Local investors, price discovery, and market efficiency

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Abstract

This study examines the effect of locally informed investors on market efficiency and stock prices using large power outages, which are exogenous events that constrain trading. Turnover in stocks headquartered in a outage area with 0.5% of U.S. electrical customers drops by 3-7% on the first full day of the outage, and bid-ask spreads narrow by 2.5%. Firm-specific price volatility is 2.3% lower on blackout dates. This effect is larger for smaller, lesser-known stocks and in higher income areas. Consistent with a valuation discount and higher expected returns for stocks with more informed traders, firms with a one standard deviation higher local trading propensity have market-to-book values that are 5% lower, Tobin's Q that is 6% lower, annualized 4-factor alphas are 1.2 percent higher, and average spreads that are 6.5% higher. Together, the evidence suggests that informed investors contribute disproportionately to both liquidity and price discovery, and that these contributions are reflected in valuations and expected returns.

Keywords: Local investors, market efficiency, adverse selection

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[1]Thanks to Robert Battalio, Shane Corwin, Margaret Forster, Ken French, Paul Gao, Alok Kumar, Tim Loughran, Rick Mendenhall, Chris Parsons, Richard Rendleman, Mark Seasholes, Phil Stocken, Wei Wang, Hayong Yun, and especially Paul Schultz, Bill Schwert (The editor) and an anonymous referee. Thanks to seminar participants at the University of Notre Dame and Dartmouth, the 2010 First Inaugural University of Miami Behavioral Finance Conference, the 2010 Financial of Research Association meeting, and Queen's University Second Annual Behavioral Finance Conference. Hang Li provided excellent assistance with TAQ. Errors are mine.

1. Introduction

There is evidence that investors of all stripes prefer to hold and trade local stocks.[2] It is plausible that some investors have privileged information about firms that are local to them, and studies of several classes of investors' holdings show that they realize superior profits on local stocks.[3] Little is known, however, about how local investors' firm-specific information advantage affects market quality in these stocks, and whether this advantage in turn affects prices and returns.

This study uses large local power outages to address these questions. The first advantage of power outages is that they are a sudden, unexpected, and significant trading friction for local investors. For example, on Thursday December 15, 2005, beginning at 4:00 AM, an ice storm caused power outages to 683,000 electrical customers in parts of Piedmont North Carolina and South Carolina. Schools were closed and power was not fully restored until six days later.[4] The blackout area was home to the headquarters of 57 firms with Compustat, CRSP and TAQ data. Although U.S. aggregate market trading volume was higher on December 15th than the daily average of the previous month, volume was lower for 41 out of the 57 firms headquartered in the outage area. Closing spreads dropped for 38 of the firms on the blackout date, and idiosyncratic price volatility dropped for 37 of the firms.

Surprisingly, even the most sophisticated traders do not seem to be equipped with backup power systems. In February 2010, a localized outage hit Nomura Securities in the World Financial center at 200 Liberty Street in New York. The following messages were published in real time on Businessinsider.com:

> *Original:* We got a tip that the World Financial Center at 200 Liberty Street

[2] Some examples are Huberman (2001), Ivković and Weisbenner (2005), Seasholes and Zhu (2010), Bodnaruk (2009), and Becker et al. (2010).

[3] Coval and Moskowitz (2001), Hau (2001), Malloy (2005), and Baik et al. (2010), for example.

[4] Sources: EIA and "Retailers welcome big crowds", *Winston-Salem Journal, N.C.* 17 December 2005.

> just lost power. The source says the building 'just shorted.' The elevators may not be working. Can anyone confirm or deny? We have a call into the building currently, though the telephone system is looping.
>
> *Update:* We've confirmed that at least one firm, Nomura, there was a major power outage. We're still trying to confirm whether it's affected the entire building. We hear traders were flipping out.
>
> *Update 2:* As far as we can tell, only Nomura was affected, and the power is back on. This is clearly a huge relief to all involved. GO back to work!"

Even if some traders do have backup power in their office and are able to trade, power outages are a source of distraction for local traders.

The second advantage of power outages is that the data they provide encompasses all trading, at high frequency, in a large cross section of stocks, not subsets of investor portfolios. This makes it possible to examine effects on aggregates such as volume, stock prices and returns. This setup is not as well suited to answer questions about portfolio holdings and profits, which prior research has examined, but is better suited to examine local investors' effects on liquidity price discovery, prices and average returns, which remain relatively unexplored.

This study makes several contributions to our understanding of the impact of local investors, and more generally informed investors, on market efficiency. First, in a sample of large power outages that occurred between 2002 and 2010, local investors as a group represent 3-7 percent of the trading in stocks headquartered within a 500,000-customer area. According to the Energy Information Administration (EIA), there were 124,937,469 electrical customers in the United States in 2008, so this represents less than 0.5% of the customers. Effects of a local blackout on turnover are larger for areas without a major city, for higher income areas and in the periods leading up to mergers and earnings announcements.

Second, this study investigates how local investors affect price discovery. Changes in idiosyncratic volatility indicate that, for the average stock, 2.3 percent of stock-specific price discovery is associated with the trading of 500,000 local customers. The drops in idiosyncratic and total volatility remain when controlling for the lower turnover, and are stronger when the blackout area is not a large city, for higher income areas, and in periods leading up to mergers or earnings announcements. Drops in idiosyncratic volatility are larger for firms that are below the sample median in size measured by total assets, are not a member of the S&P 500 index, and have no analysts.

Third, when local traders are constrained, quoted spreads are at least 2.5% narrower, suggesting that there is less adverse selection in the market. Stocks with a one standard deviation higher ratio of normal turnover to blackout-date turnover, a measure of local trading intensity, have 6.5% higher average spreads in the years before and after the blackout, suggesting that traders of these stocks face higher adverse selection.

The fourth contribution of this study is to investigate whether high levels of local trading, as measured by the drop in turnover during a local blackout, are reflected in the stock prices and expected returns of stocks, as would be predicted by, for example, Easley et al. (2002) and O'Hara (2003). These authors argue that in markets with information asymmetries where some information about assets is private rather than public, assets with a greater proportion of private information earn higher risk premia. I find that stocks with a one standard deviation higher ratio of normal turnover to blackout-date turnover have market-to-book values that are 5% lower, and Tobin's Q values that are 6% lower. These stocks also have returns and annual 4-factor alphas that are 1.2 percent higher. Together, the evidence suggests that local investors contribute substantially to price discovery, and that their contributions are priced.

This study builds on a growing literature examining local investors. It is well established that investors tilt their portfolios towards local stocks. For example, Huberman (2001) shows that investors prefer to hold their local telephone company's stock rather than that of another telephone company, and attributes this to a preference for the familiar. Ivković and Weisbenner (2005) and Seasholes and Zhu (2010) find that households investing with a large retail broker from 1991 to 1996 strongly prefer local stocks. Bodnaruk (2009) shows that when Swedish investors move, their portfolios change to favor the local stocks in their new location. Becker et al. (2010) show that block holders often live close to the company's headquarters. There is some debate about whether the overweighting of local stocks reflects preference for the familiar, or a perceived or real information advantage.

Several studies find that large local investors have privileged information. Coval and Moskowitz (2001) show that the average fund manager generates an additional return of 2.67 percent per year from local investments relative to out-of-town holdings. In addition, local stocks that fund managers hold outperform the local stocks they avoid by a risk-adjusted 3 percent per year. In another look at sophisticated investors, Hau (2001) shows that German high-frequency traders who are located close to the firm's headquarters earn abnormal trading profits compared to traders who are not close. Malloy (2005) finds that local analysts are more accurate in their forecasts than analysts located further away from a firm's headquarters. Baik et al. (2010) show that higher ownership of a stock by institutions located in the same state and quarterly changes in this ownership are associated with higher returns in future quarters. Large, sophisticated investors seem to have an information advantage in stocks that are local to them.

The evidence is more mixed for retail investors. Ivković and Weisbenner (2005) and Bodnaruk (2009) find that households realize higher returns on local investments than on their non-local investments. Seasholes and Zhu (2010), however, find that local households have no information advantage, leaving this question still open to debate. Engleberg and Parsons (2010) find that local investors remain informed about stocks through the local paper, but this may not provide an information advantage.

Existing work shows that investors disproportionately hold local stocks, and provides evidence that sophisticated local traders are well informed. There is also some limited evidence of what proportion of volume local traders represent. In investigating whether weather patterns affect stock returns, Loughran and Schultz (2004) find that in 48 blizzards in large cities between 1984 and 1997, aggregate volume for stocks headquartered in those cities is 17% lower than the average in the 10 days before the blizzard. In another study, Loughran and Schultz (2005) show that liquidity is higher in urban vs. rural firms, and suggest that the stocks of urban firms are more liquid due to a wider audience of local investors. Jacobs and Weber (2011) find that on German local holidays, stocks that are headquartered in those localities are traded less than similar stocks of other firms located somewhere else.

Research has emerged on how local investors affect prices and returns. Pirinsky and Wang (2006) show that stocks that are headquartered in the same geographic area display strong return comovement. Hong et al. (2008) show, using data on U.S. states and census regions, that the price of a stock is decreasing in the ratio of the aggregate book value of firms in its region to the aggregate risk tolerance of its investors, using aggregate income as a proxy for the latter. This suggests that local investors have a hand in the valuation of stocks. Further, Korniotis and Kumar (2010) show that stock returns vary with the business cycles of their local community. Using institutional and retail trading data, they provide evidence that when local economic conditions are good, these local investors tend to invest more in local stocks, and their effect on prices is corrected over time by non-local investors.

In contrast, and a complement to prior work, this study focuses on the effect of adverse selection that informed local investors bring to measures of market quality, price discovery, prices, and returns. The paper proceeds as follows. The next section presents the data on electrical blackouts as well as the more traditional trading and firm-specific data and summary statistics. Section 3 examines what proportion of trading is local. Section 4 investigates what proportion of stock-specific information is discovered by local traders.

Section 5 examines which stocks depend the most on local investors for price discovery and Section 6 focuses on spreads, and Section 7 examines valuation and average returns for stocks that are heavily traded by locals. The last section concludes.

2. Power outage data

The power outage data is from the Electric Power Monthly, a report released by the Energy Information Administration that contains information on generation and energy prices. Table B2 in this report contains "Electric Disturbances and Unusual Occurrences." Detailed historical data is available since 2002. The data lists the date and time that the disturbance began and ended, the power company involved, the area affected, the type of disturbance, the number of megawatts lost and the number of customers affected. Although the data lists a date when full power is restored, there are no details about how many customers regain power each day. Power companies tend to repair service to vital services such as hospitals first, next to the lines serving the largest number of customers and last to the lines serving few customers. Power restoration is likely to be a nonlinear function of time and some power is likely restored before the recorded end date of the outage. Thus, this study will use the first full business day of the outage as the "outage period," and ignore subsequent days. This also has the advantage of standardizing the outage length for comparison between events.

This study uses electrical disturbances that are reported to have cut power to 100,000 people or more and that begin less than 24 hours before the start of a trading day and have a well defined blackout area listed in the EIA report. For each disturbance, I search the power company's web page for its service area, which is usually given either in terms of cities, counties, zip code, or a map. The power company's service area intersected with the area of the outage as reported by the EIA is the outage area for this study. Compustat provides a list of all companies headquartered[5] in this outage area in the month preceding the outage. Utilities are not in the sample because their stock may be differentially affected by the outage, which is often their own. The 2003 Northeast blackout is dropped since it spans many states.

This procedure yields the 114 blackouts listed in Appendix A. Table 1 shows that the disturbances last an average of 4.1 days with a median of 3.5 days. The average number of customers affected by an outage in this sample is 338,088. The average megawatt loss, when reported, is 356.4, with a median of 290.[6] Of these disturbances, all but two were due to severe weather, which includes ice, winter and lighting storms, severe thunderstorms, floods, hurricanes or high winds, One outage was due to high load for which there were inadequate resources. There was an average of 32.7 publicly traded firms in the blackout area, with a median of 22.5.

Firm-level summary statistics for the firms in the blackout areas appear in Table 1, Panel B. The median firm has $627 million in assets according to Compustat, a CRSP market capitalization of $466 million. Over thirteen percent of firms are members of the S&P 500 at the time they are part of the sample. The median number of analysts per firm, derived from I/B/E/S, is 5 and the average is higher, with 17% of firms receiving no analysts. Each firm in the sample is part of a blackout territory an average of 2.3 times, and the median firm is used twice in the study. Panel C of Table 1 shows the exchanges that the stocks are listed on, given by the CRSP exchange code. Most of the sample (60.6%) is listed on NASDAQ, with 33.0% listed on NYSE. The balance is listed on AMEX. A few firms switch exchanges during the sample period. For the purposes of this table, I assign them the exchange on which they are listed the longest.

[5]Coval and Moskowitz (1999), Ivković and Weisbenner (2005), Loughran and Schultz (2004), and Pirinsky and Wang (2006) define a firm's location as the location of its headquarters.

[6]A watt is a measure of energy conversion defined as one joule per second. A typical U.S. household uses less than a kilowatt of energy continuously.

The trading data for each firm headquartered in each disturbance area is for the first full trading day of the disturbance and for the preceding 30 calendar days from the NYSE Trade and Quote database (TAQ). Stocks are dropped if their average share price during the period is below $2. CRSP provides daily returns, volume, number of shares outstanding, and closing bid and ask quotes. Data from TAQ and CRSP are matched by permno.

As in prior studies, *Turnover* is daily share volume divided by the number of shares outstanding from CRSP.[7] Using TAQ data, turnover is broken down into five trade size categories as defined in the Securities and Exchange Commission's Dash-5 reports as follows: 100-499 shares, 500-1,999 shares, 2,000-4,999 shares, 5,000-9,999 shares, and 10,000+ shares. Large traders are increasingly breaking up their trades, and so any results attributed to small traders may in fact be due to large traders masquerading as retail investors. On the other hand, large trades almost surely come from large traders. A daily measure of aggregate turnover, *Market turnover*, is the sum of the CRSP share turnover divided by the sum of the shares outstanding of CRSP firms with share codes 10 and 11.

Summary statistics on the trading of these stocks in the 30 calendar days before each blackout appear in Table 1, Panel D. There are some very liquid stocks in the sample. Average daily volume is 1,109,636 shares and daily turnover averages 0.825% per day. Median turnover is 0.477% per day.

The study will mainly use the log of the number of customers without power, *Log(customers)*, to measure the intensity of the blackout. This variable is zero on the days leading up to the blackout. The log is used because in a larger blackout, traders who are without power are more numerous but their average distance to the firm's headquarters will also be greater, so their effect should increase less than linearly with the size of the blackout. Some caveats are that the number of customers is reported by the utilities and may be approximate in

[7]The results of the study do not materially change if daily volume is multiplied by 2 on NYSE and AMEX to account for effective double counting of volume on NASDAQ.

some cases, and businesses are counted the same as households in utilities' customer counts. Thus, the number of customers is not the same as the number of people in the blackout area. While blackouts affecting greater numbers of customers have greater effects as the study will show, using a simple dummy variable that takes the value one for the blackout date and zero otherwise, or an estimate of the proportion of people that are without power, does not generally change the strength or significance of the results.

3. What proportion of trading is local?

3.1. Trading activity

The larger the proportion of local traders in a stock, the more likely it is that they affect prices and other aggregates of interest. Figure 1 presents box plots of the changes in daily turnover for each event, ordered by date. The change is computed as the value on the blackout date minus the average turnover in the past calendar month. Change in turnover is winsorized at the one percent level. The figure shows that the majority of the mean and median changes in turnover are negative.

Table 2, Panel A presents turnover regressed on *Log(customers)*, which is the log of the number of customers without power on the day of the blackout and zero otherwise. *Market turnover* and firm-event fixed effects are also included. Standard errors are clustered by stock-event.[8] The regressions in Panel A of Table 2 show that, controlling for market turnover, total turnover for a blackout of 500,000 customers falls by 0.00188*Log(500,000) = 0.0247 percent of shares outstanding per day. Compared to an average daily turnover of 0.825%, this is a 3% decrease. Column (2) of Table 2 shows the results when turnover is

[8]While turnover and many other variables in this study are strictly positive, which suggests a Tobit model, a linear model is preferred for several reasons. First, most of the variables rarely attain their bounds, and so a linear model is equivalent to the less intuitive Tobit model. Second, one cannot put fixed effects into a Tobit model because they cannot be conditioned out of the likelihood function Neyman and Scott (1948). Firm and event fixed effects in this study are likely to be important. Nevertheless, using a Tobit model does not change the direction or significance of the results.

averaged over all stocks in the same blackout, to control for any possible effect of correlation between stocks, although this is controlled for by clustering the standard errors by event-stock in the other columns. The result is twice as strong when using this average turnover measure; *Turnover* decreases by 7.4% of its average. Creating portfolios of stocks seems to lessen the noise added by the variability in turnover across stocks.

Columns (3) through (7) of Table 2, Panel A show that turnover in all trade sizes drops during a blackout. As a percentage of their mean, the effect of the blackout decreases monotonically with the trade size category. The smallest trade sizes drop off by 5.7 percent relative to their mean, 500-1,999 share trades drop off by 5.5% relative to their mean, and 2,000-4,999 share trades drop off 5.3%. 5,000-9,999 share trades drop off 4.1%, but the effect is not statistically significant.

These results are scaled to a 500,000 customer blackout, which represents less than half of a percent of the customers throughout this sample period. Another way to interpret the 3% drop in turnover is that a local trader is approximately six times more likely to trade a local stock than is a non-local trader. In comparison, in their paper on weather effects on returns, Loughran and Schultz (2004) find that in 48 blizzards in 25 large cities between 1984 and 1997, aggregate volume for stocks headquartered in those cities is 17% below its average on the ten days prior to the blizzard. They find a similar difference in trading volume in these cities between the day before and the day of the Yom Kippur holiday. The difference in the result is likely possibly due to the large population of these large cities and possibly due to the more conservative approach in this paper. Their method effectively uses portfolios of stocks, and the results in this paper are more than twice as strong using blackout-levels portfolios of stocks.

This analysis is conservative in three ways. First, the results are weighted towards stocks with high turnover, and one would not expect the turnover in these stocks to drop as much if they are nationally traded. For example, this regression includes General Motors which has high turnover, and will have a low percentage drop in turnover in a local blackout since it is nationally known. Second, these results reflect mean changes. Median stock-by-stock percentage changes in turnover over the trading days in the month before the blackout are higher (for example, 22% for total turnover), but some of this effect may be due to the skewness of the turnover data. Third, not all local investors are likely to be constrained by a blackout. Some may be away on business trips. Others (unlike Nomura) may have backup systems or trade by telephone.

On the other hand, these results may appear stronger then they actually are if sophisticated, non-local traders tend to pull out of the market in response to the lower volume they observe during the blackout periods. For sophisticated traders to do this, however, the drop in turnover must trigger their algorithms and thus be significant.

3.2. Alternative measures of blackout severity

Table 2, Panel B shows alternative measures of blackout severity. *Fraction out* is a rough estimate of the fraction of people without power in the area around the firms. To construct this estimate, I assume that there are 300/125 people per electrical customer since there are 125,000,000 electrical customers in the U.S. in 2008 and the population of the United States was roughly 300,000,000. For some areas, this will not be a good estimate. In fact, for 13 of the blackout areas, 300/125 multiplied by the number of customers out divided by the population of the counties affected by the blackout is greater than 100 percent. For these blackouts, I set the fraction to 100 percent. Nevertheless, Table 2 Panel B shows that this crude measure is still significant in explaining the drop in turnover on the blackout date. The last two columns of this table simply use a blackout dummy. As expected since this does not account for the severity of the blackout, this dummy is slightly weaker in explaining the drop in turnover than the other two measures.

3.3. Subsets of the data

We might expect these results to be stronger in some subsets of blackouts and stocks. For example, blackouts should be more severe in rural areas than in cities, largely because cities are never completely affected by the blackouts in this sample. In the sample, nine of the 114 blackouts occur in the ten most populous cities in the United States during the sample period. These cities are New York, Los Angeles, Chicago, Houston, Phoenix, Philadelphia, San Antonio, San Diego, Dallas, and Detroit. Table 2, Panel C shows that removing the blackouts that occur in these cities makes the drop in turnover more strongly related to *Log(customers)*. There is no effect of the blackout on turnover for these large city blackouts. No doubt, a very small proportion of the population is affected in these cases.

In affluent areas, residents are more likely to own and trade stocks, so the effect of a blackout may be stronger. To investigate this, I gather the median income by year and county from the census bureau. I average the income over the counties covered by the blackout, weighted by the number of stocks that are headquartered in that county. Since most counties in this study tend to be higher income, I use the 2/3rds percentile of median county wealth in that year as a cutoff in determining wealthy and non-wealthy areas. Columns 3 and 4 of Panel C show that the effect on turnover is not statistically significant for the 988 stock-blackout combinations in lower income counties, and is stronger for the 2,740 stock-blackout combinations in higher income counties.

Last, if local investors tend to be better informed than their non-local peers, one might expect the effect of a local blackout on turnover to be larger for firms where an earnings announcement or merger were imminent. Using all quarterly earnings announcements from the I/B/E/S database, I calculated the number of days until the next earnings announcement for each blackout. I also obtained all merger announcements from the SDC merger database and calculated the number of days until each merger announcement. I used the subsamples of stock-blackout pairs that were within a month of an earnings announcement or a merger.

I exclude the three days leading up to the event due to the spike in idiosyncratic price movements at that time not being comparable to the prior month of data. Column (5) of Panel C considers the blackout/stock pairs that are within 4-40 days before an earnings announcement or merger announcement. Again, the results are stronger for this subset.

3.4. Restoration of power

While outages are sudden, restoration of power is gradual as discussed in the previous section. Even if power were restored all at once, the effect on restoration of power should not be as strong as when power is cut off, because strategic informed traders may choose to trade gradually once their power is restored to avoid moving prices.

To get around some of these limitations, I examined the cases where the first full business day of the outage falls on a Friday, and where the EIA states that the last customer is restored over the weekend. For these outages, it is likely that the first business day after the weekend is a day when many traders return to the market after being constrained on Friday. This search resulted in only 8 outages and 164 stock-outage combinations. I interacted the first day after power is restored dummy variable with the log of the number of customers blacked out on the Friday. The sample period is again the month leading up to (but not including) the blackout for each stock in the blackout area and the Monday after the blackout. I regressed turnover and measures of price discovery and spreads on this measure.

The results remain untabulated given that there are only 8 blackouts, two of which occurred in large cities, and because it is possible that some traders may have been restored on the Friday. For these 8 Friday blackouts, however, turnover is significantly higher than pre-outage levels on the following Monday, suggesting that some traders are returning to the market.

4. Price discovery and market efficiency

4.1. Measures of price efficiency

Motivated by prior research, such as Coval and Moskowitz (2001), revealing that some local investors are informed, this section examines the role that local investors play in incorporating firm-specific information into prices. The primary measure of firm-specific price discovery in this study is the volatility of firm-specific price movements, *Idiosyncratic volatility*. Total volatility is also examined for robustness. If local investors are instrumental in impounding firm-specific information into prices, there should be a drop in idiosyncratic volatility during the blackout. If locals provide more price discovery than other traders, the effect of the blackout should remain significant when controlling for stock turnover. Thus, we would not expect to see effects of the same magnitude on an ordinary low turnover day that is not during a local blackout.

Idiosyncratic volatility in this study is the error term from the regression of 5-minute returns on contemporaneous and once-lagged 5-minute returns on the SPDR S&P 500 exchange traded fund (symbol SPY). This is one of the most liquid ETFs, and its purpose is to track the S&P 500 index. Returns are calculated using NBBO bid-ask midpoints. This involves keeping track of all market participants' best bid and ask prices throughout the day in case the most competitive quotes are cancelled. Removing the lag of market returns from the model of idiosyncratic volatility does not materially affect the results of this study.

Table 1, Panel D shows that idiosyncratic volatility has a mean of 0.252% per 5-minute period, and a median of 0.205%. Table 3 presents the results of a regression of idiosyncratic volatility on *Log(customers)*. Stock-event fixed effects are included and standard errors are clustered by stock-event. Column (1) of Table 3 shows that, controlling for market turnover, *Idiosyncratic volatility* for a 500,000-customer local blackout falls by 0.000526*Log(500,000) = 0.0069 per five minute period, or 2.8 percent of its sample average. Column (2) shows that the result falls to 2.3% of the sample average when controlling for individual stock turnover.

Thus, the majority of the effect is related to local traders in particular being absent and not to an ordinary effect of a lower turnover day.[9] This price discovery is coming from less than half of a percent of the electrical customers in the U.S. Again, these results are conservative. Using average idiosyncratic volatility over all stocks in the blackouts, such that there is one time series per blackout as with *Turnover* in Column (2) of Table 2, the coefficient on *Log(customers)* is larger and statistically significant.

Total volatility reflects the incorporation of both market and firm-specific information into prices, but unlike the measure of idiosyncratic volatility used above, it does not take a stand on the model of expected returns. Table 1, Panel D shows that the standard deviation of five minute NBBO midpoint returns, *Volatility*, has an average of 0.278% in this sample. *Volatility* drops on the blackout day, even controlling for *Turnover* and *Market turnover*. Table 3, Panel A, column (3) shows that for a blackout of 500,000 customers, the standard deviation of 5-minute returns drops by approximately 1.9 percent of its average given in Table 1. In untabulated results, the daily price range, the maximum minus the minimum trade price during the day divided by their average, is also negatively and significantly related to *Log(customers)*.

4.2. Subsets of the data

In Panel B, I examine subsets of data where one might expect the results to be stronger. The first two columns show that the change in idiosyncratic volatility is not present in the nine large city blackouts, and much stronger in the remaining ones. Large city blackouts tend to be small compared to the city's size and thus less effective in impeding the entire local population from trading. The effect of blackouts on idiosyncratic price movements is also stronger for the high income counties, where one would expect locals to trade more, and in the period before an earnings announcement or merger. As before, these results control

[9] As in prior models, a Tobit model produces equivalent results, but a linear model is used here to retain the stock-event fixed effects.

for stock turnover, market turnover and stock-blackout fixed effects.

5. Soft information and local price discovery

If locals have an information advantage, it is likely to be in firms for which information is soft and difficult to parse, and thus, the effect of a blackout on price discovery should be strongest for firms in these categories. Stein (2002) argues, in the context of organizational structure, that decision makers who are further away from the source of the information will tend to use quantifiable facts, while those who are closer to the source can rely more on soft information that is not easily transmissible. If local investors have the extra benefit of soft information, the effect of a blackout should be strongest for the most informationally opaque firms.

Presumably, small, less researched firms provide less information to the market, so price discovery in these firms should be affected to a greater extent by a local blackout. The variable *Soft information* takes the value one if the firm is not a member of the S&P 500 index, has no analysts and has less than the median level of total assets in the sample. I divide the sample into soft information and non-soft information firms and examine the difference in coefficients in Table 4.

Other firm characteristics may affect the effect of a local blackout on price discovery, and cuts of the data along those variables also appear in Table 4. The first is log of the firm's assets from Compustat, *Log(assets)*, to proxy for size. Next, the average CRSP closing stock price in the month leading up to the blackout, *Average price*. The *Dividend yield* is dollar dividends divided by closing price on the date before the blackout. The number of analysts issuing an earnings estimate in the quarter leading up to the blackout, *Analysts*, is from I/B/E/S. I also include a dummy variable for whether the firm is in the S&P 500, *S&P 500 member*, fro CRSP. The percentage of R&D expense over assets, *R&D/assets*, the percentage of advertising expense over assets, *Advertising/assets*, both from Compustat, are also included.

The type of ownership may also affect the response of *Idiosyncratic volatility* to a local blackout. Institutional ownership, *Institutional*, is the percentage of the shares owned by institutions on Thompson Financial as of the day before the blackout. Total mutual fund ownership as a percentage of shares outstanding, *Mutual fund* is from the CRSP mutual fund database. Details on the construction of these variables appear in Appendix B.

Table 4 presents the coefficients on *Log(customers)* for each cut of the data, the p-value, and the number of observations in the sub-sample. Also included in the models, but not appearing in Table 4, are firm-event fixed effects, *Market turnover*, and *Log(customers)*. Standard errors are clustered by firm-event.

Table 4 shows that small, obscure firms are more affected by the blackout. The coefficient on *Log(customers)* is four times as large when *Soft information* dummy is equal to one, than when it is not. The table also shows that firms with assets, price per share, dividend yield, number of analysts, and institutional and mutual fund ownership that are below the sample medians of these variables also see larger drops in idiosyncratic volatility during the blackout.

6. Local traders and bid-ask spreads

This section examines the effect of a local blackout on bid-ask spreads. A large theoretical and empirical literature finds that spreads reflect adverse selection [see for example Stoll (1978), Glosten and Milgrom (1985)], dealer risk aversion [see DeGenarro et al. (2010)] and inventory holding costs and order processing components. It is reasonable to assume that risk aversion, inventory and order processing costs do not change, or at least do not decrease, on the first day of a blackout, so any change in the spread is most likely due to a change in perceived adverse selection.

6.1. Daily spreads

There are several ways to measure quoted spreads. To measure daily spreads, this study uses time weighted NBBO or *TW spread*, from TAQ. This is the National best ask price minus the national best bid price, weighted by the time the spread is outstanding. Another measure is daily *Closing spreads* from CRSP. Spreads are discarded if they are above 10% of the midpoint. Table 1, Panel D displays summary statistics for the different measures of spreads. The average time weighted spread is 1.16% of the purchase price.

Another type of spread, the *Effective spread*, is a measure of average actual transactions costs given that some trades are crossed between the quotes. The effective spread is the difference between the trade price and the midpoint. It is multiplied by two for comparison with the quoted spread. *Effective spread* is lower, with a sample average of 0.560%, than time-weighted NBBO spreads, which shows that trading sometimes takes place between the quotes.

Realized spreads are meant to capture how much a market maker would profit from a trade after hypothetically closing out the position five minutes later. Thus, realized spreads are a measure of the spread earned by the market maker on the trade minus the price at which a market maker can later reverse the position taken to provide liquidity to a customer. *Realized spread* is calculated as $(p_{t+5min+} - p_t) * 2$, where p is the trade price and t indexes time, if the trade price is below the NBBO midpoint, and $-(p_{t+5min+} - p_t) * 2$ if the trade price is above the NBBO midpoint. This measure is averaged over the day. *Realized spread* is multiplied by two for consistency with the other measures of spreads. Table 1, Panel D shows that the average *Realized spread* is 0.12%.

Table 5, Panel A reports the effect of a blackout on spreads, controlling for *Turnover*, *Market turnover* and firm-event fixed effects. For a 500,000-customer blackout in this sample, the time-weighted spread drops by Log(500,000)*0.00211=0.028%, which is approximately 2.5 percent of the sample average spread. This is an unexpected result given that spreads are generally inversely related to turnover. Column (4) confirms this as the coefficient becomes more negative when controlling for turnover. Columns (1) and (2) shows that the result is stronger for CRSP closing spreads. With fewer local traders able to trade, the drop in spreads during a local blackout could be due to reduced adverse selection, as prior literature has found. Huang and Stoll (1997) find that adverse selection represents roughly 10 percent of the spread, but their decomposition of the spread is difficult to calculate today given that traders break up their trades more often than when their paper was published. In a laboratory experiment, Bloomfield et al. (2009) show that spreads decrease when uninformed investors with no liquidity trading needs are added to the market.

While quoted spreads drop, effective spreads do not change significantly, and realized spreads rise. In untabulated regressions, time-weighted size, or the number of round lots available at the NBBO quotes, drops by 0.11, or 5% of its average, but the p-value is only 0.12. Effective spreads may not change because fewer shares are available at the NBBO due to the absence of some traders. The increase in *Realized spread* on the blackout date, shown in Panel A, columns (6) and (7), suggests that a market maker who participated in a trade is able to reverse the position five minutes later at a more attractive price than when local traders are in the market. The effect is economically significant. In column 8, a 500,000 customer blackout is associated with a 0.00126*Log(500,000) = 0.017 change in realized spread, which is 14% of its sample average. This, along with lower posted spreads, suggests that adverse selection is lower during local blackouts.

6.2. Average spreads

If the drop in quoted spreads is due to adverse selection, stocks that are more frequently traded by locals should have wider average spreads. To test this hypothesis, I compute the average percentage spread in the 365 days before and after, but not including, the blackout date using CRSP data. Spreads are deleted if they are greater than 10 percent of the closing CRSP price.

To measure the extent of locally informed trading in a stock, this study uses the ratio of the average turnover in the stock to the turnover on the first full business day of the blackout. To mitigate the effect of outliers, the ratio is winsorized at the 1% level. This *Local trading ratio* should be increasing in the average extent of local trading in the stock, assuming the blackout was unexpected and the blackout date was to be a typical trading day. Table 1, Panel B shows that the mean and median of *Local trading ratio* are 1.62 and 1.21, respectively.

Table 5, Panel B shows that stocks with higher *Local trading ratio* have lower average spreads, even controlling for many other firm characteristics. In column (2) of Panel B, a one standard deviation difference in *Local trading ratio* is associated with a 0.0393*1.60 = .062 percentage point difference in average spreads. This is roughly 6.6% of the mean average closing spread in the sample. Columns (3) and (4) use only stocks with NYSE/AMEX as a primary exchange, and columns (5) and (6) focus on NASDAQ stocks. These columns show that controlling for other firm characteristics, NASDAQ firms tend to have larger spread responses to the *Local trading ratio*.

Thus, it appears that stocks that are heavily traded by locals have higher average bid-ask spreads. This is consistent with local traders creating adverse selection in the stocks that they trade. Alternatively, it is also consistent with local traders preferring to trade stocks where there is much adverse selection, but this would only be a rational choice if they considered themselves informed.

7. Local trading, valuations, and expected returns

O'Hara (2003) presents a model of asymmetric information in which assets traded by a high proportion of informed traders are discounted, due to the additional risk that the uninformed have of trading with an informed trader. In Easley et al. (2002), the probability of informed trading is related to valuations and expected returns. Since the authors cannot identify informed traders empirically, the measure of informed trading is based on trading imbalances. Here, *Local trading ratio*, as described in the prior section and in Appendix B, is used as a measure of the extent of local trading in the stock.

7.1. Valuations

Two measures of valuation of the firm by the market relative to the book or replacement value of the firm in this study are *Market/book* and *Tobin's Q*. *Market/book* is market value from CRSP (shrout*1,000*abs(prc)) on the day before the blackout divided by book value from Compustat as of the latest financial statement (bkvlps). *Tobin's Q* is calculated as (Total assets minus stockholders' equity plus market value) divided by total assets. In Compustat and CRSP terms, $(at - seq + (abs(prc) * shrout * 1,000)/1,000,000)/at$. As are all variables constructed using Compustat data, these are winsorized at the 1% level after they are constructed. Since there are some extreme values, I take logs of these variables.

Table 1, Panel B shows that *Log Market/book* has a mean value of 0.846 and a median of 0.776, and *Log Tobin's Q* has a mean of 0.552 and a median of 0.391. These variables are regressed on *Local trading ratio*, control variables, and blackout fixed effects. Standard errors are clustered by blackout. Table 6 presents the results of these regressions. Columns (1) and (3) present the valuation variables with only event-level fixed effects. Other firm-level control variables appear in columns (2) and (4). In the full models, a one standard deviation increase in *Local trading ratio* is associated with an 0.45 drop in *Log Market/book*, representing 5% of the mean value in Table 1, and a 0.03 drop in *Tobin's Q*, representing 6% of its mean value.

7.2. Returns

Assets that are riskier to hold should have higher expected returns. This study uses several measures of returns: raw daily returns, daily one-factor alphas over the CRSP value-weighted market portfolio, Fama and French (1993) 3-factor alphas, and 4-factor alphas including the Carhart (1997) momentum (UMD) factor. Both returns and alphas are calculated using daily data from the 365 days preceding and subsequent to each blackout but not including the first day of the blackout. Returns and alphas are regressed on *Local trading ratio* and dummies for each blackout event, and standard errors are clustered by blackout. Results of regressions of alphas on *Local trading ratio* appear in Table 7. The first column shows that a one standard deviation change in *Local trading ratio* is associated with a 1.64*0.00301 = 0.0049% higher daily 4-factor alpha, which, over 250 trading days, cumulates to 1.2 percent. The effect is similar for raw returns and one and three-factor alphas, but is not statistically significant for raw returns.

In a possibly related finding, Coval and Moskowitz (2001) show that stocks that are owned by local mutual funds have higher returns. While this study looks at stocks that are more heavily *traded* by all local traders and not necessarily held by local mutual funds, Table 4 shows that price discovery on blackout dates does drop more for stocks that are owned by local mutual funds, as shown by the significant negative coefficient on *Local mutual fund* . Removing stocks that are owned by local mutual funds in the 30 days before the blackout date does not affect the results.

One could also ascribe lower valuations and higher expected returns to heavily locally traded stocks to the effect described in Merton (1987), where traders are simply unaware of the existence of some assets, and the lower valuations come from the lower risk-sharing ability of the fewer traders and not to adverse selection. The higher spreads observed for heavily locally traded stocks could be due to the thinner markets in those stocks. However, one firm size, which is included in these regressions as *Log(assets)*, should control for this effect.

8. Conclusion

Power outages are exogenous events that constrain local trading. This allows for a study of local traders' daily trading habits and their effect on the incorporation of stock-specific information into prices. In a sample of 114 large power outages that occurred between 2002 and 2010, local investors as a group represent 3-7%of the trading in stocks headquartered within a 500,000-customer area. in 2008, the Energy Information Administration estimated that there were 124,937,469 electrical customers in the United States, so this represents less than 0.5% of the customers.

Next, this study investigates how local investors affect price discovery. Changes in idiosyncratic volatility indicate that, for the average stock, 2.3% of stock-specific price discovery is related to the trading of the most local 500,000 customers. The drops in idiosyncratic and total volatility remain when controlling for the lower turnover and are larger for soft information firms. They are stronger for blackouts that do not occur in large cities, for higher income counties and in the period leading up to an earnings announcement or merger.

When local traders are constrained, quoted spreads are 2.5% narrower, suggesting there is less adverse selection in the market. Stocks with a one standard deviation higher measure of trading by local investors have average spreads that are 6.6% lower in the year before and after the blackout.

The propensity of locals to trade the stock also predicts valuations, as measured by market-to-book ratio and Tobin's Q. Stocks with a one standard deviation higher measure of local trading have a 5% lower market-to-book ratio and a 6% lower Tobin's Q ratio.

Together, the evidence suggests that local investors contribute substantially to asset pricing and price discovery. If local investors are informed, as prior research has found, this study provides evidence on the different ways in which the trading of informed investors affects asset prices.

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Table 1

Summary statistics.

Panel A describes the blackouts taken from the "Electric Disturbances and Unusual Occurrences" section of the Energy Information Administration's Electric Power Monthly. *Length in days* is based on the reported start and end date and time. *Customers* and *MW loss* are directly reported. *Fraction out* is a rough estimate of the number of people without electricity under the assumption that there are 300/125 people per customer, based on the population of the United States, approximately 300 million and the number of electrical customers, approximately 125 million, in 2008. Population is the entire population of the county based on U.S. census estimates in the year of the blackout, even if that county is not entirely part of the blackout area. For 13 blackouts *Fraction out* was greater than 1 and was set to 1. *Number of firms* is the number of firms with Compustat, TAQ and CRSP data available for the day of the blackout and the preceding 30 calendar days. *Times firm used* is the number of times each firm is in a blackout territory.

Panel B shows stock characteristics. *Total assets* is total assets from Compustat, variable *at*. *Market value* in millions is the market value on the day before the blackout; shares outstanding from CRSP multiplied by closing price. *Average Price* is the average of the absolute value of the CRSP closing price in the 365 days before and after the blackout date. *Analysts* is the number of analysts who issue recommendations in the latest year before the blackout, *num_estimates*, from I/B/E/S. *Dividend yield* is dollar dividends (dv), from Compustat, divided by the market value on the day prior to the blackout. *S&P 500 member* indicates whether the stock belongs to the S&P 500 index, from CRSP. *R&D/assets* is research and development expense (xrd) from Compustat divided by total assets (at). *Advertising/assets* is advertising expense (xad) divided by total assets (at) from Compustat. *Institutional* is the total institutional ownership from Thomson Financial. *Total Mutual Fund* is the total mutual fund ownership of the stock from CRSP Mutual Fund database. *Soft information* takes the value one if the firm has below median total assets, is not a member of the S&P 500 index and has no analysts. *Market/book* is market value on the day before the blackout divided by book value from Compustat (bkvlps). *Tobin's Q* is (Total assets minus stockholders' equity plus market value) divided by total assets. All variables from Compustat are from the latest financial statement available at each date and are winsorized at the one percent level after they are constructed.

Panel C lists the primary exchanges on which firms are listed, from CRSP.

Panel D presents trading variables. Daily *Turnover* is shares traded divided by shares outstanding, multiplied by 100. *Market turnover* is the sum of shares traded in CRSP divided by the sum of shares outstanding, multiplied by 100. *TW spread* is the time-weighted NBBO spread calculated using TAQ quotes. *Closing spread* is the CRSP closing spread as a percentage of the CRSP closing price. *Average spread* is the average over the 365 days before and after the blackout of CRSP closing spread as a percentage of CRSP closing price. Spreads are deleted if they are negative or greater than 10%. *Effective spread* is two times the absolute difference between the trade price minus the NBBO midpoint, calculated using TAQ quotes, averaged over all trades of the day. *Realized spread* is an estimate of how much profit a market maker would make on the trade by reversing it within 5 minutes. *Idiosyncratic volatility* is the daily standard deviation of the error term from the regression of of 5-minute NBBO midpoint-to-midpoint returns on contemporaneous and once-lagged midpoint-to-midpoint returns on SPY, a heavily traded S&P 500 ETF. *Volatility* is the daily standard deviation of 5-minute NBBO midpoint-to-midpoint returns. *Return* is the daily return, from CRSP. *1-factor α* is the alpha of excess returns regressed on the value-weighted market risk premium *3-factor α* is the alpha of excess returns regressed on the Fama and French (1993) three factors: HML, SMB and the value weighted market risk premium. *4-factor α* is the alpha of excess returns regressed on the three factors plus UMD, the momentum factor.

Panel A

Variable	Mean	σ	P1	P25	P50	P75	P99
Length in days	4.1	3.0	0	2	3.5	5	12
Customers	338,088	387,831	101,003	145,000	200,000	359,171	1,881,134
Fraction out	0.40	0.31	0.04	0.13	0.32	0.61	1
MW loss	356.4	225.4	55	170	290	500	916
Number of firms	32.7	32.5	1	6	22.5	48	144
Times firm used	2.26	1.62	1	1	2	3	7

Panel B

Variable	Mean	σ	P1	P25	P50	P75	P99
Total Assets	7,005	41,816	10	158	627	2,277	138,920
Market value (M)	3,754	19,359	16	154	466	1,691	59,181
Analysts	6.69	7	0	1	5	10	29
Average price	22.44	21.06	2	8	17	31	91
Dividend Yield	0.014	0.072	0	0	0	0.013	0.136
S&P 500 Member	0.134	0.341	0	0	0	0	1
R&D/Assets	0.048	0.096	0	0	0	0.057	0.541
Advertising/Assets	0.009	0.023	0	0	0	0.005	0.137
Institutional	0.552	0.326	0	0.263	0.596	0.840	1.000
Mutual Fund	0.128	0.111	0	0.034	0.106	0.193	0.447
Soft Information	0.133	0.340	0	0	0	0	1
Log Market/Book	0.846	0.869	-1.169	0.323	0.776	1.302	3.383
Log Tobin's Q	0.552	0.628	-0.365	0.087	0.391	0.848	2.539
Local Trading Ratio	1.62	1.64	0.20	0.82	1.21	1.78	11.93

Panel C

NYSE	AMEX	NASDAQ
545	106	1,002
33.0%	6.4%	60.6%

Panel D

Variable	Mean	σ	P1	P25	P50	P75	P99
Volume	1,109,636	4,504,523	100	35,973	177,348	644,700	15,900,000
Turnover %	0.825	1.205	0.002	0.200	0.477	0.994	5.484
100-499 Shares	0.388	0.544	0	0.083	0.213	0.482	2.494
500-1,999 Shares	0.201	0.352	0	0.043	0.101	0.222	1.575
2,000-4,999 Shares	0.078	0.158	0	0.008	0.036	0.087	0.677
5,000-9,999 Shares	0.042	0.109	0	0	0.013	0.048	0.402
10,000+ Shares	0.055	0.134	0	0	0	0.061	0.580
Closing Spread %	0.943	2.134	0.017	0.086	0.221	0.651	10.000
TW Spread %	1.119	1.128	0.027	0.355	0.804	1.483	5.599
Effective Spread %	0.560	0.777	0.031	0.121	0.265	0.660	3.832
Realized Spread %	0.122	0.518	-0.965	-0.007	0.033	0.131	2.206
Idiosyncratic Volatility	0.252	0.193	0.037	0.136	0.205	0.313	0.904
Volatility	0.278	0.189	0.042	0.153	0.230	0.348	0.976
Daily Return	0.063	0.150	-0.326	-0.008	0.061	0.132	0.485
Excess return	0.029	0.137	-0.330	-0.037	0.026	0.094	0.417
α_1	0.026	0.139	-0.340	-0.041	0.025	0.093	0.407
α_3	0.024	0.135	-0.323	-0.040	0.024	0.089	0.376
α_4	0.019	0.136	-0.335	-0.046	0.019	0.086	0.380

Table 2

The drop in turnover during a blackout

Panel A presents fixed effects regressions during the the 30 days leading up to and including the first blackout date of measures of turnover on *Log(cust.)*, the log of the number of customers who lost power during a blackout. This variable is zero for non-blackout days. *Turnover* is daily shares traded divided by shares outstanding, multiplied by 100. This is divided into five trade size categories. *Avg. stock turnover* is turnover averaged over all of the stocks in the blackout. *Market turnover* is the sum of shares traded in CRSP divided by the sum of shares outstanding, multiplied by 100. The first column presents fixed effect regressions stock by stock. The second column groups stocks into blackout portfolios by averaging the turnover of all stocks located in the blackout area. Columns 3-7 present turnover broken down by trade size.

Panel B presents fixed effects regressions of turnover on two alternative measures of blackout severity. *Blackout dummy* is a blackout date dummy that is one on the blackout date and zero otherwise. *Fraction out* is a rough estimate of the number of people without electricity multiplied by a blackout date dummy. The estimate of the people without electricity is based on the assumption that there are 300/125 people per customer, based on the population of the United States, approximately 300 million and the number of electrical customers, approximately 125 million, in 2008. Population is the entire population of the county based on U.S. census estimates in the year of the blackout, even if that county is not entirely part of the blackout area. For 13 blackouts *Fraction out* was greater than 1 and was set to 1.

Panel C presents fixed effects regressions on *Log(cust.)* on subsets of data. In the first two columns, the data is broken down by whether the blackout occurred in one of the ten most populous cities in the U.S. These cities are: New york, Los Angeles, Chicago, Houston, Phoenix, Philadelphia, San Antonio, San Diego, Dallas, and Detroit. Nine of the 114 blackouts occurred in these cities. In the following columns, the data are compared for affluent (above the 66th percentile of median household wealth in that year provided by the Census bureau) and non-affluent counties (below this percentile). Last, the result is shown if the blackout occurs in the 4-40 calendar days prior to an earnings announcement or merger.

Regressions have stock-blackout fixed effects and the standard errors are clustered by stock-blackout, except in column 2, where there are blackout fixed effects and clusters. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels.

Panel A

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Stock Turnover	Avg. Stock Turnover	100-499 Shares	500-1,999 Shares	2,000-4,999 Shares	5,000-9,999 Shares	10,000+ Shares
Log(Cust.)	-0.00188*	-0.00470**	-0.00168***	-0.000843***	-0.000315**	-0.000130	-5.53e-05
	(0.10)	(0.02)	(0.00)	(0.00)	(0.03)	(0.22)	(0.73)
Mkt. Turnover	0.935***	0.870***	0.395***	0.173***	0.0670***	0.0430***	0.0691***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	77,671	2,429	77,671	77,671	77,671	77,671	77,671
R-squared	0.539	0.735	0.716	0.540	0.438	0.345	0.313
Fixed Effects	3,728	114	3,728	3,728	3,728	3,728	3,728

Panel B

	(1) Stock Turnover	(2) Avg. Stock Turnover	(3) Stock Turnover	(4) Avg. Stock Turnover
Fraction out	-0.0385***	-0.0483***		
	(0.00)	(0.00)		
Blackout			-0.0230	-0.0573**
			(0.11)	(0.02)
Mkt. Turnover	0.935***	0.872***	0.935***	0.870***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	77,671	2,429	77,671	2,429
R-squared	0.539	0.735	0.539	0.735
Fixed Effects	3,728	114	3,728	114

Panel C

	(1) Not Large City	(2) Large City	(3) Low Income	(4) High Income	(5) Earnings or Merger
Log(Cust.)	-0.00268**	0.00629	-0.000777	-0.00227*	-0.00579***
	(0.02)	(0.20)	(0.72)	(0.09)	(0.00)
Mkt. Turnover	0.943***	0.855***	0.906***	0.951***	1.058***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	70,216	7,455	21,218	56,453	22,443
R-squared	0.539	0.536	0.593	0.521	0.559
Fixed Effects	3,381	347	988	2,740	1,219

Table 3

Measures of price discovery.

Fixed effects regression of idiosyncratic volatility, total volatility, and R^2 of returns on the log of customers affected during the blackout. *Idiosyncratic volatility* is the daily standard deviation of the error term from the regression of of 5-minute NBBO midpoint-to-midpoint returns on contemporaneous and once lagged midpoint-to-midpoint returns on SPY, a heavily traded S&P 500 ETF. *Total volatility* is the daily standard deviation of 5-minute NBBO midpoint-to-midpoint returns. *Log(customers)* is the log of the number of customers affected by the blackout date and zero otherwise. *Turnover* is the number of shares traded in the stock divided by shares outstanding from CRSP. *Market turnover* is the number of shares traded in all CRSP stocks divided by the number of shares outstanding. In column (4), only blackout/stock pairs that are within 4-40 days before an earnings announcement or merger announcement for that firm are used. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels.

Panel B presents fixed effects regressions on *Log(cust.)* on subsets of data. In the first two columns, the data is broken down by whether the blackout occurred in one of the ten most populous cities in the U.S. These cities are: New york, Los Angeles, Chicago, Houston, Phoenix, Philadelphia, San Antonio, San Diego, Dallas, and Detroit. Nine of the 114 blackouts occurred in these cities. In the following columns, the data are compared for affluent (above the 66th percentile of median household wealth in that year provided by the Census bureau) and non-affluent counties (below this percentile). Last, the result is shown if the blackout occurs in the 4-40 calendar days prior to an earnings announcement or merger.

Panel A

	(1) Idiosyncratic Volatility	(2) Idiosyncratic Volatility	(3) Total Volatility	(4) Total Volatility
Log(Cust.)	-0.000526***	-0.000434**	-0.000405**	-0.000306*
	(0.00)	(0.01)	(0.03)	(0.09)
Turnover		0.0486***		0.0523***
		(0.00)		(0.00)
Mkt. Turn.	0.122***	0.0762***	0.149***	0.0998***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	77,671	77,671	77,671	77,671
R-squared	0.462	0.505	0.498	0.549
Fixed Effects	3,728	3,728	3,728	3,728

Panel B

	(1) Not Large City	(2) Large City	(3) Low Income	(4) High Income	(5) Earnings or Merger
Log(Cust.)	-0.000538***	0.000863	0.000434	-0.000720***	-0.000504*
	(0.00)	(0.14)	(0.23)	(0.00)	(0.10)
Turnover	0.0494***	0.0385***	0.0486***	0.0486***	0.0412***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mkt. Turn.	0.0800***	0.0497***	0.0805***	0.0724***	0.0855***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	70,216	7,455	21,218	55,341	22,443
R-squared	0.500	0.552	0.433	0.545	0.541
Fixed Effects	3381	347	988	2674	1219

Table 4

Which types of stocks depend on local investors for price discovery?

Fixed effects regressions in subsamples based on stock characteristics. The dependent variable is idiosyncratic volatility. *Log (assets)* is the natural log of total assets from Compustat, variable *at*. *Analysts* is the number of analysts that issue recommendations in the latest year before the blackout, *num_estimates*, from IBES. *Average price* is the average of the absolute value of the closing price from CRSP over the 365 days before and after the blackout. *Dividend Yield* is dollars paid in dividends (dv), from Compustat, divided by the market value on the day prior to the blackout. *S&P 500* indicates whether the stock belongs to the S&P 500 index, from CRSP. *R&D/assets* is research and development expense (xrd) divided by total assets (at) from Compustat. *Advertising/assets* is advertising expense (xad) divided by total assets (at) from Compustat. *Institutional* is the total institutional ownership from Thomson Financial. *Total mutual fund* is the total mutual fund ownership of the stock from CRSP Mutual Fund database. All variables from Compustat are from the latest financial statement and are winsorized at the one percent level after they are constructed. *Soft information* takes the value one if the firm is not a member of the S&P 500 index, has total assets lower than the sample median and has no analysts. The standard errors are clustered by stock-blackout. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels.

	Yes			No		
	Coefficient	P-value	N	Coefficient	P-value	N
Soft Information	-0.00137**	(0.03)	10,485	-0.000278*	(0.10)	67,186
S&P 500 Member	-0.000407	(0.15)	10,439	-0.000430**	(0.02)	67,232
	Above Median			Below Median		
	Coefficient	P-value	N	Coefficient	P-value	N
Log(Assets)	-0.000249	(0.20)	38,825	-0.000650**	(0.02)	38,846
Analysts	-0.000293	(0.12)	34,616	-0.000528**	(0.04)	43,055
Price	-0.000236	(0.20)	38,833	-0.000601**	(0.04)	38,838
Market/book	-0.000648***	(0.00)	38,834	-0.000195	(0.44)	38,837
Dividend yield	-7.64e-05	(0.75)	30,908	-0.000665***	(0.00)	46,763
R&D/assets	-0.000456*	(0.08)	36,007	-0.000422*	(0.06)	41,664
Advertising/assets	-0.000422*	(0.08)	35,418	-0.000444*	(0.06)	42,253
Total institutional	-0.000129	(0.47)	38,823	-0.000682**	(0.02)	38,848
Total mutual fund	-2.18e-05	(0.91)	38,830	-0.000882***	(0.00)	38,841

Table 5

Spreads

Fixed effects regressions of spreads on the log of the number of customers who lost power during a blackout. This variable is zero for non-blackout days. Panel A presents spreads. All spread measures are calculated using TAQ data. *Time wtd. spread* is the time-weighted NBBO spread as a percentage of the midpoint. *Closing spread* is the closing ask minus the closing bid divided by their average, from CRSP. *Effective spread* is two times the absolute difference between the trade price minus the NBBO midpoint, averaged over all trades of the day. The absolute difference is multiplied by two to be consistent with the other measures of spread. *Realized spread* is $(p_{t+5min+} - p_t) * 2$ if the trade price is below the NBBO midpoint, and $-(p_{t+5min+} - p_t) * 2$ if the trade price is above the NBBO midpoint. This measure is averaged over the day. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels. In Panel B, the dependent variable is CRSP closing spread as a percentage of closing price averaged over the 365 calendar days before and after the blackout. The principal independent variable is *Local trading ratio*, the ratio of the average turnover of a stock in the 30 days leading up to the blackout to the turnover on the blackout date. Columns (1) and (2) present all observations, and subsequent columns break the sample into NYSE/AMEX and NASDAQ-listed stocks.

Panel A

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Closing Spread	Closing Spread	Time Wtd Spread	Time Wtd Spread	Effective Spread	Effective Spread	Realized Spread	Realized Spread
Log(cust.)	-0.00734***	-0.00725***	-0.00211**	-0.00216**	1.82e-05	0.000127	0.00128*	0.00126*
	(0.00)	(0.00)	(0.03)	(0.02)	(0.98)	(0.85)	(0.06)	(0.07)
Turnover		0.0465***		-0.0284***		0.0432***		-0.0112***
		(0.00)		(0.00)		(0.00)		(0.00)
Mkt. turnover	0.240***	0.196***	0.0366	0.0632**	0.219***	0.179***	-0.0352**	-0.0246
	(0.00)	(0.00)	(0.22)	(0.04)	(0.00)	(0.00)	(0.02)	(0.12)
Observations	77,671	77,671	77,671	77,671	76,865	76,865	76,231	76,231
R-squared	0.260	0.261	0.668	0.668	0.656	0.658	0.211	0.211
Fixed effects	3,728	3,728	3,728	3,728	3,726	3,726	3,726	3,726

Panel B

	(1)	(2)	(3)	(4)	(5)	(6)
	Average	Average	Average	Average	Average	Average
	%Spread	%Spread	%Spread	%Spread	%Spread	%Spread
Local Trading Ratio	0.111***	0.0393***	0.0989***	0.0176	0.102***	0.0419***
	(0.00)	(0.00)	(0.00)	(0.23)	(0.00)	(0.00)
Log(Assets)		-0.0908***		-0.0971***		-0.100***
		(0.00)		(0.00)		(0.00)
Number of Analysts		-0.00806***		-6.81e-05		-0.0122***
		(0.00)		(0.97)		(0.00)
Average Price		-0.00233***		-0.00320***		-0.00184
		(0.00)		(0.00)		(0.11)
Dividend Yield		0.343		0.215		0.865*
		(0.14)		(0.41)		(0.08)
S&P 500 Member		0.168***		0.0962***		0.255***
		(0.00)		(0.00)		(0.00)
R&D/Assets		-0.400***		-1.186***		-0.325**
		(0.00)		(0.00)		(0.01)
Advertising/Assets		-0.486		-1.235*		-0.131
		(0.22)		(0.09)		(0.70)
Institutional		-0.434***		-0.324***		-0.511***
		(0.00)		(0.00)		(0.00)
Mutual Fund		-0.890***		-0.671***		-0.912***
		(0.00)		(0.00)		(0.00)
Soft Information		0.550***		0.439***		0.575***
		(0.00)		(0.00)		(0.00)
Observations	3,691	3,576	1,428	1,362	2,263	2,214
R-squared	0.163	0.607	0.169	0.605	0.188	0.620
Fixed Effects	114	114	103	103	107	107

Table 6
Valuation

Fixed effects regressions of valuation ratios and average spreads on *Local trading ratio* and control variables. *Local trading ratio*, a measure of the extent of local trading activity in the stock, is the ratio of the average turnover during the 30 days leading up to the blackout to turnover on the blackout date. The ratio is winsorized at the one percent level. *Market/book* ratio is the market value from CRSP (shrout*1000*abs(prc)) on the day before the blackout divided by book value from Compustat as of the latest financial statement (bkvlps). It is winsorized at the 1% level. *Tobin's Q* is (Total assets minus stockholders' equity plus market value) divided by total assets. In compustat and CRSP terms, $(at - seq + (abs(prc) * shrout * 1000)/1000000)/at$. *Average spread* is the average percentage bid-ask spread from CRSP over the 365 calendar days before and after the blackout, not including the blackout. Standard errors are clustered by event. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels.

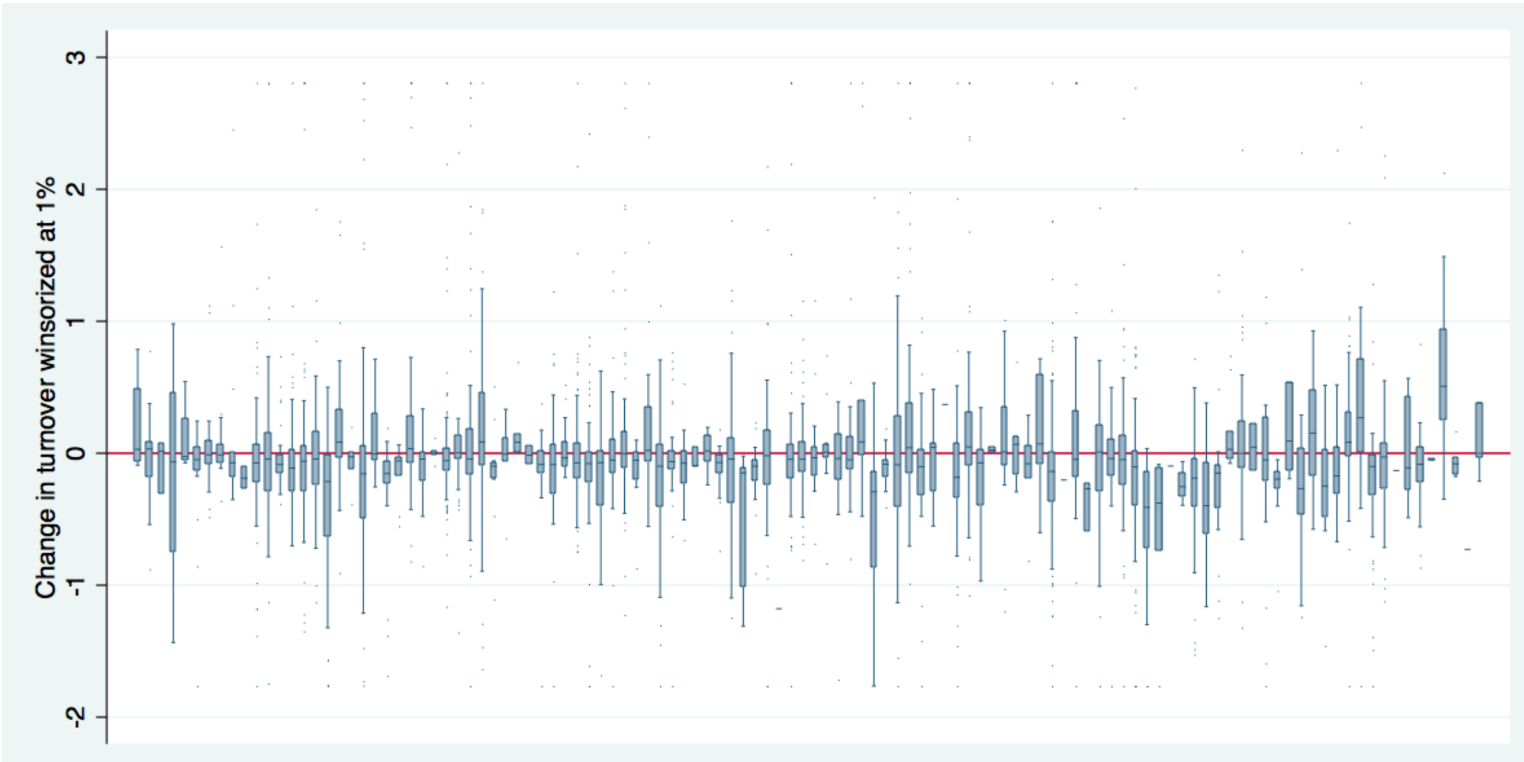
	(1) Market/ Book Ratio	(2) Market/ Book Ratio	(3) Tobin's Q	(4) Tobin's Q
Local Trading Ratio	-0.0310***	-0.0273***	-0.0161***	-0.0206***
	(0.00)	(0.00)	(0.01)	(0.00)
Log(Assets)		-0.230***		-0.234***
		(0.00)		(0.00)
Number of Analysts		0.0258***		0.0267***
		(0.00)		(0.00)
Average Price		0.0136***		0.00919***
		(0.00)		(0.00)
Dividend Yield		-0.0980		-0.135
		(0.89)		(0.27)
S&P 500 Member		0.415***		0.295***
		(0.00)		(0.00)
R&D/Assets		2.100***		1.634***
		(0.00)		(0.00)
Advertising/Assets		1.925**		1.619***
		(0.01)		(0.00)
Institutional		-0.106*		0.0298
		(0.07)		(0.41)
Mutual Fund		0.492**		0.257**
		(0.02)		(0.04)
Soft Information		-0.249***		-0.211***
		(0.00)		(0.00)
Observations	3,576	3,576	3,576	3,576
R-squared	0.108	0.356	0.120	0.510
Fixed Effects	114	114	114	114

Table 7
Average returns

Regressions of daily returns and alphas on *Local trading ratio*, including event fixed-effects. *Local trading ratio*, a measure of the extent of local trading activity in the stock, is the ratio of the average turnover during the 30 days leading up to the blackout to turnover on the blackout date. The ratio is winsorized at the 1 percent level. Returns and alphas are computed in the 365 days before and 365 calendar days after the blackout, and do not include the first day of the blackout. The market portfolio is the CRSP value weighted index. The *1-Factor* α is the alpha of excess returns regressed on the value-weighted market risk premium. The *3-Factor* α is the alpha from the Fama and French (1993) model, which includes daily High Minus Low (HML), Small Minus Big (SMB) as well as the value weighted market risk premium. The *4-Factor* α includes the Carhart (1997) momentum factor (UMD) as well. Standard errors are clustered by blackout event. P-values are in parentheses and *, **, *** denote statistical significance at the 10, 5 and 1 percent levels.

	(1) Raw Return	(2) CAPM α	(3) 3-Factor α	(4) 4-Factor α
Local Trading Ratio	0.00225	0.00347**	0.00288*	0.00301*
	(0.13)	(0.05)	(0.10)	(0.09)
Observations	3,693	3,691	3,691	3,691
R-squared	0.233	0.086	0.052	0.050
Fixed Effects	114	114	114	114

Figure 1



Box plots depicting the change in turnover on the first trading day of the blackout compared to the average for the trading days in the past 30 calendar days for all blackouts in the sample. Daily turnover is shares traded divided by shares outstanding. Blackouts appear from left to right in order of their date.

Appendix A
The Blackouts

Details as reported by the utilities appear in Table B2 of the Energy Information Administration's Electric Power Monthly. MW refers to megawatts lost.

Start Date	Days	MW	Firms	Customers	Utility	Cause
30-Jan-02	8	500	5	1,881,134	Oklahoma Gas & Elec.	Ice Storm
3-Oct-02	8	.	16	242,910	Entergy Corporation	Hurricane Lily
6-Nov-02	4	270	3	939,000	Pacific Gas & Elec.	Winter Storm
11-Dec-02	2	63	4	130,000	Dominion-VA/NC Pwr.	Winter Storm
19-Dec-02	2	56	4	385,000	Pacific Gas & Elec.	Winter Storm
27-Feb-03	2	.	30	340,000	Duke Energy Corporation	Winter Ice Storm
3-Apr-03	3	300	27	425,000	Consumers Energy	Ice Storm
4-Apr-03	1	225	21	160,000	Niagara Mohawk Pwr.	Storm
8-Jul-03	3	.	15	134,500	American Elec. Pwr.	T-Storms
15-Jul-03	3	265	2	108,000	AEP/Texas Central	Hurricane Claudette
21-Jul-03	3	750	105	185,000	PPL Elec. Utilities	Storms
18-Sep-03	3	.	46	1,800,000	Dominion-VA/NC Pwr.	Hurricane Isabel
12-Nov-03	4	82.5	28	245,000	Consumers Energy	Wind Storm
12-Nov-03	4	75	45	160,000	Detroit Edison	Storm/High Winds
13-Nov-03	3	375	61	110,000	Baltimore Gas & Elec.	High Winds
4-Dec-03	4	175	50	200,000	Puget Sound Energy	High Winds
28-Dec-03	4	160	76	241,000	Pacific Gas & Elec.	Winter Storm
7-Jan-04	3	150	49	145,000	Puget Sound Energy	Snow Storm
26-Jan-04	2	600	6	150,000	SC Elec. & Gas	Ice Storm
25-Feb-04	1	240	85	505,000	Pacific Gas & Elec.	Winter Storm
27-Apr-04	3	300	12	187,000	Snohomish County	Strong Winds
21-May-04	3	392	25	281,000	Ohio Edison	T-Storms
13-Jul-04	4	600	10	135,000	Cinergy Services	T-Storms
21-Jul-04	1	200	54	200,000	Commonwealth Edison	T-Storms
13-Aug-04	1	.	16	502,000	Progress Energy Florida	Hurricane Charley
15-Sep-04	2	.	5	1,423,590	Puerto Rico Elec. Pwr.	Hurricane Jeanne
15-Sep-04	2	916	142	916,316	Southern	Hurricane Ivan
16-Sep-04	2	500	57	175,000	Duke Energy	Hurricane Ivan
18-Oct-04	2	140	81	407,440	Pacific Gas & Elec.	Storm/Winds
1-Dec-04	1	270	41	122,000	Baltimore Gas & Elec.	High Winds
23-Dec-04	8	800	13	359,171	American Elec. Pwr.	Ice Storm
4-Jan-05	10	200	5	211,000	Westar Energy	Winter Storm
5-Jan-05	8	250	5	246,990	Ohio Edison/First Energy	Ice Storm
5-Jan-05	11	545	2	114,791	American Elec. Pwr.	Winter Ice Storm
1-Apr-05	5	.	18	211,000	Cleveland Elec./First Energy	Winter Storm

5-Jun-05	5	.	46	201,580	DTE Energy	Storm/Winds
5-Jun-05	2	55	25	105,000	Consumers Energy	Strong T-Storm
6-Jun-05	1	.	103	143,000	PECO Energy	Strong T-Storm
8-Jun-05	2	75	89	300,000	Xcel/Northern States	Strong T-Storm
29-Jun-05	5	.	46	114,711	DTE Energy	Storm/Winds
13-Sep-05	3	600	34	110,000	We Energies	Storm
21-Sep-05	6	.	92	200,000	Xcel/Northern States	High Winds/Tornadoes
24-Oct-05	6	280	9	105,000	Seminole Elec. Coop.	Hurricane Wilma
24-Oct-05	6	400	31	303,795	Allegheny Pwr.	Hurricane Wilma
6-Nov-05	5	212	44	118,000	DTE Energy	T-Storm
15-Dec-05	6	.	57	683,000	Duke Energy	Ice Storm
16-Feb-06	4	100	25	252,089	Consumers Energy	Storm/Snow/Ice
27-Feb-06	2	.	3	160,000	Pacific Gas & Elec.	Winter Storm
2-Apr-06	3	.	11	186,000	Cinergy PSI	Storms/Tornadoes
25-May-06	2	800	17	210,000	Duke Energy	Weather
1-Jun-06	2	.	69	111,555	PECO Energy	Weather
22-Jun-06	5	750	5	195,000	American Elec. Pwr.	T-Storm
16-Jul-06	5	150	16	315,000	Consumers Energy	Lightning Storms
18-Jul-06	5	.	97	492,955	PECO Energy	Lightning Storms
19-Jul-06	12	.	1	700,000	Ameren Corporation	Storms
27-Jul-06	2	.	94	167,564	PECO Energy	T-Storm
2-Oct-06	1	.	56	471,932	Exelon Corporation-ComEd	T-Storm
12-Oct-06	11	600	31	250,000	Niagara Mohawk Pwr.	Snow Storm
30-Nov-06	9	.	15	550,000	Ameren Corporation	Ice Storm
13-Dec-06	15	.	23	700,000	Puget Sound Energy	Wind Storm
14-Dec-06	1	750	26	175,000	Seattle City Light	Wind Storm
14-Dec-06	6	360	10	172,060	Snohomish County PUD No. 1	Wind Storm
26-Dec-06	5	420	71	850,068	Pacific Gas & Elec.	Weather
16-Jan-07	1	260	10	110,433	Snohomish County PUD No. 1	Major Windstorm
13-Feb-07	4	400	55	155,183	Baltimore Gas & Elec.	Winter Storm
28-Feb-07	2	110	76	671,189	Pacific Gas & Elec.	Winter Storm
12-Apr-07	0	200	27	158,977	LA Dept. of Water & Pwr.	High Winds
16-Apr-07	0	.	5	102,568	Public Svc. New Hampshire	T-Storms
16-Apr-07	2	.	1	127,545	Central Maine Pwr.	Snow Storm
16-Apr-07	2	160	47	138,000	Baltimore Gas & Elec.	T-Storms
2-May-07	1	.	54	300,000	Oncor Elec. Delivery	Storms
10-Jul-07	2	650	30	300,000	National Grid - NY	Major Storms
13-Sep-07	2	.	2	118,000	Entergy Corporation	Hurricane Humberto
18-Oct-07	4	.	19	160,000	Puget Sound Energy	High Winds
10-Dec-07	9	.	7	256,663	American Elec. Pwr.	Ice Storm
4-Jan-08	10	500	7	2,606,931	Pacific Gas & Elec.	Winter Storm
4-Jan-08	0	300	6	150,000	Sacramento Municipal Utility	Storm

9-Apr-08	4	.	144	488,689	Oncor Electrtic Delivery	Weather
12-May-08	2	55	1	135,000	Atlantic City Elec.	Storm
4-Jun-08	3	.	48	108,000	Baltimore Gas & Elec.	Storms
4-Jun-08	1	850	3	253,800	Dominion-Virginia Pwr.	T-Storms
8-Jun-08	8	500	42	150,000	Detroit Edison -DTE	Storm
10-Jun-08	4	.	46	248,800	Public Service Elec. & Gas	Storms
10-Jun-08	4	.	83	198,000	PECO Energy	T-Storms
17-Jun-08	2	.	144	234,393	Oncor Elec. Delivery	T-Storms
2-Jul-08	4	125	23	239,663	Consumers Energy	Weather
21-Jul-08	1	170	6	185,000	MidAmercian Energy	Storm
24-Jul-08	0	180	1	110,000	ISO New Engl&	Lightning Storms
18-Aug-08	1	225	4	100,000	Puerto Rico Elec. Pwr.	Shed Firm Load
19-Aug-08	3	.	52	101,950	Florida Pwr. & Light	Tropical Storm Fay
21-Aug-08	3	.	17	430,000	Progress Energy Florida	Tropical Storm Fay
12-Sep-08	2	.	25	705,000	Entergy Corporation	Hurricane Ike
14-Sep-08	5	72	10	124,596	Pennsylvania Elec.	Wind Storm
14-Sep-08	8	469	46	564,728	Ohio Edison	Wind Storm
14-Sep-08	8	430	2	245,164	Clevel& Elec.	Wind Storm
15-Sep-08	8	546	19	160,875	Allegheny Pwr.	Hurricane Ike
12-Dec-08	7	200	9	190,000	National Grid	Ice Storm
12-Feb-09	3	130	6	132,000	Pennsylvania Elec.	High Winds
13-Feb-09	2	168	31	184,000	Ohio Edison Company (RFC)	High Winds
1-Mar-09	2		11	397,000	Duke Energy/Dominion VA/NC Pwr.	Winter Storm
12-Nov-09	2	400	19	335,000	Dominion VA/Dominion NC.	Tropical Storm Ida
8-Dec-09	2		21	140,000	Arizona Public Service	Severe Weather
18-Jan-10	10	290	57	1,700,000	Pacific Gas and Electric	Severe Storm
20-Jan-10	4		23	147,223	LA Dept. of Water & Pwr.	Severe Storm
9-Feb-10	5		60	223,000	Exelon Corporation	Winter Storm
11-Feb-10	4		40	500,000	Oncor Electric Delivery	Winter Storm
23-Feb-10	2		1	150,000	Central Hudson Gas & Electric	Winter Storm
25-Feb-10	4	510	7	509,606	ISO New England	Winter Storm
23-Jun-10	2		42	300,000	Commonwealth Edison	Severe Weather
24-Jun-10	5		2	150,000	Atlantic City Electric	Thunderstorms
24-Jun-10	5		15	355,000	PECO	Thunderstorms
25-Jul-10	5	480	5	421,700	Potomac Electric/BGE	Severe Weather
5-Aug-10	3		1	145,157	Dominion - Virginia Power	Thunderstorms
12-Aug-10	1		6	101003	Potomac Electric	Severe Weather

Appendix B
Variable Definitions

Firm characteristics	
Log(assets)	The Log of total assets (at) from Compustat.
Analysts	The number of separate analysts that issue recommendations in the latest year before the blackout, $num_estimates$, from IBES.
Average price	Average absolute value of the price in the 365 days before and after the blackout, from CRSP.
Dividend yield	Dollars paid in dividends from the cash flow statement (dv), from Compustat, divided by the market value on the day prior to the blackout. It is winsorized at the 1% level.
S&P 500 member	An indicator variable for whether the stock belongs to the S&P 500 index, from CRSP.
R&D/assets	Research and development expense (xrd) divided by total assets (at) from Compustat. It is winsorized at the 1% level.
Advertising/assets	Advertising expense from the latest annual financial statement (xad) divided by total assets (at) from Compustat. If advertising expense is missing, this is set to zero. The ratio is winsorized at the 1% level.
Total institutional	The total institutional ownership at the time of the blackout, calculated using Thomson Financial.
Total mutual fund	The total mutual fund ownership of the stock at the time of the blackout, from CRSP Mutual Fund database.
Market/book	Market value from CRSP (shrout*1000*abs(prc)) on the day before the blackout divided by book value from Compustat as of the latest financial statement (bkvlps). It is winsorized at the 1% level.
Tobin's Q	(Total assets minus stockholders' equity plus market value) divided by total assets. In Compustat and CRSP terms, $(at - seq + (abs(prc) * shrout * 1000)/1000000)/at$.
Soft information	Takes the value one if the firm does not belong to the S&P 500, has less than the median level of assets, and has no analysts.

Trading, spreads and price discovery	
Turnover	Shares traded divided by shares outstanding, both from CRSP. Using TAQ, this is also broken down into 5 categories: 100-499, 500-1,999, 2,000-4,999, 5,000-9,999, and 10,000+ share trades.
Market turnover	Aggregate turnover of all shares on CRSP, calculated as the sum of all shares traded divided by the sum of all shares outstanding.
TW spread	The time-weighted NBBO spread calculated using TAQ quotes. Spreads are discarded when they are negative or greater than ten percent of the closing price. First NBBO quotes, the highest bid and lowest ask that is good for at least one round lot, are calculated for every second of every day of the sample. Quotes are discarded if either the bid or ask price increases or decreases by 25% or more in a two minute period, and also if they occur in the first four minutes of the day.
Average spread	Average over the 365 days before and after the blackout of CRSP closing spread as a percentage of CRSP closing price. Spreads are deleted if they are negative or greater than 10%.
Effective spread	Two times the absolute difference between the trade price minus the NBBO midpoint, calculated using TAQ quotes, averaged over all trades of the day. Spreads are discarded if they are above 10% of the closing price. The absolute difference is multiplied by two to be consistent with the other measures of spread.
Realized spread	Meant to capture how much profit a market maker would make on the trade. It is calculated as $(p_{t+5min+} - p_t) * 2$ if the trade price is below the NBBO midpoint, and $-(p_{t+5min+} - p_t) * 2$ if the trade price is above the NBBO midpoint. This measure is averaged over the day, using TAQ quotes. Spreads are discarded if they are above 10% of the midpoint. See Huang and Stoll (1996), for example.
Idiosyncratic volatility	The daily standard deviation of the error term from the regression of of 5-minute NBBO midpoint-to-midpoint returns on contemporaneous and once-lagged midpoint-to-midpoint returns on SPY, a heavily traded S&P 500 ETF.
Volatility	The daily standard deviation of 5-minute NBBO midpoint-to-midpoint returns.
Return	Daily return, from CRSP.
1-factor α	Alpha of excess returns regressed on the value-weighted market risk premium

3-factor α	Alpha of excess returns regressed on the Fama and French (1993) three factors: HML, SMB and the value weighted market risk premium.
4-factor α	Alpha of excess returns regressed on the three factors plus UMD, the momentum factor.

Variables related to the blackout	
Log(customers)	The log of the number of customers affected by the blackout on the day of the blackout, and zero otherwise. The number of customers out is eported by the EIA.
MW Loss	The estimated loss in Megawatts reported by the EIA.
Fraction out	A rough estimate of the number of people without electricity using the number of customers out and under the assumption that there are 300/125 people per customer, based on the population of the United States, approximately 300 million and the number of electrical customers, approximately 125 million, in 2008. Population is the entire population of the county based on U.S. census estimates in the year of the blackout, even if that county is not entirely part of the blackout area. For 13 blackouts *Fraction out* was greater than 1 and was set to 1.
Local trading ratio	The average turnover in the stock over the 30 calendar days before the blackout divided by the turnover in the stock during the blackout. This is a measure that is increasing in the propensity of local investors to trade the stock.