systematic differences across the intraday price patterns for U.S. stocks versus ADRs from other time zones around the world are statistically significant, and they cannot be attributed to any microstructure-based explanation related to the opening of trading in the U.S.

6. Summary and Conclusions

We document a strong tendency for the daily opening price to be high relative to the closing price, as well as the mean intraday price, when averaged across the 3000 largest U.S. stocks over the period, 1996-2004. This high opening price results in a propensity for positive overnight returns and negative trading day reversals. We show that this pattern in intraday returns can be explained by the theory of Miller (1977) and other disagreement models. Consistent with this view, we show that the evidence of positive overnight returns and trading day reversals is limited to stocks subject to high dispersion of opinions measured near the open or throughout the trading day. We further show that these overnight return patterns are exacerbated when we explore finer subsamples subject to the greater limits to arbitrage embodied in high transaction costs and binding short sale constraints (proxied by low institutional ownership and high short interest).

This overnight return behavior is robust when we use median returns rather than mean returns, when we use trade prices to measure overnight and trading day returns, and when we exclude low-price stocks. These patterns also apply to subsamples of stocks traded on the NASD or the NYSE, and to small or large stocks, although we find greater overnight returns and trading day reversals for NASD stocks and small stocks. We also find a tendency for larger overnight return patterns for stocks with greater information asymmetry (measured by PIN). In contrast, we find no tendency for closing prices to decline below the intraday average for stocks with greater overnight liquidity risk. Furthermore, we demonstrate that this overnight return behavior is stable across subperiods before and after March of 2000, and across all years of the sample period.

Finally, we find that Mondays reveal a higher opening price, and thus a larger (weekend) overnight return and trading day reversal than other days of the week. In addition, we examine the intraday price patterns for ADRs traded in the U.S., and we find a similar tendency for the U.S. opening price to exceed the average intraday price. However, the magnitude of this upward bias depends on the length of the overnight period from the close in the ADR's home market to the open in the U.S. Specifically, ADRs traded in U.S. time zones display relatively high prices near the U.S. open that are nearly identical to those for U.S. stocks. In contrast, relative prices near the U.S. open are significantly lower for ADRs from the Asia / Pacific region, and are lower still for ADRs from European time zones. These results indicate that the shorter overnight period for Asian or European stocks is associated with less upward price bias near the U.S. open. This evidence cannot be attributed to any microstructure-based explanation associated with the opening of trading in the U.S., and thereby provides further support for the predictions of disagreement models.

Throughout all of our analyses we find uniform and corroborating evidence that supports the implications of disagreement models as an explanation for this overnight return behavior. We consistently document a higher opening price, along with larger overnight returns and trading day reversals, for stocks subject to a longer overnight period, or to greater dispersion of opinions at the open and through the day, combined with more binding short sale constraints and high transaction costs. In our most stringent tests based on subsamples with high spreads and relative short interest, these results are enormous. For the subsample most prone to overpricing at the open, abnormal overnight returns average 40 basis points per day (100% per annum), and abnormal trading day reversals average -78 basis points per day (-195% per annum). On the other hand, while these return patterns are large in economic terms, they remain within the confines allowed by limits to arbitrage embodied in short sale constraints and transaction costs.

This study thus provides a unifying explanation for the here-to-fore “anomalous” overnight return behavior documented here and elsewhere (e.g., see Branch and Ma, 2008, and Cliffe et al., 2008). Furthermore, we contribute to the literature on cross-sectional return predictability. In particular, we show that overnight return predictability based on absolute and relative dispersion of opinions is concentrated among stocks with binding short sale constraints and high transaction costs. In addition, this evidence indicates that the economic forces behind disagreement models contribute to opposing price movements during the overnight period versus the trading day session. Thus, in contrast to most previous work, we show how this optimism bias can affect stock price movements both away from and back toward fundamental values, and we document how these price effects can be manifested over short time frames.

Appendix A: Data Collection for Institutional Holdings

We use low institutional ownership to proxy for short sale constraints, because it embodies both direct and indirect costs of short selling (Nagel, 2005). First, direct costs include fees to borrow stock, which can be high when the supply of loanable shares is scarce. Since institutions are the main suppliers of stock loans, low institutional ownership often reflects low supply and high direct costs of short selling. On the other hand, over the short time frames analyzed in this study, these direct costs are likely to be small compared to other direct trading costs (i.e., the spread, commission, and price impact).[29] Thus a second, more plausible reason why low institutional ownership is important in our study rests with the indirect costs of short selling. Indirect costs involve institutional and cultural constraints that effectively prevent short selling by institutional investors. Due to these constraints, most professional investors simply never sell short, and thus cannot trade against overpriced stocks they do not own (Almazan et al., 2004). Given these indirect short sale constraints, efficient pricing depends on individual investors who own the stock. However, individual stock owners may not recognize or act on any overpricing, especially over such short time frames. Consequently, stocks with low institutional ownership could experience the recurring and persistent overpricing behavior we hypothesize overnight.[30]

Quarterly data on institutional holdings are taken from CDA Spectrum 13F filings. All institutional investors that manage portfolios of $100 Million or more must file quarterly 13F reports with the SEC. These institutions include banks, insurance companies, brokerage firms, pension funds, etc. Institutions are required to report all equity holdings greater than 10,000 shares or $200,000 in value, at the end of each quarter. Consistent with prior research, we refer to institutional ownership as the equity holdings of managers that submit quarterly 13F Filings.

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29 See Asquith et al. (2005), D'Avolio (2002), Geczy et al. (2002), Jones and Lamont (2002), and Ofek et al (2004).
30 Since institutions can always buy underpriced stocks, there are no such impediments to arbitrage on the buy side.

Following other research, we address problems and inconsistencies in the quarterly 13F filings data from Thomson Financial Institutional Holdings (see Asquith et al., 2005, Gompers and Metrick, 2001, and Nagel, 2005). For example, one problem arises due to occasional missing or inaccurate data in the 13F filings on the number of shares outstanding at the end of the filing quarter. We resolve this problem by replacing the end-of-quarter shares outstanding from the Thomson Financial Institutional Holdings database with the analogous variable from CRSP.

Another potential problem has to do with stock splits, which can cause inaccuracies in the institutional holdings data. For example, an institution may submit a late 13F filing after the SEC's 45-day deadline following the end of a quarter, when a split occurred during this 45-day grace period. In this situation, CDA Spectrum adjusted the holdings record even though it should not have been adjusted for the record date. In such cases there are inaccuracies due to the failure of CDA Spectrum to properly synchronize the holdings data with the split-adjustment.

We find the magnitude of these problems is small for our sample. We use CRSP data to document all firm-quarters when a stock split occurred in the dataset on 13F filings (this includes all quarters that experience changes in shares outstanding due to stock splits or stock dividends). We find that 2.5 percent of all firm-quarters in our dataset are during quarters with stock splits.

This evidence suggests that the potential problem associated with stock splits and late 13F filings is likely to have a minimal impact on our results. Still, we have followed several procedures to investigate the impact of this potential problem. First, we have omitted from our analysis all observations during firm-quarters when a stock split or stock dividend occurs. Second, we have replaced all daily observations on institutional ownership during a quarter with a stock split with the previous quarter's value of the percent of institutional ownership for that firm. All these procedures lead to robust results consistent with those presented in this study.

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Table 1. Descriptive Statistics and Correlations across Variables

The initial sample includes the 3,000 largest U.S. stocks selected each year over the period, 1996-2004. This analysis is applied to the subsample of these stocks each day with nonmissing TAQ data on quotes. The focus of this study is on percentage overnight and trading day returns, measured as 100 times the log of the price relative using quote midpoints at the open and the close: raw_cto = actual close-to-open (overnight) return, and raw_otc = actual open-to-close (trading day) return. We also analyze the difference between overnight and trading day returns (raw_DIFF = raw_cto - raw_otc), as well as this same difference after deducting transaction costs measured as the average spread at the day's open and close: raw_DIFF-TC = raw_DIFF - [SPR(open)+SPR(close)]/2. In addition, we examine daily abnormal returns by adjusting for market movements over the same time frame. These abnormal returns are labelled: cto, otc, DIFF, and DIFF-TC, and are calculated as the actual raw return over each time frame minus the return on the value-weighted portfolio of all stocks in the sample, measured over the same time frame. Finally, we also examine daily abnormal returns measured over the 24-hour periods from close-to-close and from open-to-open: ctc, and oto.

We consider four proxies for dispersion of opinions, including two measures of absolute dispersion throughout the entire trading day, and two measures of relative dispersion near the open versus the rest of the trading day. The two measures of absolute dispersion are: (i) Abs_TURN = daily share turnover as a percent of shares outstanding (multiplied by 1,000), and (ii) Abs_VOL = the standard deviation across 30-minute returns throughout the trading day. The two measures of relative dispersion are: (i) Rel_TURN = the difference between share turnover during the first hour of the trading day and turnover per hour during the rest of the trading day, as a percent of turnover per hour during the entire trading day, and (ii) Rel_VOL = the difference between the standard deviation across 30-minute returns during the first hour of trading and the standard deviation across 30-minute returns during the rest of the trading day.

Next, we consider limits to arbitrage for each firm, in the form of two proxies for short sale constraints and three measures of transaction costs. Our two proxies for short sale constraints are: (i) the percent of institutional ownership (INST) computed from quarterly 13F Filings using aggregate shares held by institutions as a percent of total shares outstanding, and (ii) relative short interest (RSI) measured as the number of shares sold short each month divided by total shares outstanding. Our three measures of daily transaction costs include: (i) the bid-ask spread as a percent of the quote midpoint at the open (SPR(open)), (ii) the percent spread at the close (SPR(close)), and (iii) the daily effective half spread (Spread). Finally, firm size (SIZE) is proxied by daily market capitalization.

The descriptive statistics in Panels A and B are calculated by first computing the cross-sectional mean (or median) each day, and then averaging these means (or medians) across all days in the sample period. The standard deviation of the time series average across daily means is then used to construct the t-test for each statistic in Panels A and B. Similarly, the Spearman correlations in Panel C are calculated by first computing the cross-sectional correlation each day, and then averaging these correlations across all days in the sample. Once again, the standard deviation of the time series average correlation is used to construct the t-test for each average correlation in Panel C.

Panel A: Descriptive Statistics for Close-to-Open (Overnight) Returns, Open-to-Close (Trading Day) Returns, and 24-Hour Returns

	Unadjusted Overnight & Trading Day Returns				Market-Adjusted Overnight & Trading Day Returns				24-Hour Returns	
	raw_cto	raw_otc	raw_DIFF	raw_DIFF-TC	cto	otc	DIFF	DIFF-TC	ctc	oto
Mean (%)	.080	-.049	.130	-.766	.020	-.068	.088	-.807	-.048	.021
Median (%)	.031	-.048	.079	-.681	-.029	-.066	.038	-.722	-.094	-.032
T (H_0: mean=0)	7.4 **	-2.4 *	5.8 **	-34.8 **	4.0 **	-7.0 **	7.6 **	-61.7 **	-4.7 **	1.9
Avg # Firms/Day	2584	2585	2584	2491	2584	2584	2584	2491	2584	2584

* indicates significance at the .05 level; and ** indicates significance at the .01 level.

Table 1, continued

Panel B: Descriptive Statistics for Measures of Dispersion of Opinions, Short Sale Constraints, Transaction Costs, and Firm Size

	Dispersion of Opinions				Short Sale Constraints		Transaction Costs			
	Abs_TURN	Abs_VOL	Rel_TURN	Rel_VOL	INST	RSI	SPR(open)	SPR(close)	Spread	SIZE ($000)
Mean (%)	.72	.61	39.0	.014	45.6	3.0	.98	.78	.21	4,450,533
Median (%)	.34	.48	37.5	.009	48.7	1.4	.72	.53	.16	917,918
T (H_0: mean=0)	79.4 **	142.3 **	396.9 **	9.5 **	259.8 **	110.8 **	199.5 **	102.3 **	98.6 **	187.6 **
Avg # Firms/Day	2585	2574	2557	2504	2614	2553	2530	2543	2555	2585

Panel C: Spearman Correlations

Abs_TURN	1.00									
Abs_VOL	.450 **	1.00								
Rel_TURN	.206 **	.069 **	1.00							
Rel_VOL	.161 **	.216 **	.072 **	1.00						
INST	.254 **	.060 **	-.015 **	.042 **	1.00					
RSI	.538 **	.292 **	.138 **	.120 **	.288 **	1.00				
SPR(open)	-.206 **	.158 **	-.193 **	-.030 **	-.163 **	-.168 **	1.00			
SPR(close)	-.191 **	.136 **	-.148 **	-.058 **	-.178 **	-.192 **	.489 **	1.00		
Spread	-.104 **	.258 **	-.172 **	-.028 **	-.314 **	-.179 **	.616 **	.578 **	1.00	
SIZE	.099 **	-.106 **	.206 **	.064 **	.183 **	.152 **	-.539 **	-.525 **	-.759 **	1.00
cto	.060 **	.045 **	.025 **	.017 **	-.008 **	.023 **	.021 **	.001	.021 **	-.012 **
otc	.008 **	-.012 *	-.019 **	-.012 **	.005 **	-.027 **	-.003 *	-.017 **	-.018 **	.025 **
DIFF	.012 **	.022 **	.025 **	.017 **	-.006 **	.032 **	.008 **	.014 **	.021 **	-.024 **
DIFF-TC	.068 **	-.029 **	.068 **	.027 **	.047 **	.084 **	-.206 **	-.193 **	-.157 **	.127 **

* indicates significance at the .05 level; and ** indicates significance at the .01 level.

Table 2. Overnight and Trading Day Returns across Portfolios Double-Sorted by:
(1) Relative Dispersion of Opinions Near the Open, and (2) Institutional Ownership

This table reports mean overnight (close-to-open, or cto) and trading day (open-to-close, or otc) abnormal returns, for four different 3 x 3 partitioning schemes of portfolios. In each 3 x 3 scheme, we independently double-sort the sample every day into terciles, based on the firm's size-adjusted: (1) relative dispersion of opinions at the open, and (2) institutional ownership. The rows in each scheme represent low, medium, or high relative dispersion of opinions, and the columns reflect low, medium, or high institutional ownership.

The analysis is applied to the subsample of the largest 3,000 U.S. firms each year, for which TAQ data are available. Mean overnight returns are provided in Panel A, and mean trading day returns appear in Panel B. The scheme on the left (right) side of each Panel uses share turnover (return volatility) to proxy for relative dispersion of opinions.

For every portfolio in each 3 x 3 scheme, we first compute the mean return across all firms each day, and then average these cross-sectional means across all days in the sample period. The time series standard error is then used to obtain the T-statistic for each portfolio's average daily returns. At the bottom of each column in every 3 x 3 scheme, we provide the mean-difference T-test across portfolios with high versus low relative dispersion of opinions, conditional on institutional ownership.

Panel A. Abnormal Overnight Returns (close-to-open, or cto%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	-.02 **	-.03 **	-.03 **	.03 **	.01	.00
Med	.02 **	.00	.00	-.01	-.02 **	-.01
High	.08 **	.04 **	.02 **	.10 **	.04 **	.01
High-Low	.10	.07	.05	.07	.03	.01
T-stat	12.8 **	9.7 **	8.6 **	8.7 **	5.0 **	2.4 *

Panel B. Abnormal Trading Day Returns (open-to-close, or otc%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	-.03 *	-.01	-.02	-.04 *	-.02	-.02
Med	-.08 **	-.05 **	-.05 **	-.06 **	-.06 **	-.07 **
High	-.16 **	-.11 **	-.09 **	-.20 **	-.10 **	-.06 **
High-Low	-.14	-.10	-.07	-.17	-.09	-.04
T-stat	-12.7 **	-9.9 **	-7.5 **	-8.3 **	-4.7 **	-2.1 *

* indicates statistical significance at the .05 level; ** at the .01 level.

Table 3. Overnight and Trading Day Returns across Portfolios Double-Sorted by:
(1) Relative Dispersion of Opinions Near the Open, and (2) Institutional Ownership,
for Subsample with High Absolute Dispersion of Opinions throughout the Trading Day

This table reports mean overnight (close-to-open, or cto) and trading day (open-to-close, or otc) abnormal returns, for four different 3 x 3 partitioning schemes of portfolios. In each 3 x 3 scheme, we independently double-sort the sample every day into terciles, based on the firm's size-adjusted: (1) relative dispersion of opinions at the open, and (2) institutional ownership. The rows in each scheme represent low, medium, or high relative dispersion of opinions, and the columns reflect low, medium, or high institutional ownership.

The sample selection begins with the subsample of the largest 3,000 U.S. firms each year for which TAQ data are available. We then further limit the sample to the 33% of stocks each day with the highest size-adjusted absolute dispersion of opinions throughout the day.

Mean overnight returns are provided in Panel A, and mean trading day returns appear in Panel B. The scheme on the left (right) side of each Panel uses share turnover (return volatility) to proxy for absolute and relative dispersion of opinions. For every portfolio in each 3 x 3 scheme, we first compute the mean return across all firms each day, and then average these cross-sectional means across all days in the sample period. The time series standard error is then used to obtain the T-statistic for each portfolio's average daily returns. At the bottom of each column in every 3 x 3 scheme, we provide the mean-difference T-test across portfolios with high versus low relative dispersion of opinions, conditional on institutional ownership.

Panel A. Abnormal Overnight Returns (close-to-open, or cto%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	.05 **	.04 **	.00	.14 **	.10 **	.06 **
Med	.13 **	.10 **	.04 **	.09 **	.06 **	.05 **
High	.19 **	.13 **	.06 **	.21 **	.14 **	.08 **
High - Low	.14	.09	.06	.07	.04	.02
T-stat	10.1 **	7.6 **	7.6 **	7.6 **	4.1 **	2.2 *

Panel B. Abnormal Trading Day Returns (open-to-close, or otc%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	-.08 **	-.06 **	-.05 **	-.09 **	-.07 **	-.07 **
Med	-.19 **	-.16 **	-.09 **	-.26 **	-.21 **	-.17 **
High	-.31 **	-.23 **	-.15 **	-.37 **	-.27 **	-.17 **
High - Low	-.23	-.17	-.10	-.29	-.19	-.10
T-stat	-10.2 **	-9.3 **	-7.4 **	-11.0 **	-7.9 **	-4.2 **

* indicates statistical significance at the .05 level; ** at the .01 level.

Table 4. Overnight and Trading Day Returns across Portfolios Double-Sorted by:
(1) Relative Dispersion of Opinions Near the Open, and (2) Institutional Ownership,
for Subsample with High Transaction Costs and High Absolute Dispersion of Opinions

This table reports mean overnight (close-to-open, or cto) and trading day (open-to-close, or otc) abnormal returns, for four different 3 x 3 partitioning schemes of portfolios. In each 3 x 3 scheme, we independently double-sort the sample every day into terciles, based on the firm's size-adjusted: (1) relative dispersion of opinions at the open, and (2) institutional ownership. The rows in each scheme represent low, medium, or high relative dispersion of opinions, and the columns reflect low, medium, or high institutional ownership.

The sample selection begins with the subsample of the largest 3,000 U.S. firms each year for which TAQ data are available. We then further limit the sample to: (i) the 50% of stocks each day with the highest effective half spread, and (ii) the 33% of these stocks with the highest size-adjusted absolute dispersion of opinions throughout the day.

Mean overnight returns are provided in Panel A, and mean trading day returns appear in Panel B. The scheme on the left (right) side of each Panel uses share turnover (return volatility) to proxy for absolute and relative dispersion of opinions. For every portfolio in each 3 x 3 scheme, we first compute the mean return across all firms each day, and then average these cross-sectional means across all days in the sample period. The time series standard error is then used to obtain the T-statistic for each portfolio's average daily returns. At the bottom of each column in every 3 x 3 scheme, we provide the mean-difference T-test across portfolios with high versus low relative dispersion of opinions, conditional on institutional ownership.

Panel A. Abnormal Overnight Returns (close-to-open, or cto%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	.09 **	.09 **	.03 **	.20 **	.18 **	.11 **
Med	.19 **	.15 **	.08 **	.15 **	.11 **	.08 **
High	.27 **	.22 **	.13 **	.31 **	.23 **	.14 **
High - Low	.19	.13	.10	.11	.06	.03
T-stat	9.6 **	7.9 **	8.9 **	7.8 **	3.8 **	3.1 **

Panel B. Abnormal Trading Day Returns (open-to-close, or otc%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
Low	-.08 **	-.10 **	-.04	-.09 *	-.10 **	-.08 *
Med	-.21 **	-.20 **	-.12 **	-.37 **	-.33 **	-.24 **
High	-.40 **	-.33 **	-.22 **	-.49 **	-.41 **	-.26 **
High - Low	-.31	-.23	-.18	-.40	-.31	-.19
T-stat	-9.2 **	-8.5 **	-9.6 **	-11.9 **	-9.4 **	-6.0 **

* indicates statistical significance at the .05 level; ** at the .01 level.

Table 5. Overnight and Trading Day Returns across Portfolios Double-Sorted by: (1) Relative Dispersion of Opinions Near the Open, and (2) Institutional Ownership, for Subsample with High Transaction Costs, High Relative Short Interest, and High Absolute Dispersion of Opinions

This table reports mean overnight (close-to-open, or cto) and trading day (open-to-close, or otc) abnormal returns, for four different 3 x 3 partitioning schemes of portfolios. In each 3 x 3 scheme, we independently double-sort the sample every day into terciles, based on the firm's size-adjusted: (1) relative dispersion of opinions at the open, and (2) institutional ownership. The rows in each scheme represent low, medium, or high relative dispersion of opinions, and the columns reflect low, medium, or high institutional ownership.

The sample selection begins with the subsample of the largest 3,000 U.S. firms each year for which TAQ data are available. We then further limit the sample to: (i) the 50% of stocks each day with the highest effective half spread, (ii) the 20% of these firms with the highest relative short interest, and (iii) the 33% of these stocks with the highest absolute dispersion of opinions.

Mean overnight returns are provided in Panel A, and mean trading day returns appear in Panel B. The scheme on the left (right) side of each Panel uses share turnover (return volatility) to proxy for absolute and relative dispersion of opinions. For every portfolio in each 3 x 3 scheme, we first compute the mean return across all firms each day, and then average these cross-sectional means across all days in the sample period. The time series standard error is then used to obtain the T-statistic for each portfolio's average daily returns. At the bottom of each column in every 3 x 3 scheme, we provide the mean-difference T-test across portfolios with high versus low relative dispersion of opinions, conditional on institutional ownership.

Panel A. Abnormal Overnight Returns (close-to-open, or cto%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative to the Entire Trading Day	Size-Adjusted Institutional Ownership: Low	Medium	High	Size-Adjusted Institutional Ownership: Low	Medium	High
Low	.16 **	.08 *	.07 **	.33 **	.28 **	.18 **
Med	.30 **	.23 **	.15 **	.32 **	.26 **	.16 **
High	.37 **	.24 **	.18 **	.40 **	.28 **	.20 **
High - Low	.21	.16	.11	.07	.00	.02
T-stat	4.2 **	3.9 **	3.9 **	2.7 **	.1	.7

Panel B. Abnormal Trading Day Returns (open-to-close, or otc%)

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership: Low	Medium	High	Size-Adjusted Institutional Ownership: Low	Medium	High
Low	-.27 **	-.29 **	-.15 **	-.17 **	-.22 **	-.21 **
Med	-.42 **	-.39 **	-.23 **	-.67 **	-.50 **	-.38 **
High	-.57 **	-.40 **	-.34 **	-.78 **	-.58 **	-.41 **
High - Low	-.29	-.12	-.19	-.61	-.36	-.20
T-stat	-3.9 **	-1.7 *	-4.0 **	-10.0 **	-5.0 **	-3.0 **

* indicates statistical significance at the .05 level; ** at the .01 level.

Table 6. Regression between Overnight or Trading Day Returns and Measures of Dispersion of Opinions and Short Sale Constraints

This Table presents the results of estimating the following regression model:

$$(cto, otc) = a + b_1\,Rel\_Disp + b_2\,Abs\_Disp + b_3\,INST + b_4\,(INST*Rel\_Disp) + b_5\,(INST*Abs\_Disp) + b_6\,Size + \varepsilon$$

Results are provided for two different dependent variables: abnormal overnight returns (cto), and abnormal trading day returns (otc). The variable, Abs_Disp, refers to our proxies for absolute dispersion of opinions measured throughout the trading day. We use two proxies for Abs_Disp: (i) daily share turnover as a percent of shares outstanding, and (ii) the standard deviation across all 30-minute returns throughout the trading day. The variable, Rel_Disp, refers to our measures of relative dispersion of opinions near the open versus the rest of the trading day. We use two proxies to capture relative dispersion of opinions: (i) the difference between share turnover during the first hour of trading and turnover per hour during the rest of the trading day, as a percent of turnover per hour during the entire trading day, and (ii) the difference between the standard deviation across 30-minute returns during the first hour of trading and the standard deviation across 30-minute returns during the rest of the trading day. The variable, INST, is the firm's percent of institutional ownership. Finally, we also include firm size.

Our regression variables, Rel_DISP and Abs_DISP, are measured each day as the average daily values over the previous 20 trading days. INST is assigned the value for institutional ownership over the previous quarter. Firm size is the firm's average daily market capitalization over the previous 20 trading days.

We estimate rank regressions, by transforming the main explanatory variables into decile ranks every day. We then scale the decile ranks to range from -0.5 to +0.5, to facilitate interpretation of the results. We first estimate the cross-sectional regression coefficients across all stocks for each day. Second, we compute the mean coefficients across all trading days in the sample period. The t-statistic for each mean coefficient is computed using the standard error of each time series mean.

Dispersion Measure:		Share Turnover		Stock Return Volatility	
Dependent Variable:		cto%	otc%	cto%	otc%
Intercept	a	.01 *	-.07 **	.02 **	-.07 **
Rel_Disp	b_1	.14 **	-.17 **	.02 **	-.10 **
Abs_Disp	b_2	.13 **	-.15 **	.21 **	-.27 **
INST	b_3	-.08 **	.10 **	-.06 **	.07 **
INST * Rel_Disp	b_4	-.07 **	.14 **	-.08 **	.22 **
INST * Abs_Disp	b_5	-.05 **	-.01	-.13 **	.09 **
Size	b_6	-.15 **	.10 **	-.05 **	-.01
Avg # Firms / Day		2,563	2,563	2,455	2,455
Avg Adjusted R^2		.031	.033	.036	.058

* indicates statistical significance at the .05 level; and ** indicates significance at the .01 level.

Table 7. Portfolio Approach: Extensions and Robustness Tests
Based on Alternative Return Measures and Subsamples

This Table presents eleven robustness tests. In every test, we reproduce the portfolio approach from Table 3 in which we analyze the 33% of stocks each day with the highest absolute dispersion of opinions (Abs_DISP). We then focus on the difference between elements in the bottom versus the top row of every 3 x 3 scheme, double-sorted by relative dispersion of opinions (Rel_DISP) and institutional ownership (INST). That is, we present mean abnormal returns for "hedge portfolios" that are long the tercile with high relative dispersion near the open (bottom row by Rel_DISP) and short the tercile with low values (top row by Rel_DISP), conditional on institutional ownership (the column). For brevity, within each 3 x 3 scheme, we only report results for the terciles (columns) based on low and high institutional ownership, respectively. The base-case reproduces the abnormal "hedge portfolio" returns (i.e., mean difference t-tests) from the 3 x 3 schemes in Table 3. In each subsequent test (row), we change only one aspect of the analysis to facilitate comparison with the base case.

	Difference across Portfolios (Rows) with High vs Low Rel_DISP							
	Overnight Returns (cto%)				Trading Day Returns (otc%)			
Rel_DISP Measure:	Turnover		Volatility		Turnover		Volatility	
Institutional Ownership:	Low	High	Low	High	Low	High	Low	High
Base Case (Table 3)	.14	.06	.07	.02	-.23	-.10	-.29	-.10
t-ratio	10.1 **	7.6 **	7.6 **	2.2 *	-10.2 **	-7.4 **	-11.0 **	-4.2 **
1. Using the Median Return across stocks each day	.12	.05	.06	.03	-.25	-.08	-.20	-.08
	10.2 **	8.8 **	9.4 **	5.8 **	-12.4 **	-6.5 **	-8.1 **	-3.0 **
2. Using Trade Prices to Measure Returns	.15	.07	.07	.02	-.24	-.11	-.29	-.10
	10.7 **	8.9 **	7.2 **	2.2 *	-10.7 **	-8.1 **	-11.0 **	-4.1 **
3. No Low-Price Stocks (with Price < $5)	.12	.06	.05	.01	-.19	-.10	-.23	-.09
	8.7 **	6.9 **	5.9 **	1.6	-8.7 **	-7.2 **	-8.8 **	-3.7 **
4. NASD Stocks	.13	.06	.07	.00	-.31	-.14	-.45	-.20
	4.5 **	4.0 **	4.2 **	-.3	-6.9 **	-5.3 **	-10.8 **	-4.9 **
5. NYSE Stocks	.04	.03	.04	.03	-.08	-.06	-.04	-.03
	3.5 **	5.4 **	5.5 **	5.1 **	-4.8 **	-5.8 **	-2.1 *	-2.0 *
6. Small Stock Quintile	.17	.08	.11	.00	-.30	-.19	-.36	-.21
	5.8 **	4.9 **	5.2 **	.2	-6.1 **	-7.2 **	-8.3 **	-5.5 **
7. Large Stock Quintile	.09	.06	.02	-.01	-.12	-.06	-.17	-.08
	3.6 **	4.2 **	1.5	-1.2	-3.0 **	-2.5 *	-5.2 **	-2.7 *
8. Low PIN Quintile	.13	.06	.01	-.02	-.23	-.05	-.16	-.06
	4.5 **	4.4 **	.8	-1.8	-5.5 **	-2.3 *	-4.5 **	-2.0 *
9. High PIN Quintile	.17	.05	.11	.03	-.23	-.09	-.27	-.11
	6.7 **	4.1 **	5.5 **	2.2 *	-5.7 **	-4.0 **	-7.3 **	-3.4 **
10. Low Liquidity Risk	.09	.06	.08	.03	-.24	-.10	-.26	-.09
	4.3 **	4.7 **	4.9 **	2.4 *	-5.6 **	-4.5 **	-7.0 **	-2.9 **
11. High Liquidity Risk	.10	.06	.08	.03	-.14	-.09	-.23	-.08
	4.1 **	4.1 **	4.7 **	1.7	-3.3 **	-3.6 **	-6.2 **	-2.2 *

* indicates statistical significance at the .05 level, and ** indicates significance at the .01 level.

Table 8. Portfolio Approach: Stability Tests for Subperiods

This Table presents stability tests on subperiods of our sample. For every subperiod, we reproduce the portfolio approach from Table 3 in which we analyze the 33% of stocks each day with the highest absolute dispersion of opinions (Abs_DISP). We then focus on the difference between elements in the bottom versus the top row of every 3 x 3 scheme, double-sorted by relative dispersion of opinions (Rel_DISP) and institutional ownership (INST). That is, we present mean abnormal returns for "hedge portfolios" that are long the tercile with high relative dispersion near the open (bottom row by Rel_DISP) and short the tercile with low values (top row by Rel_DISP), conditional on institutional ownership (the column). For brevity, within each 3 x 3 scheme, we only report results for the terciles (columns) based on low and high institutional ownership, respectively. The base-case reproduces the abnormal "hedge portfolio" returns (i.e., mean difference t-tests) for the entire sample period, from the 3 x 3 schemes in Table 3. In each subsequent stability test (row), we apply the same approach to different subperiods.

Difference across Portfolios (Rows) with High vs Low Rel_DISP

	Overnight Returns (cto%)				Trading Day Returns (otc%)			
Rel_DISP Measure:	Turnover		Volatility		Turnover		Volatility	
Institutional Ownership:	Low	High	Low	High	Low	High	Low	High
Base Case (Table 3)	.14	.06	.07	.02	-.23	-.10	-.29	-.10
t-ratio	10.1 **	7.6 **	7.6 **	2.2 *	-10.2 **	-7.4 **	-11.0 **	-4.2 **
Before March 1, 2000	.14	.09	.11	.07	-.20	-.10	-.25	-.10
	9.1 **	8.3 **	9.5 **	8.0 **	-7.3 **	-5.8 **	-7.8 **	-7.6 **
After March 1, 2000	.14	.04	.04	-.03	-.26	-.10	-.31	-.11
	6.4 **	3.4 **	2.8 **	-2.6 *	-7.4 **	-4.8 **	-8.0 **	-2.8 **
1996	.04	.06	.05	.03	-.16	-.09	.03	-.01
	1.6	3.8 **	2.8 **	2.1 *	-3.5 **	-2.6 *	.7	-.2
1997	.06	.08	.04	.02	-.14	-.12	.06	.06
	2.8 **	3.1 **	2.2 *	1.0	-3.4 **	-3.0 **	1.1	1.4
1998	.13	.10	.11	.07	-.17	-.14	-.17	-.14
	4.1 **	4.2 **	5.4 **	3.7 **	-3.3 **	-4.1 **	-2.6 *	-2.2 *
1999	.27	.11	.18	.14	-.29	-.06	-.79	-.25
	6.7 **	5.3 **	6.3 **	8.1 **	-3.8 **	-1.7	-10.6 **	-4.6 **
2000	.26	.14	.13	-.01	-.57	-.26	-.65	-.29
	5.1 **	4.1 **	3.2 **	-.1	-7.3 **	-4.9 **	-5.7 **	-2.4 *
2001	.15	-.01	.07	-.02	-.29	-.07	-.48	-.05
	2.6 *	-.3	2.0 *	-.8	-3.2 **	-1.5	-4.7 **	-.5
2002	.10	.01	.01	-.03	-.10	-.08	-.25	-.08
	1.7	.3	.3	-1.0	-1.1	-1.5	-2.9 **	-1.0
2003	.18	.06	.03	-.03	-.12	-.05	-.17	-.10
	5.0 **	2.9 **	1.1	-1.9	-1.8	-1.7	-2.7 *	-1.6
2004	.08	.01	.01	-.03	-.25	-.03	-.14	-.07
	2.3 *	1.0	.2	-1.9	-4.9 **	-1.2	-2.5 *	-1.3

* indicates statistical significance at the .05 level, and ** indicates significance at the .01 level.

Table 9. Overnight and Trading Day Returns and the Length of the Overnight Period

This table provides evidence regarding the behavior of overnight and trading day returns across Mondays versus other days of the week, and across subsamples of ADRs from different regions of the world. These comparisons involve overnight periods of different lengths.

Panels A and B report mean overnight and trading day abnormal returns, respectively, for different 3 x 3 schemes based on Mondays versus other weekdays. We also present mean difference t-tests comparing abnormal returns in the bottom row of each 3 x 3 scheme for Mondays versus other weekdays. In Panels A and B we analyze the 33% of U.S. stocks each day with the highest absolute dispersion of opinions.

In Panel C we compare the intraday price patterns from Figure 5, across all U.S. stocks and subsamples of ADRs from different regions of the world. These different groups of ADRs have overnight periods of different lengths between the close in the home market and the open in the U.S.

Panel A. Abnormal Overnight Returns (cto%) for Mondays versus Other Weekdays

Size-Adjusted Dispersion of Opinions:	Share Turnover			Stock Return Volatility		
Near the Open Relative To the Entire Trading Day	Size-Adjusted Institutional Ownership			Size-Adjusted Institutional Ownership		
	Low	Medium	High	Low	Medium	High
	Mondays					
Low	.07 **	.08 **	.01	.17 **	.13 **	.07 **
Med	.05	.06 **	.01	.10 **	.07 **	.07 **
High	.25 **	.18 **	.11 **	.24 **	.21 **	.12 **
	Other Weekdays					
Low	.04 **	.03 *	-.01	.13 **	.09 **	.06 **
Med	.02 *	.02 *	.01	.09 **	.05 **	.04 **
High	.19 **	.12 **	.06 **	.20 **	.12 **	.07 **
	Mean Difference T-tests: Bottom Row across 3 x 3 Schemes					
(Mondays - Other Weekdays)	.06	.06	.05	.04	.09	.05
T-stat	1.8	2.1 *	2.4 *	1.2	2.8 **	1.9

Panel B. Abnormal Trading Day Returns (otc%) for Mondays versus Other Weekdays

	Low	Medium	High	Low	Medium	High
	Mondays					
Low	-.22 **	-.25 **	-.20 **	-.31 **	-.27 **	-.29 **
Med	-.26 **	-.29 **	-.19 **	-.34 **	-.31 **	-.28 **
High	-.50 **	-.39 **	-.31 **	-.57 **	-.47 **	-.40 **
	Other Weekdays					
Low	-.04	.01	.00	-.03	-.03	-.02
Med	-.06 *	-.04	-.02	-.24 **	-.19 **	-.14 **
High	-.25 **	-.18 **	-.11 **	-.33 **	-.22 **	-.12 **
	Mean Difference T-tests: Bottom Row across 3 x 3 Schemes					
(Mondays - Other Weekdays)	-.24	-.22	-.21	-.24	-.25	-.28
T-stat	-3.6 **	-3.7 **	-4.4 **	-3.1 **	-3.6 **	-4.2 **

* indicates statistical significance at the .05 level; ** at the .01 level.

Table 9, Continued

Panel C. Comparing the Intraday Price Patterns During the First 30 Minutes of Trading Across U.S. Stocks and Subsamples of ADRs from Different Regions of the World, With Different Overnight Periods between Close in Home Market and Open in U.S.

This Panel presents the mean intraday price ratios at 5-minute intervals, over the first 30 minutes of the trading day, for the patterns plotted in Figure 5. These intraday price ratios are provided for U.S. stocks and for three groups of ADRs from countries: (i) in the U.S. time zone whose home market opens concurrently with or later than the U.S. market, (ii) in Asia / Pacific time zones, and (iii) in European time zones. In addition, this Table provides mean difference t-tests across price ratios for the different subsamples of stocks, at each 5-minute interval. This analysis is applied to the subsample of the largest 3,000 U.S. firms each year, for which TAQ data are available during the entire trading day. Likewize, we analyze the subsamples of ADRs from these three regions, for which TAQ data are available. First, for each day we compute the average price ratio at every time (T) across all stocks in each sample analyzed. Second, we compute the time series mean of these cross-sectional average price ratios, for all days in the sample period. The mean-difference t-tests incorporate the standard errors of these time series means.

	Mean Intraday Price Ratios During First 30 Minutes of Trading						
Subsample (i)[1]	9:30	9:35	9:40	9:45	9:50	9:55	10:00
1. U.S. Stocks	1.00079	1.00072	1.00063	1.00056	1.00049	1.00041	1.00037
ADRs from:							
2. US time zone	1.00081	1.00071	1.00057	1.00057	1.00056	1.00048	1.00047
3. Asia/Pacific	1.00053	1.00046	1.00041	1.00032	1.00026	1.00018	1.00015
4. Europe	1.00032	1.00033	1.00029	1.00024	1.00018	1.00013	1.00010
Subsample (i-j)	Mean Difference T-Tests across Subsamples of Stocks						
Mean Diff (1-2)	-.00003	.00001	.00006	-.00001	-.00007	-.00007	-.00011
Mean Diff (1-3)	.00026	.00026	.00022	.00023	.00023	.00023	.00021
Mean Diff (1-4)	.00047 ***	.00038 **	.00034 **	.00031 **	.00031 **	.00028 *	.00027 *
Mean Diff (2-3)	.00029	.00025	.00016	.00024	.00030 *	.00030 *	.00032 **
Mean Diff (2-4)	.00050	.00038 *	.00028	.00032 *	.00038 **	.00035 **	.00037 **
Mean Diff (3-4)	.00021	.00013	.00012	.00008	.00008	.00005	.00006

* indicates a significant mean difference t-test at the .10 level; ** at the .05 level; and *** at the .01 level.

1 There are an average of 1,929 firms per day for the sample of U.S. stocks, 10 ADRs per day from U.S. time zones, 21 ADRs per day from the Asia / Pacific region, and 51 ADRs per day from European time zones.

Figure 1. Intraday Price Pattern
Ratio of Midquote at Time T to Average Intraday Midquote
across All U.S. Stocks and Days

This intraday price pattern traces out the ratio of the midquote at different times (T) during the trading day, to the intraday average midquote, where this intraday average is computed across all 30-minute intraday intervals excluding quotes in the first and last 30 minutes of the trading day. These intraday price ratios are computed for each stock at 5-minute intervals over the first and last 30-minutes of the trading day, and at 30-minute intervals over the rest of the trading day. First, for each day we average this price ratio at every intraday time (T) across all stocks in the sample. Second, we compute the time series mean of these daily cross-sectional averages across all days in the sample period. The 95 percent confidence interval about a ratio of 1.0 is constructed using the standard error of the time series mean across all days, at each time (T).

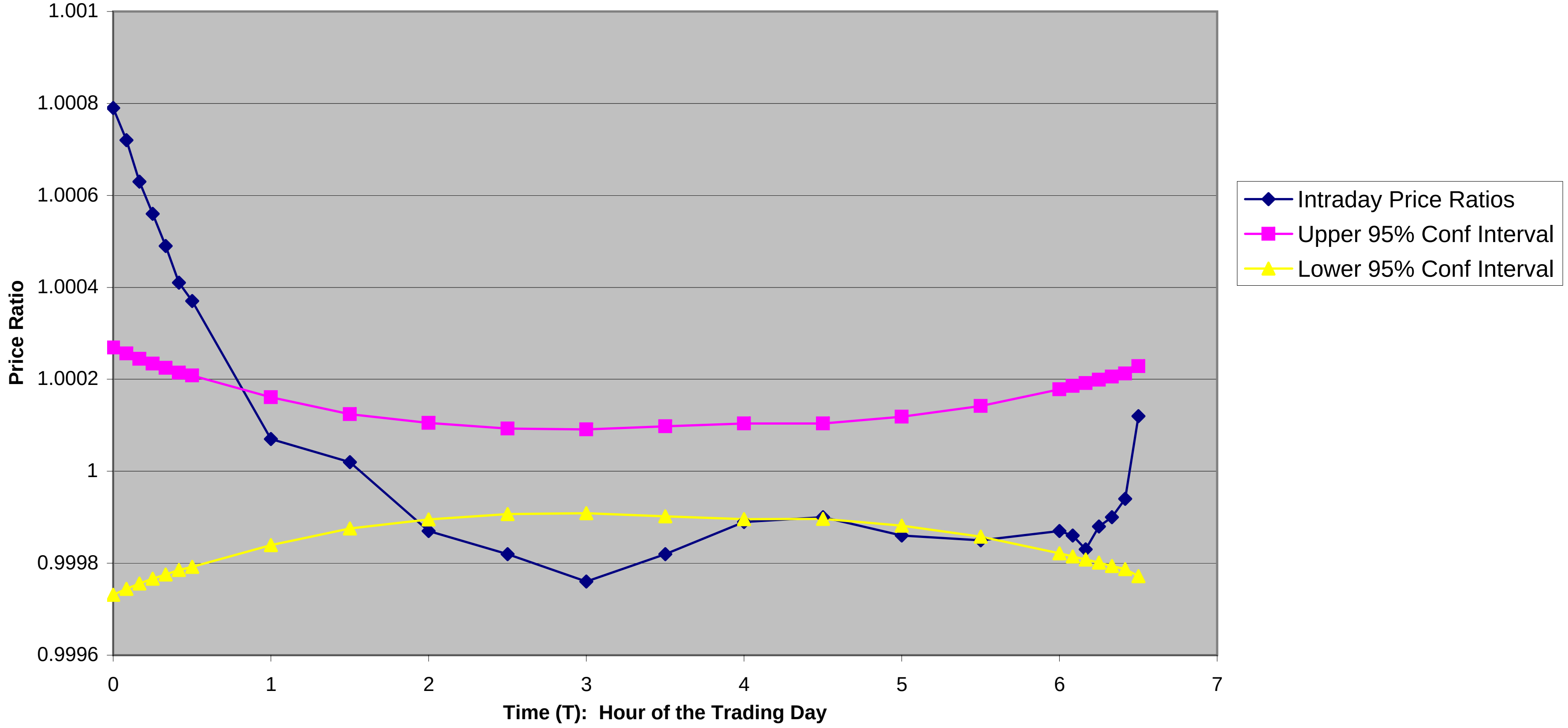

Figure 2. Intraday Price Pattern
Ratio of Midquote at Time T to Average Intraday Midquote
for Quintiles of Firms Sorted by Institutional Ownership

These intraday price patterns trace out the ratio of the midquote at time (T) to the average intraday midquote, where this intraday average is computed across all 30-minute intraday intervals excluding quotes in the first and last 30 minutes of the trading day. These price ratios are provided at 5-minute intervals over the first and last 30-minutes of the trading day, and at 30-minute intervals over the rest of the trading day. First, for each day we average this price ratio at every time (T) across all stocks in each quintile based on institutional ownership. Next, for each quintile we compute the time series average of these daily cross-sectional means across all days in the sample period.

The 95 percent confidence interval about a ratio of 1.0 is constructed using the standard error of the time series mean at each time (T), using only the bottom quintile of stocks each day with low institutional ownership. This quintile has the largest standard errors for different times (T) throughout the day, and thus has the widest confidence interval. Therefore, comparison of the intraday pattern for other quintiles with this confidence interval represents a conservative approach to determine the statistical significance of these intraday price patterns throughout the trading day.

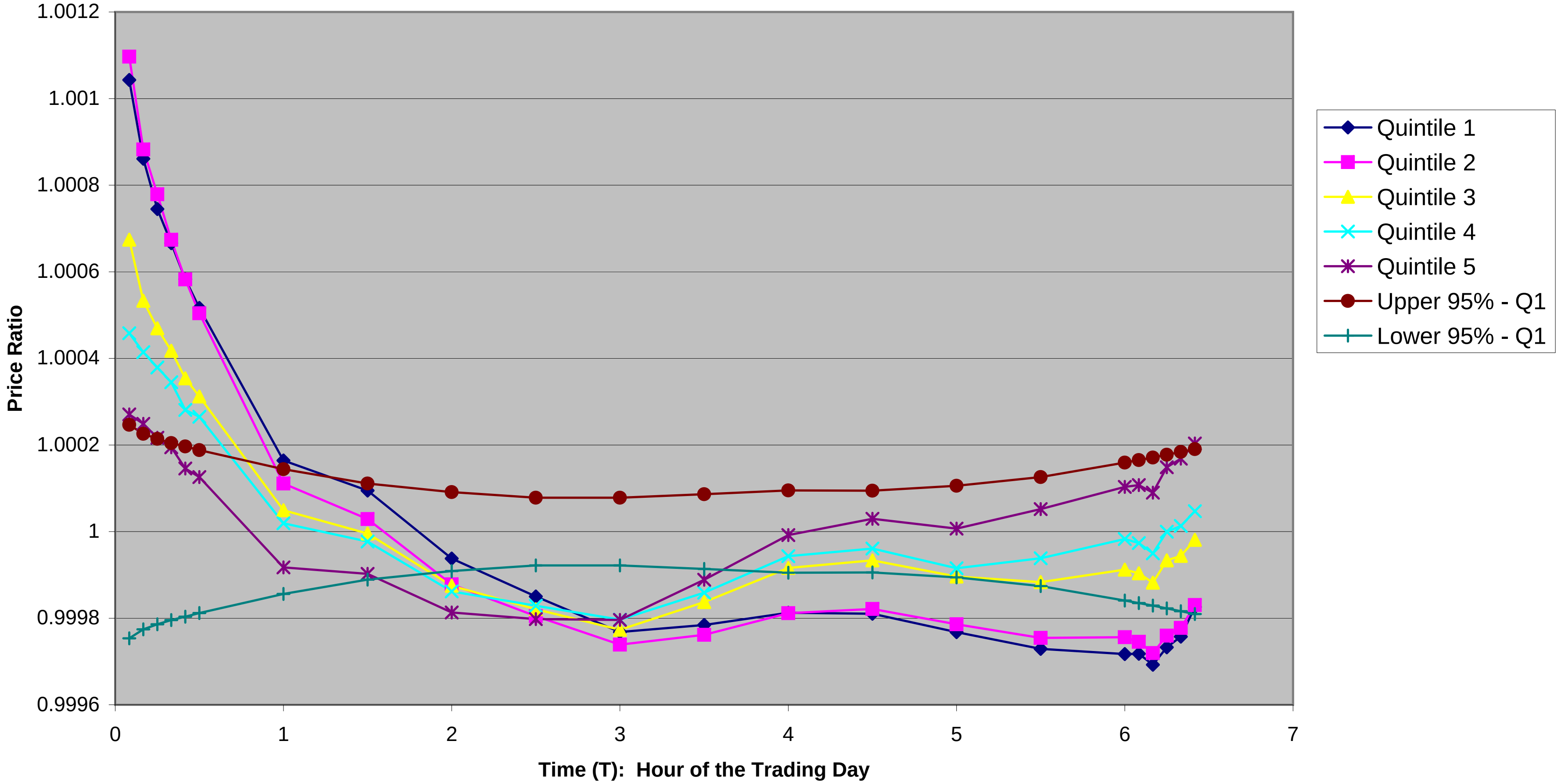

Figure 3. Intraday Price Pattern
Ratio of Midquote at Time T to Average Intraday Midquote
for Quintiles of Firms Sorted by Overnight Liquidity Risk

These intraday price patterns trace out the ratio of the midquote at time (T) to the average intraday midquote, where this intraday average is computed across all 30-minute intraday intervals excluding quotes in the first and last 30 minutes of the trading day. These price ratios are provided at 5-minute intervals over the first and last 30-minutes of the trading day, and at 30-minute intervals over the rest of the trading day. First, for each day we average this price ratio at every time (T) across all stocks in each quintile based on the firm's degree of overnight liquidity risk, where overnight liquidity risk is measured as the sensitivity of daily changes in a firm's percent spread to overnight changes in the market spread. Next, for each quintile we compute the time series average of these daily cross-sectional mean price ratios across all days in the sample period.

The 95 percent confidence interval about a ratio of 1.0 is constructed using the standard error of the time series mean at each time (T), using only the bottom quintile of stocks with low overnight liquidity risk. All five quintiles based on overnight liquidity risk have similar standard errors for different times (T) throughout the day, and thus have similar confidence intervals. Therefore, the choice of a quintile to use as a basis for comparison with confidence intervals is immaterial.

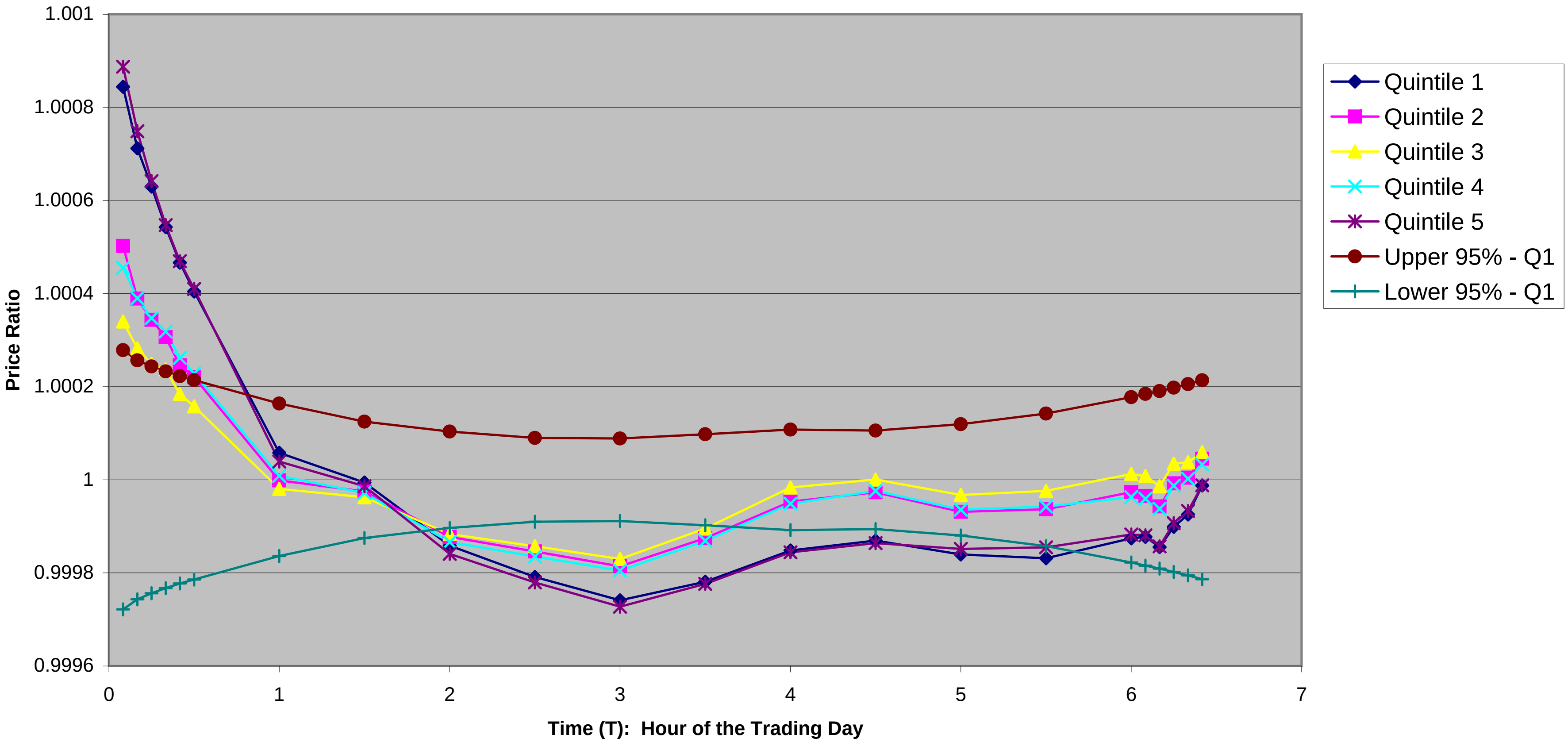

Figure 4. Intraday Price Pattern
Ratio of Midquote at Time T to Average Intraday Midquote
for Mondays versus Other Days of the Week

These intraday price patterns trace out the ratio of the midquote at time (T) to the average intraday midquote, where this intraday average is computed across all 30-minute intraday intervals after omitting quotes in the first and last 30 minutes of the trading day. For each day we first average this price ratio at every time (T) across all stocks in the sample. Next, we compute the time series average of these daily cross-sectional mean price ratios across two subsamples: all Mondays versus all other weekdays in the sample period. The 95 percent confidence interval about a ratio of 1.0 is constructed using the standard error of the time series mean at each time (T), for the subsample of Mondays. This subsample has the largest standard errors for different times (T) throughout the day, and thus has the widest confidence interval. Thus, comparison of the intraday pattern for other days of the week with this confidence interval represents a conservative approach to determine the statistical significance of these intraday price patterns throughout the trading day.

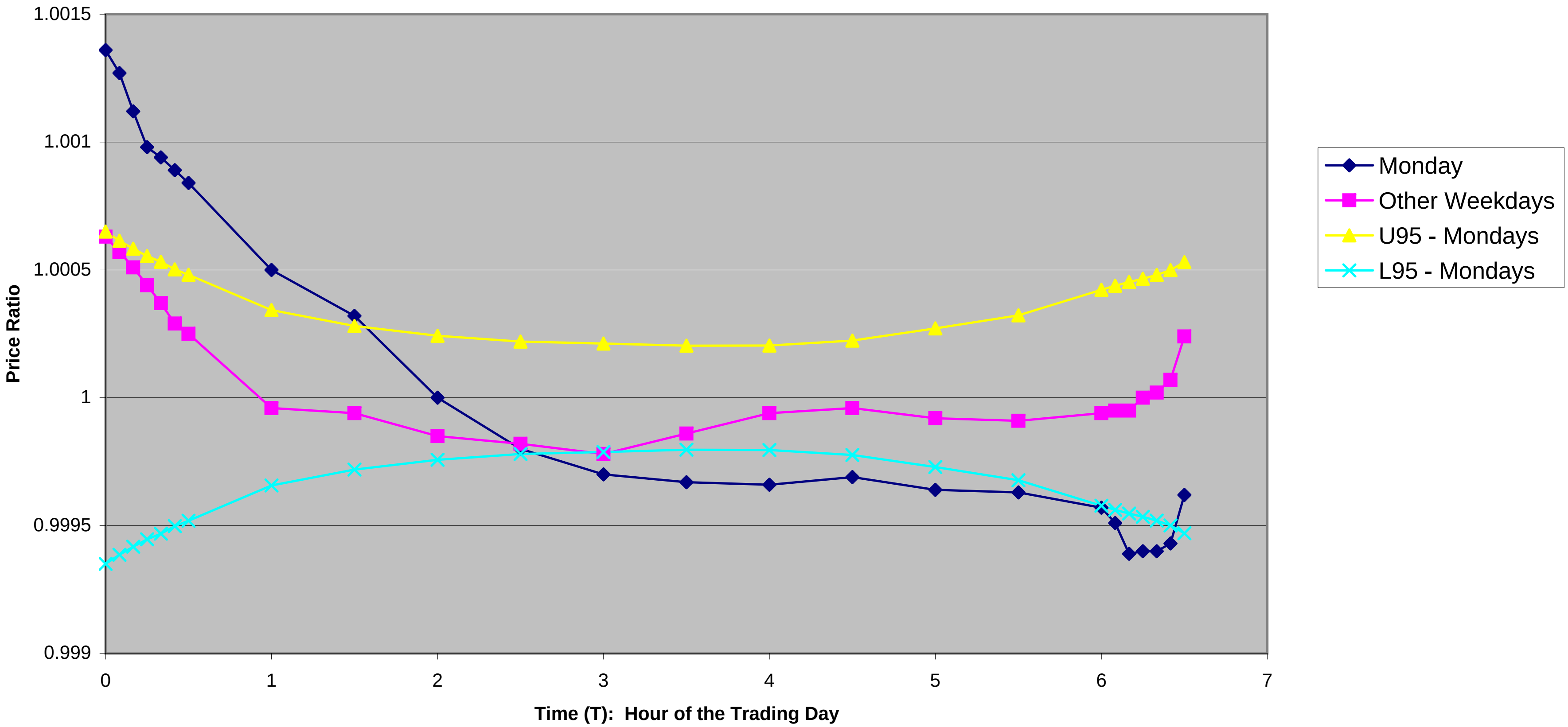

Figure 5. Intraday Price Patterns
Ratio of Midquote at Time T to Average Intraday Midquote
for Subsamples of ADRs by Region of the World

These intraday price patterns trace out the ratio of the midquote at different times (T) during the trading day, to the intraday average midquote, where this intraday average is computed across all 30-minute intraday intervals excluding quotes in the first and last 30 minutes of the trading day. These intraday price patterns are provided for all U.S. stocks, as in Figure 1, and for three subsamples of ADRs from countries: (i) in the U.S. time zone whose home market opens concurrently with or later than the U.S. market, (ii) in the Asia / Pacific region, and (iii) in European time zones. The 95 percent confidence interval about a ratio of 1.0 is constructed using the standard error of the time series mean across all days at each time (T), from the sample of U.S. stocks in Figure 1.