Corporate governance and stock return volatility: A temporary component perspective

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Abstract

Using the variance ratio, this paper shows that stocks with fewer antitakeover provisions have a larger fraction of their return volatility attributable to a temporary component than stocks with more such protections. This finding suggests that the greater openness to the market for corporate control renders an otherwise short-lived shock capitalized into stock price. Conversely, the result implies that antitakeover provisions block private information flow from being incorporated into stock price until it depreciates away. Our analysis thus completes the explanation for the inverse relationship between average stock return volatility and the number of takeover protections. We also discuss how our analysis helps rationalize two different uses of idiosyncratic stock return volatility, i.e., as a proxy for private information flow and for arbitrage risk.

Keywords: corporate governance; antitakeover provisions; idiosyncratic stock return volatility; temporary component; variance ratio

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1. Introduction

The openness to the market for corporate control is unique in a firm's governance structure, as it directly affects the behavior of outside investors as well as that of corporate managers. More precisely, in addition to disciplining corporate managers to work in the interests of shareholders, an active takeover market can provide outside investors with an incentive to produce and trade on private information (Ferreira and Laux 2007). Consequently, the stock price implications of the takeover vulnerability are likely to be larger than those of other governance characteristics. In this paper, we attempt to enhance our understanding of how governance affects equity prices by focusing on stock return volatility in relation to takeover vulnerability as measured by the existence of antitakeover provisions.

There are at least two motivations for this investigation. One is the argument in the literature that the lack of takeover protections increases the *average* stock return volatility by improving the cost-benefit tradeoff of private information production (Ferreira and Laux 2007). However, given that private information is simply the earlier acquisition of new information, it is unclear why such private information affects the return volatility that is averaged over an extended period of time. The second motivation comes from the observation that, since private information tends to be firm-specific rather than market-wide (e.g., Roll 1988), the private information argument concentrates on the *idiosyncratic* stock return volatility. However, in several strands of finance literature, the firm-specific stock return volatility is used as a proxy for arbitrage risk and, hence, firm-specific mispricing. Consequently, it is unclear how the greater openness to takeover market—and thus the greater firm-specific stock return volatility—is associated with both greater private information flow and greater mispricing.

To answer these two questions, we propose gauging the role of a temporary component in stock price. The idea is straightforward. For a stock with more takeover protections to have a

lower average return volatility, it should be the case that the stock misses information that depreciates over time. If that information does not grow stale, then it will be eventually capitalized into stock price, making its average return volatility comparable to that of a stock with fewer protections. For example, one can imagine a situation in which the price of a stock with few protections may change today due to active trading on private information, whereas the price of another stock with more protections changes tomorrow after the private information is fully revealed and becomes public. The only difference between the two stocks is the timing when the information is incorporated into price; that is, their *average* daily volatility should be the same. To rationalize the inverse relationship between takeover protections and average volatility, we thus hypothesize that the openness to takeover market makes an otherwise short-lived shock capitalized into stock price. More precisely, we predict that a temporary component contributes to stock return volatility more in stocks with fewer protections than in stock with more protections.

The contribution of a temporary component to stock return volatility is also instructive to understand the two different uses of idiosyncratic volatility. To see this, recall the notion of Grossman and Stiglitz (1980). Information is costly to obtain and thus investors will engage in information acquisition only when the expected profit is large enough to cover the costs. Since the profit stems from a better understanding of a stock's fundamental value, informed investors will concentrate on stocks whose fundamentals are not easily accessible to ordinary investors. Hence, a stock's fundamental uncertainty and its private information flow can be positively correlated. Given that the fundamental uncertainty is likely to be a permanent component in stock price, isolating a temporary component-driven volatility can clarify what informed traders contribute as opposed to what they are attracted to. In other words, recognizing the role of a temporary component in stock return volatility guides us to the right question, namely, whether takeover vulnerability fosters production of private information over and above what the

fundamental uncertainty does.

To examine the validity of our idea, we use the variance ratio. By comparing the variance of stock return during a given measurement interval with the return variance for a longer period, this ratio examines whether the return variance increases linearly with the length of the interval, which should be the case without a temporary component in price (e.g., Lo and MacKinlay 1988). We choose this methodology on the grounds of Poterba and Summers (1988) who show that, among several alternatives, the variance ratio is most powerful in detecting a temporary component in stock price.

Using all common stocks covered by the Compustat, CRSP, and the Investor Responsibility Research Center (IRRC, hereafter) databases, we find strong support for our prediction. Specifically, the ratio of one-day return variance to k-day return variance (scaled by k) is significantly larger for stocks with fewer takeover protections.[1] This result means that a larger portion of daily return volatility is driven by a temporary component when the stock is more vulnerable to takeover. The result is robust to controlling for various firm characteristics such as firm size, book-to-market ratio, and institutional holdings. In compiling firm-level antitakeover provision information, we follow Gompers, Ishii, and Metrick (2003) and Cremers and Nair (2005), and our results are robust to using these two alternative schemes. However, the results are stronger with Cremers and Nair's (2005) method, which focuses more on takeover vulnerability rather than on the broader-based shareholder rights.

It is important to note that our results are based on individual stock returns, not portfolio returns. We intentionally focus on individual stocks, since the autocorrelation of a portfolio is simply the average cross-autocorrelation within the portfolio. Thus, our results will not be useful

[1] We analyze daily return because this data frequency is short enough to capture a temporary component. Another candidate, namely, weekly frequency, does not seem to be appropriate, as it allows little room for a temporary component in individual stock returns. See Lo and MacKinlay (1988).

in identifying a profitable portfolio strategy. Still, some useful portfolio insights can be drawn from our analysis. For example, when we repeat the analysis using portfolio returns, the results disappear completely. That is, the portfolio of stocks with fewer antitakeover provisions does not have a different variance ratio than the portfolio of stocks with more such protections. This no-result means that the temporary component that drives our individual stock results is indeed idiosyncratic and thus diversified away in a portfolio. Hence, our analysis lends support to the recent finding of Johnson, Moorman, and Sorescu (2009) that the abnormal return of the governance-sorted portfolios is attributable to other factors besides governance itself, such as industry. Conversely, it is also suggested that the takeover vulnerability of a firm is not relevant for the holding period decision of a *portfolio* investor.

This paper proceeds as follows. In Section 2, we formally develop our testing hypothesis. Section 3 details our sample and data, and Section 4 reports the empirical results. Section 5 concludes the paper.

2. Hypothesis development

2.1. An illustrative example

Consider a stock and its three trading periods, 0, 1, and 2.[2] Suppose that while the expected per-period price change of the stock is zero, there is an information shock at 1 that doubles the stock price. With no other information shock, the average per-period return volatility of this stock is: $[(0 + 100^2 + 0) / 3]^{½} = 57.74\%$. Alternatively, suppose that a group of investors engage in information acquisition and become aware of the information shock one period ahead (i.e., at 0). They will trade on this private information and double the stock price immediately. In this

[2] We assume that the terminal date is far into the future and, hence, there is no resolution of fundamental uncertainty during these three periods. We consider the three trading periods since an average return volatility is calculated over them. The example can be easily modified to suit other lengths of trading periods.

alternative scenario, there is greater production of private information, but the stock's average return volatility remains the same: $[(100^2 + 0 + 0) / 3]^{½} = 57.74\%$. Of course, an in-between case is that the informed traders incorporate only, say, half the information shock into the price, leaving the other half as public information at 1; in this case, the volatility is 40.82%: $[(50^2 + 50^2 + 0) / 3]^{½}$.

The lesson from the above example is that the relationship between private information production and average return volatility is theoretically ambiguous; in this particular example, their relationship is either non-existent (without the 3rd scenario) or U-shaped (with the 3rd scenario).[3] Given this theoretical ambiguity, how can we rationalize the empirical finding that stocks with greater takeover vulnerability have a greater average return volatility? We hypothesize that takeover-motivated informed traders discover and trade on information that would otherwise depreciate away. In the above example, for instance, if the information shock that informed traders capitalize into price is transient, then the absence of informed trading will leave the price unchanged *both* at 0 (since there is no informed trading) and at 1 (since the information has dissipated by then). Consequently, the per-period or average return volatility is zero, thereby associating the informed trading always with a larger average return volatility.

2.2. A formal setup

To present our idea in a more formal manner, we employ the following model for stock price (in logarithm):

$$P_t = P_t^* + u_t \,, \qquad (1)$$

where P_t^* follows a random walk process and u_t follows a mean-zero stationary process. That is, the former represents a permanent component in stock price (with an innovation, ε_t, following *iid*

[3] Lee and Liu (2009) have a theoretical model for such a U-relationship. Their approach, however, is different from ours.

(0, σ_ε^2)), whereas the latter stands for a temporary component (with a variance of σ_u^2). Note that this model is a general version of Summers (1986), Fama and French (1988), and Poterba and Summers (1988).

In this setup, the average one-period return variance is:

$$\text{var}(R_1) = \sigma_e^2 + 2(1-\rho_1)\sigma_u^2, \qquad (2)$$

where R_1 stands for one-period return on the stock and ρ_1 is the one-period autocorrelation of the temporary component.[4] Eq. (2) implies that, given certain values of σ_ε^2 and σ_u^2, the persistence of the temporary component reduces its contribution to the return variance. In other words, as u_t decays more slowly, the average return variance becomes more comparable to the one without a temporary component. Conversely, the more quickly an innovation in the temporary component works its way into the stock price, the higher is the average return variance. Viewing the innovation in the temporary component as the information shock that informed traders capitalize into price, the model's implication is precisely in line with what the earlier example illustrates.

2.3. Hypothesis

Our goal is to gauge the contribution of an innovation in the temporary component to the stock return volatility. To this end, we employ the variance ratio. With a log return, k-period return is the sum of k one-period returns. Also, with a sufficiently large k, the temporary component is irrelevant in the k-period return.[5] Consequently, the ratio of one-period return variance to k-period return variance (scaled by k) converges to:

[4] See, e.g., Poterba and Summers (1988) or Campbell, Lo, and MacKinlay (1997).
[5] Hence, a one-period is defined as the measurement interval during which a temporary component is present, whereas a k-period is the one in which the temporary component grows stale.

$$VR_k \equiv \frac{\text{var}(R_1)}{\text{var}(R_k)/k} \rightarrow \frac{\sigma_e^2 + 2(1-\rho_1)\sigma_u^2}{\sigma_e^2}. \quad (3)$$

As seen in the above equation, the variance ratio is: 1 + the ratio of the variance of the temporary component to the variance of the permanent component.[6] Using this ratio, we can thus measure how much of the one-period return variation is driven by an innovation in the temporary component. Since our argument is that a greater average return volatility of stocks with greater takeover vulnerability is due more to a temporary component than to a permanent component, the following testing hypothesis arises:

H: The variance ratio of one-period return variance to k-period return variance (scaled by k) is greater for stocks that are more open to takeover market.

Of course, an alternative is that the return on a stock open to takeovers is volatile due to its fundamental uncertainty (i.e, permanent component). In this alternative scenario, Eq. (3) suggests that the variance ratio should be smaller for takeover-vulnerable stocks, which is exactly the opposite of our hypothesis.

2.4. Embellishments of the hypothesis

It is generally accepted that private information is likely to be firm-specific rather than market-wide (e.g., Roll 1988). Hence, our preceding analysis with total return volatility easily carries over to idiosyncratic stock return volatility. In this sub-section, we embellish the hypothesis derived above by focusing on idiosyncratic return volatility.

[6] See Campbell, Lo, and MacKinlay (1997; pp.56-57).

In the literature, idiosyncratic volatility is often used as a proxy for arbitrage risk and, hence, firm-specific mispricing (e.g., Wurgler and Zhuravskaya 2002; Pontiff 2007). This appears to be in conflict with another use of idiosyncratic volatility that we have been discussing, namely, a proxy for private information flow. One way of reconciling this seeming contradiction is to view arbitrage as a business. In other words, we need to understand that arbitrageurs discover and bet against mispricing only when the expected profit is large enough to cover the associated costs (Grossman and Stiglitz 1980). This notion implies that a stock's fundamental uncertainty (i.e., mispricing) and its private information flow are likely to be positively correlated, since the former creates a profit opportunity for private information acquisition and the latter represents the informed trading that is motivated by the former. The upshot is that a variable like idiosyncratic volatility may well proxy for both.

This reconciliation implies that our hypothesis might lack the statistical power, since the numerator and the denominator in the variance ratio are positively correlated. To test our hypothesis more precisely, we thus control for σ_ε^2. Our test with this control is equivalent to asking whether takeover vulnerability fosters production of private information more than the fundamental uncertainty does.

Another embellishment is motivated by the argument of Campbell, Grossman, and Wang (1993). The authors conjecture that a supply/demand shock created by a liquidity trading affects the stock price, but does not only temporarily. More precisely, they hypothesize a price concession by liquidity traders in order to induce other investors to absorb the supply/demand shock. Since this price change is for a non-fundamental reason, the price will revert back to the original level. In other words, a temporary component in stock price can arise for reasons other than private information flow.

Unlike our hypothesis, however, this alternative is a *conditional* statement: conditional on a

high trading volume, the stock price will revert if (and only if) that high trading volume is caused by a liquidity trading. On the contrary, if the trading is in fact an informed speculation, then the price will not revert; rather, it may well show some continuation. To directly address this effect, we control for trading intensity. Specifically, we use the measure devised by Gaspar, Massa, and Matos (2005), which is the churn rate of institutional investors.

3. Sample and data

We construct the sample with companies that are covered by CRSP, Compustat, and IRRC databases. Following the convention in the literature, we exclude companies with multiple classes of stock from the sample (see, e.g., Gompers et al. 2003; footnote 5). Finally, we require at least three years' worth of daily stock return data to be available during our sample period from September 1990 to December 2003.

The IRRC database provides firm-level information about various antitakeover provisions as of 1990, 1993, 1995, 1998, 2000, and 2002. Its initial coverage in the 1990 database—out in September—included the companies in the Standard and Poor's 500 Index and some other firms that are followed by major news media (e.g., *Fortune*). Subsequently, it has expanded into smaller companies, and approximately 1,500 companies are covered in a given year. Using this database, Gompers, Ishii, and Metrick (2003) construct an index, namely the governance index, by adding up the existence of 24 pre-select takeover protections within a company.

One potential problem with this index is that the 24 takeover protections may not have the same effectiveness. To address this issue, Cremers and Nair (2005) propose an alternative index based on a subset of three core protection schemes: the existence of classified (staggered) boards, of blank check preferred stock (poison pill), and of restrictions on shareholders on calling special meetings or acting through written consent. We thus use this core index as well as the original

governance index. We use them either as a continuous variable or as a sorting variable to categorize stocks into several groups.

4. Empirical results

4.1. Summary statistics

Table 1, Panel A, reports summary statistics of daily log return of our initial sample stocks. Across 1,961 stocks that ever appear in this preliminary sample during our study period, the average daily log return is very close to zero with a standard deviation of 3.1%. Daily returns are ranged between -27.8% and 23%, which is somewhat wide. As the initial look at the data, however, we use all of them to calculate the variance ratio.

To calculate the ratio, we use four different k-day windows. Specifically, we examine a 5-day window, which is a one-week period from Wednesday to Wednesday. If there is any missing return during this weekly window, we treat this week as a missing observation. Another k-day window, namely a 10-day period, is the Wednesday-Wednesday period over two weeks. Finally, 15- and 20-day windows are examined and defined similarly. As with the 5-day window, these alternative k-day windows require no missing daily return during the window. We also require at least 30 observations to be available to estimate the return variance. For example, a valid 20-day return variance needs at least 30 non-missing 20-day windows each of which has all 20 daily returns. Consequently, some of the 1,961 stocks in the initial sample have fewer than 30 valid k-day returns and thus are dropped out of the sample. As shown in Panel B of Table 1, all of the 1,961 stocks have more than 30 five-day returns, but some of them have missing 10-, 15-, or 20-day returns.

Using the remaining valid return variances, we calculate the variance ratio as defined by Eq. (3). As explained in Section 2, if daily returns follow the i.i.d. process, or equivalently, if there is

no temporary component, then the variance ratio should have a value of one because the variance of k-day return is simply k times the daily return variance. Table 1, Panel B, however, shows that the average variance ratio is greater than one for various values of k. This result attests to the role of a temporary component in daily price changes. That is, part of the daily price change is due to an innovation in the temporary component. This result is also consistent with French and Roll (1986) who find a negative autocorrelation in daily individual stock returns, particularly in small stock returns.

It is also noteworthy that some of the variance ratios take extreme values. For example, the maximum of VR_{15} is as large as 14.53. This outlier problem is less severe with other ratios, but the maximum values of VR_{10} and VR_{20} are both greater than 6. In the following analysis, we thus use only the variance ratios between 0.5 and 99.5 percentiles.

4.2. Univariate analysis – total return

We now conduct the univariate analysis to test our hypothesis. The procedure is as follows. Of the variance ratios used for Table 1, we first exclude those that are outside the 0.5~99.5 percentile range. We then sort the remaining ratios into four groups by their governance or core index value. For this univariate analysis, the variance ratios are estimated across the entire sample period. Accordingly, we need to use the average of the governance or core index value. With the governance index, group 1 contains stocks whose average index value is less than or equal to 5. Group 2 consists of stocks whose average index value is greater than 5 but smaller than 10. Stocks in group 3 have the average index value of 10 or higher but less than 14. Finally, group-4 stocks have the average index value of 14 or higher. With the core index, group-1 stocks have the average index value of 0, meaning that they have none of the three antitakeover provisions at any point in time. Group 2 has stocks whose average index value is greater than 0 but less than 1.5.

Group 3 has stocks with the average index value of 1.5 or higher but less than 3. Finally, stocks in group 4 are those that have all three provisions at all times (i.e., average index value of 3).

In each of the four groups, the average variance ratio and the standard error are calculated, and the following *t*-ratio is used to test the difference in variance ratio between groups 1 and 4:

$$t = (VR_{k,1} - VR_{k,4}) \Big/ \sqrt{\left(stderr_{k,1}^2 + stderr_{k,4}^2\right)}, \qquad (4)$$

where $VR_{k,i}$ and $stderr_{k,i}$ are, respectively, the cross-sectional average 1-day/*k*-day variance ratio within group *i* and the corresponding standard error. This approach amounts to assuming that the variance ratios in a given governance-sorted group are independent. Since this may not be true, we will produce the statistical significance alternatively in the later analysis.

Table 2 reports the results. We find a strong support for our hypothesis that a temporary component plays a larger role in stocks with fewer antitakeover provisions than in stocks with more such protections. More precisely, the difference in variance ratio between groups 1 and 4 is statistically significant, as the *t*-ratio for VR_5 is 2.57 for the governance index and 3.13 for the core index. With the governance index, the significance is somewhat sensitive to the value of k, as the *t*-ratios for VR_{10}, VR_{15}, and VR_{20} are, respectively, 0.14, 1.86, and 2.09. However, the greater variance ratio of group 1 than that of group 4 is remarkably robust with the core index. We also note that the variance ratios in Table 2 are no greater than 4.22, thereby making the outlier problem less of an issue.

The stronger results with the core index are attributable to two things. One is its exclusive focus on three key provisions. In other words, the core index is a more precise measure of takeover vulnerability than the governance index.[7] The other reason is the way that stocks are sorted by the index value. Recall that group-1 (group-4) stocks sorted by the core index have none (all) of the three provisions at any point in time. With the governance index, however,

[7] See, e.g., Bebchuk, Cohen, and Ferrell (2009) for a discussion on the noise in the governance index.

stocks are categorized into group 1 (group 4) as long as their average index is up to 5 (14 or higher). This means that they can have an index value higher than 5 (lower than 14) at some points in time.

To minimize such an information loss associated with the averaging of the index across the entire sample period, we examine the sub-periods defined by the updating of the IRRC database. By construction, the governance or core index value does not change during a given sub-period. This alternative approach is also useful in that the *t*-ratio can be calculated without assuming independence across individual variance ratios. That is, a t-ratio can be calculated by the average and standard error across the sub-periods as in, e.g., French and Roll (1986). The cost of this approach, however, is that those sub-periods span only two to three years, so some of the k-day return variances cannot be estimated precisely. For example, a sub-period spanning two years will give only about 50 observations for 10-day return variance estimation. We thus focus on VR_5 for this sub-period analysis. For each sub-period, we calculate the variance ratio using the daily or 5-day return variances that are estimated with at least 30 observations, and among them, we use only those ratios that are within the 0.5~99.5 percentile range.

Table 3 reports the results. Across the six sub-periods and the two alternative indices, VR_5 of group 1 is always greater than that of group 4. On average, group 1's VR_5 is 1.15 with the governance index and 1.17 with the core index. This means that 13 percent (= 1 – 1/1.15) to 17 percent (= 1 – 1/1.17) of daily return variance is caused by an innovation in the temporary component that goes away within a week. Group 4 has a smaller fraction of daily return variance attributable to an innovation in the temporary component, as the average VR_5 is 1.10 with the governance index and 1.11 with the core index. The *t*-ratio, based on the average and the standard errors across the sub-periods, indicates that the difference between the two extreme groups is statistically significant: the *t*-ratio is 2.78 with the governance index and 4.31 with the core index.

This sub-period approach addresses another important issue. As was detailed in Section 3, the composition of the IRRC database has changed significantly over time as it has expanded to smaller firms. This means that pooling the data over time can blur the actual cross-sectional distribution of the governance index. In this regard, the sub-period analysis is particularly instructive due to its exclusive focus on the cross-section of the index value at one point in time. We thus use this approach for the remaining analyses. We discuss the whole-period results when they are different from those of the sub-period analysis.

4.3. Univariate analysis – idiosyncratic return

The argument of stock return volatility as a sign of private information flow mostly concentrates on the firm-specific component of stock return. It is because private information is likely to be about firm-specific events rather than some market-wide affairs (e.g., Roll 1988). We thus repeat the analysis using firm-specific component in stock return instead of the total return. To extract this idiosyncratic element, we estimate the following equation:

$$r_{i,t} = \alpha_i + \beta_{i,1} MKTrf_t + \beta_{i,2} SMB_t + \beta_{i,3} HML_t + \beta_{i,4} LIQ_t + \varepsilon_{i,t}, \qquad (5)$$

where $r_{i,t}$ is the daily log return on stock i, *MKTrf*, *SMB*, and *HML* are the Fama-French's (1993) three factors, and *LIQ* is the liquidity factor of Pastor and Stambaugh (2003). We estimate this equation using daily-frequency data so that the residuals, $\varepsilon_{i,t}$, can represent firm-specific component in daily return on stock i. To obtain a k-day idiosyncratic return, we accumulate daily residuals during the k-day window. Using these residuals, we repeat the variance ratio calculation following the same procedure as the one for total returns.

Table 4 shows that the difference in VR_5 between groups 1 and 4 is more pronounced than the total return case. Specifically, group 1's VR_5 is, on average, 1.20 with the governance index, and is 1.21 with the core index. Group 4 has the average VR_5 of 1.16 with the governance index and

1.17 with the core index. More importantly, the *t*-ratio for the difference between the two groups is as large as 5.08 with the governance index and 7.17 with the core index.

In an unreported result, we also conducted the whole-period analysis using the idiosyncratic stock returns. Consistent with the total return results, stocks with fewer takeover protections have a greater VR_5 than those with more such protections, and this result is robust to using two different indices. Similar to the total return case, VR_{10}, and VR_{15} to a lesser extent, are not significantly different between the governance index-sorted extreme groups. However, the core index defines the two extreme groups in such a way that their VR_{10}, VR_{15}, and VR_{20} are reliably different.[8]

4.4. Multivariate analysis

4.4.1. Control variables

We now conduct the multivariate analysis to establish that stocks with fewer antitakeover provisions have a greater variance ratio even after controlling for other firm/stock characteristics. As detailed in Section 2.4 as one of the two embellishments of the hypothesis, we control for the volatility driven by a permanent component. Specifically, we control for the k-day return variance level. As the other embellishment, we include a measure of trading intensity of institutional investors, devised by Gaspar et al. (2005), since the demand/supply shock created by institutions is known to affect stock prices for non-fundamental reasons (e.g, Gompers and Metrick 2001). Hence, this measure speaks to the liquidity shock-driven mean reversion of Campbell, Grossman, and Wang (1993).

Given the finding of French and Roll (1986) that small stock returns are more negatively autocorrelated at daily frequency, firm size is also a natural control variable. Book-to-market ratio

[8] The results are available from the authors upon request.

and institutional holdings also need to be controlled for, since they represent the intensity of investor interests. Finally, we control for industry effects by using the 0/1 industry dummy variables, which are defined by Fama and French's 49 industry classifications. This control is crucially important, since takeover vulnerability and stock return volatility may be endogenously determined at the industry level. For instance, Gaspar and Massa (2006) find that firms in more competitive industries have a greater idiosyncratic volatility. Gillan, Hartzell, and Starks (2003) also show that the industry is an important factor affecting a firm's governance including its takeover vulnerability. We thus need to ensure that our univariate results are not driven by the cross-industry differences.

4.4.2. Regression analysis

Using these control variables, we estimate the Fama-MacBeth (1973) regressions: that is, we first estimate the cross-sectional regression for each sub-period and then average the estimated coefficients across the sub-periods.

Table 5 reports the regression results. The left-half panel is based on the governance index, and the first model in that panel shows that this index is negatively related to the variance ratio even in the presence of the control variables. This result means that the idiosyncratic volatility decreases with the number of takeover protections in a company. When the dummy variables are used instead of the continuous index value, the dummy for group 4 enters the regression significantly with a negative coefficient. Since the baseline case is group 1, this significant and negative coefficient means that the two groups have significantly different variance ratios, with that of group 4 being smaller.

The next two models use the idiosyncratic—as opposed to total—return-based variance ratios. The economic and statistical significance of the governance index or that of the dummy for group

4 remains largely unchanged. One noteworthy change in these two models is that the control variables are no longer significant. A possible explanation is that we already control for relevant firm characteristics by estimating Eq. (3) to obtain the firm-specific component in stock return.

The right-half panel is the results based on the core index. Qualitatively, there is little difference from the governance index-based results. In fact, the results are stronger with the core index. Recall that this was also the case in the univariate analysis and that we interpreted this pattern as indicative of our results being driven by takeover vulnerability (as measured by the core index), not by the general power balance between corporate managers and outside investors (as measured by the governance index).

Note that the values of the control variables are measured at the start of each sub-period, just as we measure the governance or the core index. We believe that using their initial value is appropriate, since our goal here is to see whether the earlier univariate relationship between takeover protections and variance ratio is driven by some other firm characteristics. Since the takeover vulnerability of a firm is measured at the beginning of the sub-period, it is correct to control for other aspects of the firm at the same point in time. However, to ensure the robustness of our results, we alternatively use the value of the control variables that are averaged during the sub-period. This will spuriously enhance their explanatory power, since the variance ratio measured during this period will be jointly determined with other firm characteristics. For example, an increase in institutional holdings might be caused by, rather than cause, the stock price behavior in a certain way that affects the variance ratio.

Table 6 reports the regression results. Two observations stand out in this table. First, the control variables become much more significant and, as a result, the R-squared improves noticeably. In this stronger presence of the control variables, the governance or core index is still reliably related to the variance ratio. With the total return-based variance ratio, the *t*-ratios for the

governance and for the core index are, respectively, -3.31 and -3.35. With the idiosyncratic return-based variance ratio, the *t*-ratio is somewhat lower but it is at least 2 in absolute terms. The dummy variable for group 4 also remains significant with just one exception; with the idiosyncratic return and the governance index, the *t*-ratio for the group-4 dummy variable is -1.74.

4.4.3. Alternative specifications

So far, we have not included the trading intensity measure of Gaspar et al. (2005) due to its high correlation with the institutional holdings. Specifically, their correlation coefficient is as high as 0.429 with the *p*-value smaller than 0.001. We now include it as another control variable to see whether our results hold up even when the non-fundamental price pressure (by institutions) is taken into account.

The results in Table 7 prove the robustness of our results to this additional control, which is measured at the start of each sub-period. The governance or core index continues to enter the regression with a significantly negative coefficient, and the dummy for group 4 continues to have a significantly negative coefficient. It is also interesting that the trading intensity measure itself is not significantly related to the variance ratio. However, when the trading intensity measure is averaged during the sub-period, its significance improves dramatically. As shown in Table 8, it enters the regression with a significant and positive coefficient, meaning that more active trading by institutions is contemporaneously associated with a greater variance ratio (i.e., greater mean-reversion in stock price). This is precisely what Campbell et al. (1993) predict. Still, the takeover vulnerability remains reliably related to the variance ratio with a negative coefficient.

In an unreported result, we employed another alternative specification that excludes financial or utilities firms. A typical rationale for such exclusion is that these industries are regulated and takeovers are mostly friendly. Note that this feature per se does not weaken the applicability of

our argument to those industries. To the extent that takeover is associated with a large price increase and thus motivates investors to engage in private information acquisition, our argument holds. However, if the lack of hostility in a takeover is associated with a smaller increase in stock price, then the private information flow may be smaller accordingly. Our use of this alternative specification addresses such a possibility, and we found that the results are robust to the exclusion of financial or utilities firms.[9]

4.5. Portfolio analysis

Thus far, we have analyzed individual stock returns. A natural question is whether our results carry over to portfolio. If this were the case, then the temporary component that we have detected via variance ratio cannot be idiosyncratic, thereby contradicting our underlying assumption that the innovations in the temporary component represent private information shocks, which are likely to be firm-specific (e.g., Roll 1988). Using the equally weighted portfolios sorted by the governance or core index, we found no relationship between the variance ratio and the takeover vulnerability at the portfolio level.

Of course, this analysis alone cannot tell whether an innovation in the temporary component is noise or information. However, given the mounting evidence that idiosyncratic stock return volatility proxies for private information flow (e.g., Durnev, Morck, and Yeung 2004) and that the vulnerability to an active takeover market is positively related to other proxies for private information flow (e.g., Ferreira and Laux 2004), our results are most consistent with the interpretation that those temporary shocks to stock price are information rather than noise.

5. Conclusions

[9] Those results are available from the authors upon request.

In this paper, we examine the variance ratio of individual stocks in relation to their antitakeover provisions. Our goal is to see whether the two are inversely related. That is, we test whether stocks with fewer antitakeover provisions have a larger fraction of their return volatility attributable to the innovations in a temporary component in stock price. Using the intersection of IRRC, CRSP, and Compustat stocks for the period from 1990 to 2003, we find strong support for this hypothesis. Our finding suggests that the greater openness to takeover market enhances the cost-benefit tradeoff of private information production in such a way that an otherwise short-lived shock is capitalized into price.

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Table 1. Summary statistics of daily log return and variance ratios – Initial sample

This table reports summary statistics of daily log return of the initial sample stocks and their variance ratios. This preliminary sample includes stocks that are covered by CRSP, Compustat, and IRRC databases. Stocks of the companies with multiple classes of stock are excluded from the sample. We also require at least three years' worth of daily stock return data to be available during our sample period from September 1990 to December 2003. In Panel B, VR_k represents the ratio of one-day return variance to k-day return variance (scaled by k). In doing so, if there is any missing daily return during a k-day window, we treat the k-day return for this window as missing.

	# firms	mean	stdev	min	max
Panel A. Summary statistics of daily log return					
	1,961	0.000	0.031	-0.278	0.230
Panel B. Summary statistics of variance ratios					
VR_5	1,961	1.11	0.27	0.55	4.80
VR_{10}	1,959	1.18	0.41	0.45	6.90
VR_{15}	1,933	1.24	0.59	0.39	14.53
VR_{20}	1,294	1.18	0.52	0.31	6.15

Table 2. Variance ratios – total return

This table reports the variance ratios of our sample stocks. Of all the variance ratios used in Table 1, only those within the 0.5~99.5 percentile range are used for this table. Specifically, those remaining variance ratios are sorted into four groups by the stock's governance or core index value averaged across the entire sample period. Within each group, the mean and standard errors (and other summary statistics) of individual variance ratios are estimated and reported.

	Based on governance index of Gompers,Ishii, and Metrick (2003)					Based on core index of Cremers and Nair (2005)				
group	# firms	mean	sterr	min	max	# firms	mean	sterr	min	max
Panel A. Ratio of 1-day return variance to 5-day return variance/5 (VR_5)										
1	137	1.16	0.03	0.70	2.53	95	1.21	0.04	0.76	2.38
2	1,071	1.11	0.01	0.70	2.28	577	1.10	0.01	0.70	2.53
3	664	1.08	0.01	0.69	2.39	786	1.10	0.01	0.69	2.39
4	71	1.06	0.02	0.73	1.85	485	1.09	0.01	0.69	2.38
t-stat for diff: 1 vs. 4		[2.57]					[3.13]			
Panel B. Ratio of 1-day return variance to 10-day return variance/10 (VR_{10})										
1	136	1.20	0.03	0.63	2.77	94	1.26	0.05	0.66	3.15
2	1,069	1.17	0.01	0.60	3.15	574	1.17	0.01	0.62	3.15
3	666	1.15	0.01	0.60	3.12	787	1.16	0.01	0.60	3.12
4	70	1.19	0.05	0.65	3.13	486	1.15	0.01	0.60	3.13
t-stat for diff: 1 vs. 4		[0.14]					[2.12]			
Panel C. Ratio of 1-day return variance to 15-day return variance/15 (VR_{15})										
1	131	1.30	0.05	0.61	4.22	92	1.37	0.07	0.58	4.22
2	1,059	1.23	0.01	0.52	4.00	565	1.21	0.02	0.52	4.00
3	657	1.20	0.02	0.54	4.19	780	1.22	0.02	0.53	4.19
4	68	1.17	0.05	0.58	2.81	478	1.20	0.02	0.54	3.68
t-stat for diff: 1 vs. 4		[1.86]					[2.49]			
Panel D. Ratio of 1-day return variance to 20-day return variance/20 (VR_{20})										
1	61	1.21	0.06	0.51	3.25	59	1.32	0.07	0.59	3.25
2	665	1.20	0.02	0.46	3.90	387	1.17	0.02	0.46	3.90
3	501	1.12	0.02	0.44	3.81	531	1.17	0.02	0.44	3.81
4	55	1.04	0.05	0.49	2.88	305	1.10	0.02	0.47	2.88
t-stat for diff: 1 vs. 4		[2.09]					[2.84]			

Table 3. Variance ratios (VR_5) – total return by sub-period

This table reports the variance ratios of our sample stocks by sub-periods. The sub-periods are defined by the updating of the IRRC database. For each sub-period, we follow exactly the same procedure as the one for Table 2.

		Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
period	group	# firms	mean	min	max	# firms	mean	min	max
1	1	122	1.10	0.64	2.59	127	1.10	0.65	2.67
	2	519	1.07	0.61	3.15	382	1.07	0.64	3.15
	3	457	1.04	0.63	3.10	363	1.05	0.61	3.10
	4	77	1.06	0.63	2.71	303	1.05	0.63	2.71
2	1	137	1.22	0.66	2.92	125	1.21	0.73	3.08
	2	541	1.14	0.69	3.21	386	1.16	0.66	2.92
	3	540	1.13	0.66	2.70	427	1.12	0.66	2.70
	4	89	1.13	0.67	2.57	369	1.13	0.67	3.21
3	1	121	1.13	0.66	2.67	101	1.21	0.74	2.67
	2	559	1.17	0.67	2.81	344	1.16	0.66	2.81
	3	565	1.15	0.69	2.44	470	1.15	0.67	2.44
	4	81	1.12	0.70	2.68	411	1.14	0.70	2.68
4	1	187	1.08	0.61	2.29	91	1.11	0.61	2.29
	2	673	1.07	0.59	2.31	424	1.06	0.61	2.06
	3	595	1.07	0.61	2.22	552	1.09	0.59	2.31
	4	73	1.03	0.61	1.60	461	1.04	0.61	2.22
5	1	129	1.22	0.71	2.94	81	1.22	0.72	2.94
	2	637	1.21	0.67	2.91	341	1.22	0.67	2.84
	3	547	1.21	0.67	2.93	499	1.21	0.67	2.91
	4	72	1.22	0.68	2.59	464	1.21	0.70	2.93
6	1	79	1.12	0.74	1.99	51	1.14	0.61	1.87
	2	523	1.10	0.58	1.98	253	1.11	0.67	1.99
	3	530	1.07	0.59	1.91	429	1.09	0.58	1.98
	4	82	1.05	0.57	1.93	481	1.07	0.57	1.98
average	1		1.15				1.17		
	2		1.13				1.13		
	3		1.11				1.12		
	4		1.10				1.11		
t-stat for diff: 1 vs. 4			[2.78]				[4.31]		

Table 4. Variance ratios (VR_5) – idiosyncratic return by sub-period

This table reports the variance ratio of idiosyncratic stock return by sub-periods. Instead of total return, we use the firm-specific component in stock return to calculate the variance ratio. The firm-specific component is extracted from Eq. (5). Other procedures are exactly the same as the one for Table 3.

		Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
period	group	# firms	mean	min	max	# firms	mean	min	max
1	1	122	1.20	0.69	2.58	127	1.20	0.71	2.74
	2	518	1.17	0.68	3.01	382	1.18	0.69	3.01
	3	458	1.16	0.68	2.87	361	1.16	0.68	2.87
	4	77	1.20	0.70	2.80	305	1.17	0.68	2.80
2	1	137	1.25	0.70	2.76	125	1.25	0.80	3.01
	2	542	1.19	0.70	3.09	387	1.21	0.70	3.09
	3	539	1.19	0.70	2.61	428	1.18	0.70	2.61
	4	89	1.20	0.72	2.69	367	1.19	0.72	2.69
3	1	121	1.17	0.69	2.62	101	1.23	0.78	2.62
	2	556	1.20	0.69	2.94	343	1.18	0.68	2.25
	3	567	1.18	0.68	2.54	471	1.19	0.69	2.94
	4	82	1.14	0.76	2.73	411	1.18	0.73	2.73
4	1	186	1.17	0.66	2.20	90	1.19	0.67	2.32
	2	674	1.17	0.65	2.32	424	1.16	0.66	2.27
	3	594	1.15	0.64	2.29	550	1.18	0.64	2.31
	4	74	1.12	0.67	1.74	464	1.13	0.64	2.29
5	1	129	1.23	0.71	2.32	81	1.22	0.71	2.32
	2	638	1.21	0.65	3.00	340	1.21	0.68	2.63
	3	547	1.21	0.66	3.00	499	1.21	0.65	3.00
	4	71	1.18	0.71	2.39	465	1.20	0.66	3.00
6	1	79	1.19	0.78	2.07	51	1.20	0.78	1.96
	2	525	1.15	0.66	2.24	254	1.16	0.69	2.24
	3	529	1.13	0.59	2.21	429	1.13	0.66	2.21
	4	81	1.12	0.60	1.88	480	1.13	0.59	1.97
average	1		1.20				1.21		
	2		1.18				1.18		
	3		1.17				1.17		
	4		1.16				1.17		
t-stat for diff: 1 vs. 4			[5.08]				[7.17]		

Table 5. Fama-MacBeth regression of VR_5 on firm characteristics

This table reports the results of the Fama-MacBeth regression of VR_5 on various firm characteristics including the governance or core index. The value of control variables is as of the beginning of the sub-period.

	Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
	Total return-based VR_5		Idiosyncratic return-based VR_5		Total return-based VR_5		Idiosyncratic return-based VR_5	
intercept	1.636	1.627	1.141	1.137	1.626	1.637	1.116	1.136
	[9.42]	[9.19]	[10.99]	[12.73]	[9.35]	[9.27]	[11.44]	[11.73]
Governance	-0.003		-0.005		-0.010		-0.013	
or Core index	[-2.63]		[-3.90]		[-2.83]		[-4.70]	
Dummy		-0.015		-0.018		-0.022		-0.040
(group 2)		[-2.62]		[-1.25]		[-2.62]		[-3.20]
Dummy		-0.021		-0.037		-0.030		-0.050
(group 3)		[-4.22]		[-3.83]		[-2.14]		[-2.96]
Dummy		-0.030		-0.036		-0.036		-0.054
(group 4)		[-2.77]		[-2.05]		[-2.66]		[-4.00]
ln(mktcap)	-0.018	-0.018	0.003	0.003	-0.018	-0.018	0.003	0.003
	[-2.76]	[-2.77]	[1.11]	[1.00]	[-2.76]	[-2.71]	[1.16]	[1.16]
ln(BM)	-0.002	-0.002	0.004	0.004	-0.002	-0.002	0.004	0.004
	[-0.41]	[-0.42]	[0.82]	[0.81]	[-0.37]	[-0.35]	[0.73]	[0.74]
Institutional	-0.239	-0.238	-0.021	-0.019	-0.237	-0.236	-0.020	-0.021
holdings	[-6.54]	[-6.62]	[-0.74]	[-0.65]	[-6.66]	[-6.82]	[-0.70]	[-0.76]
Variance	-6.619	-6.558	-1.187	-1.186	-6.514	-6.470	-0.983	-0.937
level	[-2.75]	[-2.75]	[-1.61]	[-1.58]	[-2.73]	[-2.74]	[-1.37]	[-1.28]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average R^2	14.0%	14.1%	5.2%	5.4%	14.0%	14.2%	5.1%	5.4%
Average # obs.	1,065	1,065	1,041	1,041	1,065	1,065	1,041	1,041

Table 6. Fama-MacBeth regression of VR_5 on firm characteristics - alternative specifications

This table reports the results of the Fama-MacBeth regression of VR_5 on various firm characteristics including the governance or core index. The value of control variables is the average during the sub-period.

	Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
	Total return-based VR_5		Idiosyncratic return-based VR_5		Total return-based VR_5		Idiosyncratic return-based VR_5	
intercept	1.738	1.729	1.675	1.673	1.724	1.728	1.664	1.673
	[9.80]	[9.53]	[12.20]	[11.91]	[9.69]	[9.68]	[12.12]	[11.89]
Governance or Core index	-0.004		-0.003		-0.010		-0.008	
	[-3.31]		[-2.00]		[-3.35]		[-2.58]	
Dummy (group 2)		-0.022		-0.022		-0.015		-0.018
		[-2.54]		[-2.78]		[-1.82]		[-3.40]
Dummy (group 3)		-0.030		-0.028		-0.024		-0.024
		[-7.21]		[-3.79]		[-2.00]		[-1.76]
Dummy (group 4)		-0.035		-0.034		-0.032		-0.029
		[-3.43]		[-1.74]		[-2.89]		[-2.86]
ln(mktcap)	-0.022	-0.022	-0.021	-0.021	-0.022	-0.022	-0.021	-0.021
	[-3.62]	[-3.63]	[-5.43]	[-5.40]	[-3.64]	[-3.59]	[-5.50]	[-5.42]
ln(BM)	-0.012	-0.012	-0.009	-0.009	-0.012	-0.012	-0.009	-0.009
	[-2.64]	[-2.72]	[-2.66]	[-2.69]	[-2.59]	[-2.60]	[-2.76]	[-2.74]
Institutional holdings	-0.290	-0.289	-0.223	-0.220	-0.290	-0.289	-0.222	-0.220
	[-8.43]	[-8.73]	[-5.87]	[-5.98]	[-8.51]	[-8.60]	[-6.01]	[-6.07]
Variance level	-6.507	-6.466	-4.855	-4.833	-6.409	-6.398	-4.774	-4.774
	[-2.06]	[-2.06]	[-1.39]	[-1.38]	[-2.04]	[-2.05]	[-1.39]	[-1.39]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average R^2	14.5%	14.5%	11.8%	12.0%	14.4%	14.6%	11.8%	11.9%
Average # obs.	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127

Table 7. Fama-MacBeth regression of VR_5 on firm characteristics - Including trading intensity

This table reports the results of the Fama-MacBeth regression of VR_5 on various firm characteristics including the governance or core index. The value of control variables is as of the beginning of the sub-period.

	Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
	Total return-based VR_5		Idiosyncratic return-based VR_5		Total return-based VR_5		Idiosyncratic return-based VR_5	
intercept	1.595	1.581	1.296	1.277	1.580	1.586	1.282	1.298
	[8.95]	[8.78]	[10.37]	[10.76]	[8.92]	[8.78]	[10.23]	[10.35]
Governance or Core index	-0.004		-0.005		-0.012		-0.015	
	[-3.30]		[-5.54]		[-2.70]		[-5.86]	
Dummy (group 2)		-0.017		-0.023		-0.020		-0.025
		[-1.98]		[-2.59]		[-2.99]		[-1.49]
Dummy (group 3)		-0.030		-0.038		-0.029		-0.040
		[-4.37]		[-3.04]		[-2.03]		[-2.92]
Dummy (group 4)		-0.038		-0.054		-0.040		-0.052
		[-4.03]		[-5.89]		[-3.00]		[-7.29]
ln(mktcap)	-0.016	-0.016	-0.011	-0.011	-0.016	-0.016	-0.012	-0.012
	[-2.27]	[-2.28]	[-5.66]	[-5.39]	[-2.29]	[-2.23]	[-5.51]	[-5.37]
ln(BM)	-0.010	-0.010	-0.001	-0.001	-0.009	-0.009	-0.001	-0.001
	[-2.04]	[-2.07]	[-0.15]	[-0.12]	[-1.94]	[-1.86]	[-0.17]	[-0.16]
Institutional holdings	-0.224	-0.223	0.031	0.031	-0.224	-0.223	0.029	0.029
	[-6.76]	[-6.84]	[2.51]	[2.42]	[-7.00]	[-7.18]	[2.42]	[2.41]
Variance level	-8.568	-8.515	-0.981	-0.950	-8.490	-8.460	-0.776	-0.809
	[-5.54]	[-5.47]	[-0.84]	[-0.81]	[-5.38]	[-5.37]	[-0.69]	[-0.71]
Trading intensity	-0.077	-0.077	-0.059	-0.069	-0.069	-0.074	-0.060	-0.068
	[-0.41]	[-0.41]	[-0.47]	[-0.55]	[-0.36]	[-0.39]	[-0.48]	[-0.51]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average R^2	14.2%	14.2%	6.5%	6.5%	14.2%	14.4%	6.5%	6.7%
Average # obs.	1,024	1,024	957	957	1,024	1,024	957	957

Table 8. Fama-MacBeth regression of VR_5 on firm characteristics - Including trading intensity & alternative specifications

This table reports the results of the Fama-MacBeth regression of VR_5 on various firm characteristics including the governance or core index. The value of control variables is the average during the sub-period.

	Based on governance index of Gompers,Ishii, and Metrick (2003)				Based on core index of Cremers and Nair (2005)			
	Total return-based VR_5		Idiosyncratic return-based VR_5		Total return-based VR_5		Idiosyncratic return-based VR_5	
intercept	1.652	1.644	1.615	1.615	1.640	1.647	1.603	1.613
	[8.84]	[8.64]	[11.87]	[11.64]	[8.75]	[8.76]	[11.74]	[11.59]
Governance or Core index	-0.003		-0.003		-0.010		-0.009	
	[-2.19]		[-1.88]		[-3.12]		[-2.94]	
Dummy (group 2)		-0.013		-0.024		-0.019		-0.018
		[-1.46]		[-2.83]		[-2.61]		[-3.99]
Dummy (group 3)		-0.021		-0.029		-0.028		-0.028
		[-2.33]		[-3.93]		[-2.35]		[-2.11]
Dummy (group 4)		-0.025		-0.036		-0.035		-0.033
		[-2.29]		[-1.71]		[-3.05]		[-3.12]
ln(mktcap)	-0.020	-0.020	-0.022	-0.022	-0.020	-0.020	-0.022	-0.022
	[-2.69]	[-2.69]	[-6.19]	[-6.12]	[-2.69]	[-2.67]	[-6.20]	[-6.15]
ln(BM)	-0.009	-0.009	-0.007	-0.007	-0.008	-0.008	-0.006	-0.006
	[-1.75]	[-1.79]	[-1.55]	[-1.63]	[-1.60]	[-1.58]	[-1.41]	[-1.38]
Institutional holdings	-0.298	-0.296	-0.255	-0.251	-0.296	-0.294	-0.253	-0.251
	[-8.52]	[-8.69]	[-7.06]	[-7.20]	[-8.71]	[-8.90]	[-7.32]	[-7.41]
Variance level	-8.023	-7.987	-6.285	-6.309	-7.949	-7.935	-6.225	-6.243
	[-4.11]	[-4.16]	[-2.65]	[-2.65]	[-4.11]	[-4.18]	[-2.70]	[-2.72]
Trading intensity	0.370	0.369	0.688	0.682	0.388	0.384	0.695	0.691
	[2.26]	[2.22]	[4.03]	[4.01]	[2.38]	[2.35]	[3.91]	[3.88]
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average R^2	14.3%	14.4%	11.4%	11.5%	14.3%	14.5%	11.3%	11.5%
Average # obs.	1,066	1,066	1,100	1,100	1,066	1,066	1,100	1,100