DO INDIVIDUAL INVESTORS AFFECT SHARE PRICE ACCURACY? SOME PRELIMINARY EVIDENCE

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1. Introduction

When the securities laws were enacted, the goal of securities regulation was perceived as protecting the "ordinary" investor (Winter 1988). However, modern scholars of securities regulation assert that the goal of securities regulation should be the attainment of efficient financial markets to improve the allocation of resources in the economy (see, for example, Goshen and Parchomovsky 2006). Of course, the proposed modern and historical goals do not necessarily have to be in conflict. Providing legal protection for ordinary investors is justified if, in doing so, the efficiency of the market functions they perform is enhanced (Winter 1988).

Some leading scholars, however, suggest not only that ordinary (individual) investors perform no valuable market functions warranting special protections, but also that these investors are "noise traders"[1] that distort asset prices and harm market efficiency (see, for example, Barber, Odean and Zhu 2005). Share prices are "accurate" or reflective of "fundamental value" when they serve as good predictors of future cash flows to shareholders over the life of the firm (see, for example, Fox et al. [2003] for a comprehensive discussion of the related concepts of "share price accuracy" and "share price informedness."). Share prices do this by incorporating information that predicts these future cash flows, rather than reflecting "noise."

Accurate share prices play an important role in the economy. Stock prices serve as signals for the proper allocation of capital among firms, as investors use stock prices in making investment decisions (Durnev et al. 2003). Nobel laureate James Tobin (1982) describes the state of affairs when the stock market directs capital to its highest value use as "functional efficiency." Share prices must be accurate (that is, track the fundamental value of the firm in question) if there is to be functional efficiency (Durnev et al. 2003).

Because of the importance of share price accuracy, researchers have struggled with attempts to understand what things affect share price accuracy, including engaging in extensive study of the role of individual investors and noise traders in capital markets. The policy implications seem clear. If individuals, as a group, act as noise traders, one could argue that society would be better served if the direct participation of retail investors in securities markets were restricted.[2] Indeed, one leading securities regulation scholar, Donald Langevoort (2002, 172-73), states:

> "…[T]he more emotions and cognitive biases of noise traders adversely affect market prices, the more noise traders can be construed as "bad guys." Good public policy would then be to eradicate these biases if possible, or at least neutralize their social and economic

[1] Noise is that which is introduced into stock prices when investors trade, not based on company fundamentals, but on fads, rumors or other types of unreliable information.

[2] Though eliminating individual investors from the capital markets seems politically infeasible, it is not implausible. One leading securities regulation scholar, Stephen Choi (2000), though not arguing that individual investors distort stock prices, has proposed an investor classification scheme (based on informational resources and market knowledge, as displayed on a licensing exam) that would prohibit direct investment in securities markets by unsophisticated investors. In addition, (1) the recent proliferation, and then consolidation, of private trading platforms, which are open only to large institutional investors trading securities issued privately through Rule 144A offerings, and (2) the existence of alternative trading systems (so-called "dark pools"), designed to provide additional liquidity for institutional investors trading in public securities, demonstrate that market participants are willing to trade in an environment that excludes individual investors. Though it is perhaps unlikely that a private trading platform or alternative trading systems could replace our current deep, liquid public capital markets, the creation of a market with no or limited individual investor participation is at least possible.

> influence…[T]his is the deep concern about where the behavioral literature leads us: if accurate, it invites regulation that privileges the savvy and treats unsophisticated traders as economic undesirables."

This Article provides evidence on the effect of individual investors on share price accuracy and attempts to contribute to the debate surrounding whether individual investors are indeed "economic undesirables." This study uses a new data set of New York Stock Exchange ("NYSE") retail trading statistics and finds that higher levels of trading, as well as stock ownership, by individual investors are significantly correlated with a commonly used metric for share price accuracy, firm-specific stock return variation (R^2). Though there is some controversy about the correct interpretation of this metric, the predominant view among R^2 adherents is the greater a stock's firm-specific return variation (that is, the lower the R^2), the more accurate is its price. The evidence provided by this study shows not only that increased levels of retail trading and stock ownership are associated with lower R^2's, but also that there is reason to believe the relationship is a causal one (that is, retail trading and ownership cause changes in R^2). If the proper interpretation of R^2 is that a lower R^2 is consistent with a more accurate price, then restricting the access of large numbers of individual investors to equity markets is not only unwarranted, but also could harm market functioning. If the prevailing view is misguided, however, and lower R^2 reflects informational inefficiency, then it is likely that individual investors, as a group, do negatively affect share price accuracy, and labeling such investors as noise traders may be justified.

The Article proceeds as follows. Section 2 summarizes the existing literature surrounding noise trading and individual investors in an attempt to provide some context for the debate. Section 3 describes the R^2 methodology, and Section 4 describes the data used and analytical methodologies of the study. Section 4 also presents preliminary results. Section 5 concludes and briefly considers the policy implications of this study's findings.

2. Review of Existing Literature

Finance scholars are keenly interested in the effects of irrational or noise traders on stock prices and market efficiency. The traditional belief is that irrational traders cannot affect share prices over the long run. Under this theory, trading based on mistaken beliefs will lead to trading losses against rational, informed investors and wealth reductions that will make it impossible for irrational traders to survive in a competitive marketplace (see, for example, Friedman 1953; Fama 1965). In addition, under this view, the trades of irrational traders are random and uncorrelated, thus tending to cancel one another out and largely eliminating any price effects from such trading (see, for example, Friedman 1953; Fama 1965). Thus, as the theory goes, there is little reason to worry about the presence of noise traders.

The historical view has come under intense attack, as scholars debate whether irrational traders can survive in the long run and affect share prices.[3] In a recent study, Kogan et al. (2006) conclude that irrational traders can have a persistent effect on stock prices even if they do not "survive" (that is, the value of their trades is infinitesimal in relation to the total value of trades because they have suffered wealth reductions). In addition, a great deal of empirical analysis provides evidence that the trades of irrational investors are not random and do not cancel one another out. Indeed, the evidence suggests that noise traders often act as a herd (see Hirshleifer and Teoh [2003] and Lux [1995] for a review of the literature related to herding behavior). Thus, in the opinion of many in the finance and legal academies, the noise trader risk is real, and protecting market efficiency requires creating a climate that can

[3] As noted by Kogan et al. (2006, 195-96), De Long et al. (1990) argue, on the basis of a partial equilibrium model, that irrational traders hold portfolios with high growth and can potentially outgrow rational traders and thus survive. Conversely, Sandroni (2000) and Blume and Easley (2001), using general equilibrium models, conclude that "irrational traders do not survive in the long run."

counteract the effects of noise traders (see, for example, Goshen and Parchomovsky 2006; Langevoort 2002).

Given the potential effects on market efficiency by irrational traders, scholars have been very interested in the question of who the irrational traders are. Individual investors are natural targets of noise trading suspicion, as most prior research shows that individual investors are more likely than institutional investors to make irrational or imprudent investment decisions (Jackson 2003).

Many assert that individual investors are, in fact, noise traders (see, for example, Barber, Odean and Zhu 2005), but some researchers have found evidence that calls that belief into question. Jackson (2003), after analyzing a unique dataset of 41.9 million retail investor trades over an 11-year period on the Australian Stock Exchange, finds that, though individuals invest in a systematic fashion, it would not be appropriate to characterize their trading behavior as "irrational." Indeed, the trades of individuals investing through full-service brokerage firms positively predict future market returns.[4] Jackson states that one potential reason for this result could be individuals' possession of valuable private information.

In addition, Choe, Kho and Stulz (2001), based on a study of two years (1996-1998)[5] of Korea Stock Exchange trading data, find that domestic retail investors[6] possess a short-lived informational advantage over both foreign investors and domestic institutional investors. An event study on trading behavior of different classes of investors around days on which stock prices have a 5% or more, in absolute value, abnormal return reveals that domestic individual traders have a higher proportion of buy trades before the event than after and a lower proportion of sell trades before the event than after. No other investor class studied exhibits this pattern. This suggests that individual investors, in the aggregate, are capable of predicting future corporate events.

The seemingly more traditional view on noise trading risk is reflected in the results of the following three studies. Barber, Odean and Zhu (2005), like Jackson (2003), find that small trades (serving as a proxy for trades by individual investors) are correlated and can move equity markets. However, unlike Jackson and consistent with the more prevalent view, Barber, Odean and Zhu conclude that buying by retail investors pushes prices too high (above their fundamental values) and that selling by retail investors pushes prices too low (below their fundamental values). The researchers, taking it as a given that individual investors are the noise traders in markets, then conclude that noise traders do move markets. Similarly, Hvidkjaer (2006), using trade size as a proxy for the trades of individual investors, conducts a study on individual investor trading patterns and concludes that there is a systematic component to retail trading and that such trading behavior can lead to or protract periods where a stock is over- or undervalued. Finally, Kumar and Lee (2006) also find that retail investor trades are systematically correlated, that this concerted action can affect stock returns and that this "retail sentiment" does not appear to be an outgrowth of a reaction to factors related to fundamental value.

This Article contributes to the literature by providing information to assess the noise trader claim against retail investors. One of the benefits of this study is its use of direct New York Stock Exchange retail

[4] Jackson examines trades from individuals that invest through 47 full-service brokerage firms and 9 Internet brokers. The trades of the full-service brokerage clients drive the study's results.
[5] It is possible that the Asian crisis of the late 1990's and its market effects during the study period may not make the findings of this study generalizable.
[6] Choe, Kho and Stulz (2001) report that, at the time of the study, retail investors were the most active traders on the Korea Stock Exchange, with their sales representing 77.43% of the gross value of stock sales in 1998. This, of course, is a much higher proportion of retail investor participation than that which exists in the United States.

trading data and not individual investor trading proxies such as small share size[7] or odd-lot trading,[8] which suffer from some important limitations.[9] First, using small share size as a proxy for trades by individual investors potentially can distort results. Institutions often break up their trades into smaller batches to hide their intentions from other market participants or for other, liquidity-based reasons (Hvidkjaer 2006). Thus, trades that appear to be made by individuals, given the small size, could actually be a portion of a trade made by an institutional investor.[10] In addition, odd-lot trading data has a strong potential for underinclusiveness with respect to retail trading. Though any investor is permitted to trade in odd lots, it is generally believed that individual investors of lower wealth are more apt to do so. The problem with using odd-lot trading data as a proxy for individual investor trading is that many individual investors trade in round lots; indeed, there is evidence that they prefer to do so.[11] Use of odd-lot data loses the impact of round-lot trading in study results. This study also contributes to the literature, as it is the first, to my knowledge, to study the relationship between retail trading activity and R^2, a statistic, as described in the next section, used extensively in the finance literature as a measure of share price informedness and accuracy.

3. R^2

In this study, I use R^2 as a measure of share price accuracy. The R^2 used in this context is the R^2 statistic obtained by regressing the individual returns of a firm's stock on the returns of the market as a whole and the firm's industry group (excluding the firm in question). In statistics, R^2 tells us how much of the variation (expressed as a percentage) observed in a dependent variable (in this case, a firm's individual stock return) is explained[12] by the independent or explanatory variables (in this case, the market return and the industry return). R^2 takes the value of 0.0 – 1.0, with an R^2 of 0.0 signifying that none of the variation in the dependent variable is explained by its relationship with the independent variables. Conversely, an R^2 of 1.0 means that 100% of the variation in the dependent variable is explained by its relationship with the independent variables.

In the context of this study, a high R^2 means that a great deal of the variation in an individual firm's stock returns can be explained by the market return and the industry return. In other words, the firm's stock price is influenced primarily by movements in the market as a whole and stocks in the firm's industry group. Conversely, a low R^2 means that a firm's stock price movements bear little relation to movements in market prices or prices of its industry peers. There are two potential explanations for this occurrence: 1) Low R^2 means that the firm's stock price is more "informationally efficient" because it incorporates firm-specific (rather than market or industry) information and is therefore more "accurate" or 2) Low R^2

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[7] Barber, Odean and Zhu (2005) recognize the limitations of small share size as a proxy for individual investor trading and do some limited testing of their data against actual brokerage firm data to gain comfort in the representativeness of their data sets.

[8] Odd-lot trading is trading a number of shares other than that which is required for a round lot (100 shares). Wu (1972), in a study of individual investor trading behavior that used odd-lot trading data as a proxy for the trades of such investors, concludes that odd-lot trading has no effect on share prices. For an example of a recent work using odd-lot trading data as a proxy for retail investor trading, see Brusa, Liu and Schulman (2005).

[9] Kaniel, Saar and Titman (2008), in a study of retail investor behavior, use a proprietary data set of NYSE trades provided to the researchers directly by the NYSE. They find that retail investor trades tend to follow certain patterns, but that there is no strong evidence that the trades of individuals are correlated. Though their findings are relevant to the ongoing debate, they do not provide evidence that directly addresses the question of whether individual investors affect share price accuracy.

[10] Indeed, the average size of a market trade today is 260 shares, down from 1,400 shares a decade ago (Patterson and Lucchetti 2008).

[11] See note 56 for further discussion.

[12] The word "explained" as used in this context does not suggest that the independent variables *cause* changes in the dependent variable.

means the firm's stock price reflects a great deal of non-market or industry information, but such information is noise, rather than information related to a company's fundamentals (Roll 1988, Durnev et al. 2003).[13]

In current finance scholarship, among R^2 metric adherents,[14] the former view prevails, but is controversial. The evidence that a low R^2 is a metric of informational efficiency and share price accuracy is strong. Durnev et al. (2003) provide the most direct evidence on this question as they compare firm-specific stock return variation (R^2) and accounting-based measures of stock price informativeness. They define stock price informativeness as the measure of how much information stock prices contain about future earnings, estimated from a regression of then-current stock returns on current and future accounting earnings. Durnev et al. (2003) find that firm-specific variability (a lower R^2) is positively correlated with their measures of stock price informativeness and conclude that low R^2 is indeed a sign of share price accuracy and not noise impounded in share prices.

In addition, Durnev, Morck, and Yeung (2001) find, *inter alia*, that firms operating in U.S. industries with lower R^2's (greater firm-specific return variation) use more external financing. The authors suggest that this provides evidence that low R^2 is associated with stock prices that more closely track firm fundamentals, as outside financing is less costly because accurate prices reduce information asymmetry. In another study, Durnev, Morck, and Yeung (2004) find a strong correlation between firm-specific return variation and economically efficient corporate investment. Here, the authors suggest that capital investment should be more efficient when stock prices are more informative because accurate prices give signals to both management and financial market participants about the quality of management's investment decisions. Presumably managers may use this signal to change course when necessary, and investors, as Durnev, Morck, and Yeung (2004) suggest, may use this signal to intervene as necessary in the face of poor management decisions. Similarly, Chen, Goldstein and Jiang (2007) present evidence that fluctuations in stock prices affect the capital investment decisions of firms with low R^2's more than those with high R^2's. The authors of the study, who adopt the informational efficiency interpretation of low R^2, conclude that this result serves as evidence of managers learning valuable information about company fundamentals from changes in stock prices and incorporating such new knowledge in their investment decisions.

The conclusions the researchers draw in the aforementioned studies of informational efficiency at the firm and industry level is consistent with other evidence of R^2 at the country level. A number of studies show correlations between better functioning equity markets and greater firm-specific return variation (lower R^2's). For example, Morck, Yeung and Yu (2000) calculate, inter alia, the average R^2's of the firms in each of 40 different countries. The five countries with firms having the highest average levels of firm-specific variation (lowest R^2's) include, in order, the United States, Ireland, Canada, the UK and Australia. The five countries with firms having the lowest average levels of firm-specific variation (highest R^2's) include, in order, Poland, China, Malaysia, Taiwan and Turkey. Overall, and with few

[13] Of course, a low R^2 could simply mean that a firm's stock price moves largely independently of the market and its industry group and that the information compounded in its stock price is a combination of fundamental information and noise. This explanation is quite plausible, but, as described in this section, researchers have provided evidence on whether one or the other explanation (rather than a little of both) is more likely.

[14] Asset pricing adherents are likely to be skeptical of the claim that the R^2 metric can tell us anything about share price accuracy or informational efficiency. They may argue that R^2 is very similar to beta, and a high beta indicates that a stock's returns closely track the returns of the overall market. Under this interpretation, which is consistent with asset pricing models, both high beta and low beta stocks operate in an environment that is assumed to be fully informed. There is a point of fundamental disagreement between R^2 adherents and asset pricing adherents with respect to influences on share price changes. There is a longstanding debate among finance theorists on whether the capital asset pricing model accurately predicts asset returns. This debate is well-known and bears no repeating here.

exceptions, firms in low-income economies (measured by per capita GDP) have, on average, the highest R^2's. This evidence is consistent with the intuition that firms in more well developed economies have more accurate share prices.[15] Similarly, researchers find that lower average firm R^2's are associated with more efficient capital allocation in a country (Wurgler 2000) and less country-level opaqueness[16] (Jin and Myers 2006).

The R^2 methodology also has found adherents among the ranks of legal scholars who contribute valuable evidence to the debate. For example, Fox and his co-authors Morck, Yeung and Durnev (2003) conclude that enhanced mandatory disclosure rules adopted in the United States in December 1980 made share prices more accurate (as evidenced by a decrease in average R^2 across firms). In addition, Beny (2005) employs the country R^2 statistics of Morck, Yeung and Yu (2000) as a measure of share price informativeness and concludes that stronger formal insider trading laws in a country are associated with more informative share prices (that is, lower average R^2) for firms within that country.

Though a number of leading finance and legal studies use R^2 as a metric of stock price informational efficiency, the correct interpretation of the R^2 metric recently has been the subject of intense debate in the finance literature. Hou, Peng and Xiong (2006) question the informational-efficiency interpretation of R^2 and contend instead that R^2 is a measure of price *inefficiency.* They base this view on the results of independent empirical analysis and also point to the following studies as evidence consistent with their interpretation of R^2.

Chan and Hameed (2006) conduct a study that compares stock price synchronicity and research analyst activity in emerging markets and find that greater coverage by research analysts is associated with more stock price synchronicity (lower firm-specific information in prices or higher R^2's). This result is consistent with that of a similar study of firms in the United States (see Piotroski and Roulstone 2004). Based on these results, Chan and Hameed (2006) conclude that the conventional wisdom that research analysts produce firm-specific information is incorrect and that what analysts actually produce is market-wide information. Hou, Peng and Xiong (2006), however, point to this result as evidence that the R^2 metric is not a measure of informational efficiency -- apparently, because this result is contrary to expectations.[17]

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[15] The study also finds there is greater firm-specific stock return variation in firms in countries with stronger private property rights for public investors. The authors suggest that the presence of strong property rights makes informed arbitrage more likely and noise trading less likely, thus leading to the impounding of more firm-specific information into prices. Morck, Yeung and Yu (2000, 242-43) describe informed arbitrage thusly, "Finance theory posits that risk arbitragers expend resources uncovering proprietary information about stocks and earn an acceptable return by using the information to trade against less informed investors. Risk arbitrageurs accumulate information until the marginal cost of gathering an additional unit of information exceeds its risk-adjusted marginal return. Such trading by many risk arbitrageurs, each with unique proprietary information, is thought to capitalize information into share prices. Risk arbitrage of this sort may be less economically attractive in countries that protect property rights more poorly for several reasons…[including because] risk arbitrageurs who…make correct predictions may not be allowed to keep their earnings in countries that protect private property rights poorly, especially if the risk arbitrageurs are political outsiders."

[16] Jin and Myers (2006, 281) define opaqueness as a "lack of information that would enable investors to observe operating cash flow and income and determine firm value."

[17] The work of Veldkamp (2006) may help bridge the gap between these two competing interpretations. Veldkamp (2006, 823) sets forth a model in which "investors purchase information that generates comovement." Consistent with this model, she argues, is the finding by Hameed, Morck and Yeung (2005) that firms (after controlling for size) with more analyst coverage tend to have fundamentals that predict other firms' fundamentals. Thus, the information provided by research analysts can produce comovement.

Hou, Peng and Xiong (2006) also cite a study performed by Ashbaugh-Skaife, Gassen and LaFond (2006), which finds that (1) higher, not lower, R^2's are associated with more informative prices in the United States and Germany and (2) no statistically significant relationship exists between R^2 and measures of stock price informativeness in the U.K., Australia, France or Japan. Ashbaugh-Skaife, Gassen and LaFond conclude that there is no consistent relationship between R^2 and stock price informativeness in international markets.

Teoh, Yang, and Zhang (2006) conclude that firms with low R^2's were more likely to have accounting-based return anomalies, poor earnings quality and weak fundamentals. Thus, rather than a metric of share price accuracy, these researchers assert that a low R^2 is actually an indicator of the level of *uncertainty* faced by investors. Finally, Hou, Peng and Xiong (2006) report the results of their own study that finds evidence that stocks with lower R^2's exhibit what the researchers term "overreaction-driven price momentum" and more long run price-reversals.[18]

Similar to the findings above, legal scholar Ferrell (2003) reports the change of R^2 in over-the-counter stocks (OTC) after passage of the 1964 Securities Acts Amendments in the United States. The 1964 Amendments extended mandatory disclosure requirements, which then applied only to exchange-listed stocks, to over-the-counter stocks. Ferrell finds that prior to OTC mandated disclosure, the R^2s of OTC stocks were lower, on average, than those of listed stocks, a result Ferrell terms "highly implausible" if low R^2's are a sign of informational efficiency.

As demonstrated above, currently the prevailing view (as measured by publication) in the academy among g is that R^2 is a measure of price informativeness, but that view is highly controversial. Lee and Liu (2007) attempt to reconcile the two competing interpretations of R^2. They hypothesize that the relationship between R^2 and share price informativeness is not monotonic, but rather U-shaped. They then conclude that when there is more firm-specific return variation in stocks that operate in "good" information environments, as defined by six "informativeness" measures adopted by the researchers and widely used in the literature,[19] lower R^2s are a sign of more price informedness. Conversely, for firms that operate in "poor" information environments, higher R^2's are a sign of more accurate prices.[20] The idea is that if a firm operates in a good environment for information, then having more of the firm-specific variety will enhance share price accuracy.[21]

Similarly, the findings of Dasgupta, Gan and Gao (2007) also may help reconcile the competing views on R^2. The researchers argue that the R^2 metric must be put into context vis-à-vis a firm's transparency

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[18] The researchers consider price momentum in a stock an outcome of investor overreaction. Price momentum is defined in this study as the presence of a phenomenon by which an investor could buy the "winning" stocks and short sell the "losing" stocks from a prior six-month period and generate economically and statistically significant trading profits over the next one to six months. Evidence of momentum is assumed to be a sign of informational inefficiency.

[19] A good information environment for a firm is characterized by higher institutional ownership, longer time in existence, lower research analyst forecast dispersion, lower research analyst forecast error, higher liquidity (defined as greater ease of selling without affecting price) and a lower probability that a market maker in a stock will trade with an informed trader (because most firm-specific information is already incorporated into the price). This last measure is not observed by the researchers, but derived from a market microstructure model first set forth by Easley, Hvidkjaer, O'Hara (2005). Interpreting lower values of this metric as a sign of greater price informativeness is not uncontroversial (see Lee and Liu 2007).

[20] The researchers rely on the information environment rather than the metric of informativeness used by Durnev et al. (2003) (that is, how well the price predicts future earnings) because of data availability and tractability given their research design.

[21] Teoh, Yang, and Zhang (2006) provide evidence that calls into question certain elements of Lee and Liu's (2007) theory of the U-shaped relationship between price informativeness and idiosyncratic volatility.

before the period over which R^2 is calculated. For example, consider, the researchers urge, the extreme case of Firm ABC that is "completely transparent" as of December 31, 2006 (that is, there is no firm-specific information about Firm ABC that is unknown to public market investors as of that date). In this case, investors would have incorporated perfectly firm-specific data into the then-current price. If researchers were to regress the returns of Firm ABC on the market's return, say, for example, from January 1 – December 31, 2007, they likely would find, according to the account of Dasgupta, Gan and Gao (2007), that the regression would yield an R^2 of 1.0. Dasgupta, Gan and Gao (2007) argue that as firm-specific events unfold during 2007, the firm's stock price would not move after these events because the market already would have anticipated the occurrence of such events (that is, there is no "surprise").[22] The only area of uncertainty with respect to the appropriate price for Firm ABC's stock is the effect of market-wide events on Firm ABC, which would explain the perfect comovement with the market return. Conversely, a firm that is "completely opaque" on December 31, 2006, likely would have a low R^2 for the January1 – December 31, 2007 time period. Thus, the researchers theorize that firms that operate in better information environments are likely to have higher return synchronicity with the market.[23]

4. Data Sources, Sample, Methodology and Results of Analysis

4.1 Data and Sample

The period of this study is April 1, 2005 – August 31, 2006. This project requires data on firm-level, industry-level and market returns, as well as share prices, shares outstanding, total volume and firm industry group. I obtain all of these data from the Center for Research in Security Prices (CRSP) database. I acquire firm-level accounting data from the merged CRSP-Compustat database.[24] The project also requires data on firm-level retail trading activity, including total shares purchased and sold by retail investors on the NYSE each day[25] for a particular stock.[26] I obtain this data from the NYSE ReTracEOD Summary.[27] Institutional ownership data, based on the quarter ended March 31, 2005, are from the Thomson Financial institutional holdings database. The First Call database is the source of information on research coverage and research activity during the study period, and news coverage

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[22] This analysis assumes, of course, that the market would be able to incorporate the information into the price accurately.

[23] In addition to setting forth a theory, Dasgupta, Gan and Gao (2007) provide empirical evidence to support this assertion.

[24] See Section 4.3 for a description of the accounting data used in this study.

[25] Retail trading data for April 21, 2006 are unavailable and, thus, is not a part of the sample. However, because there is no reason to believe that retail trading behavior differed significantly on that date from other dates in the sample, this omission should not bias the overall conclusions of this Article.

[26] Though this figure does not capture all trading by retail investors in NYSE-listed stocks (only that executed on the NYSE), it is reasonable to assume that it captures the same proportion of retail trading activity as the NYSE executed volume is of total trading volume. This figure has been shown to be between 75% and 85% (see, for example, Goldstein et al. 2006). Thus, these retail trading figures should serve as a good proxy for the activities of all NYSE firm retail investors.

[27] The ReTrac figures are generated by the NYSE from information accompanying orders. Every order that is traded on the NYSE is required to have an account-type designation (see ReTracEOD Data Discussion Board 2006; New York Stock Exchange 2004, 29). ReTrac EOD files track retail investor trades (defined as those made by accounts with the designation "I" (non-program trading, individual investor, as defined in NYSE Rule 80A)). NYSE Rule 80A offers the following definition: "'Account of an individual investor' means an account covered by Section 11(a)(1)(E) of the Securities Exchange Act of 1934." Exchange Act Section 11(a)(1)(E) covers the following accounts: "… the account of a natural person, the estate of a natural person, or a trust (other than an investment company) created by a natural person for himself or another natural person". It is possible that some trades made on behalf of individuals are executed along with institutional investor orders (that is, without the "I" designation), thus resulting in such trades not being included in the ReTrac data. However, this occurrence is believed to be sufficiently rare so as to not affect the reliability of the ReTrac data.

information is derived from the Dow Jones News Service. Finally, I obtain data on industry SIC codes, insider ownership and 5% holder ownership, as of March 31, 2005, from Thomson Financial's Compact D SEC Disclosure.

To construct a sample, I begin with every common stock[28] in the CRSP database traded on the NYSE during the study period.[29] I then eliminate from the sample any company that lacked data for the variables used in the study and all firms in industry groups with fewer than three members.[30] My final sample for this study consists of 1,129 different stocks. For all analyses, I report results derived from the overall sample, as well as results derived after splitting the sample into two approximately equal groups of 565 and 564 different stocks based on size (as determined by average market capitalization during the study period). I refer to these groups as "Top Half" for the larger firms and "Bottom Half" for the smaller firms.

This study's primary limitation is that its results are derived from a dataset including only a subset of publicly traded firms – NYSE companies only; it suffers from a failure to include the broader universe of firms traded on other exchanges or markets. This is unavoidable given the lack, for non-NYSE companies, of direct (non-proxy), market-wide retail trading data of the sort used in this study. However, the fact that such strong results, as described below, are obtained through the use of a relatively homogenous group of companies with very low levels (relative to smaller capitalization stocks) of retail trading suggests that the study's results would hold if the sample included all publicly traded firms. In addition, it allows one to test the relationship between R^2 and retail trading among firms that, relative to the broader market, operate in what could be termed a good information environment.

A second limitation of this study is the inability to separate the trades of retail investors who are advised by a broker or other financial professional from the trades of individuals that make investment decisions independently. Though some may question the value of a broker's advice or her influence on an individual's trading decisions, this distinction in meaningful in assessing the effect of retail traders on market efficiency.

4.2 Firm-Specific Stock Return Variation

As a measure of share price informedness or accuracy, I use firm-specific stock return variation. Following the model of Durnev et al. (2003) and others, I obtain firm-specific stock return variation (R^2) by use of the following regression:

$$r_{i,d,t} = \alpha_{i,t} + \beta_{i,t}\, r_{m,d,t} + \gamma_{i,t}\, r_{j,d,t} + \varepsilon_{i,d,t} \qquad (1)$$

of firm *i*'s total returns $r_{i,d,t}$ on market return $r_{m,d,t}$ and a broad industry return $r_{j,d,t}$, which includes the market value-weighted average return of all firms in industry *j* (defined as all firms in the same two-digit SIC code), excluding the firm in question.[31] Returns are measured across *d* daily periods during the study

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[28] Stocks include those classified by CRSP as "ordinary common shares" of share codes 10 (companies that have not been further defined), 11 (companies that need no further definition), 12 (companies incorporated outside the U.S.) and 18 (REITs).

[29] Firms that fail to trade on any day during the study period are excluded. When a firm does not trade on a particular day, CRSP gives its daily return a value of "0." Including these firms in the sample would distort the R^2 calculation because the "0" value is not a reflection of investors' collective decision to keep the stock at the same price after a day of trading, but rather the result of no trading activity at all.

[30] For firms operating in industries with fewer than three members, it would not be possible to calculate R^2 because it would not be possible to construct an "industry group" of two or more firms for use in the calculation.

[31] Consistent with Durnev et al. (2003), the firm in question is excluded to avoid "spurious correlations" between firm returns and industry returns for companies in industries with only a few firms.

period t (April 1, 2005 – August 31, 2006). If the prevailing view in the literature among R^2 adherents is correct, the lower the value of R^2 generated from the above regression, the more firm-specific information there is incorporated into a firm's stock price and the more accurate the price.[32]

4.3 Empirical Methodology and Results of Analysis

My objective is to examine the relationship between firm-specific stock return variation, on the one hand, and retail trading activity and retail stock ownership, on the other. Consistent with the practice in the R^2 literature, I use the logistic transformation of R^2, New R^2, as my dependent variable.[33] New R^2 is calculated as follows:

$$New\ R^2 = ln(R^2_i/1 - R^2_i) \tag{2}$$

In the regressions that follow, I use a number of independent variables (See Table 1 for descriptive statistics).[34] My principal independent variable of interest is retail trading. Retail trading activity is defined as the proportion of the trading in a firm's common stock that is executed by retail investors. I calculate two measures of retail trading activity in this study: 1) the ratio of the number of shares of a firm's stock bought by retail investors to the total number of a firm's shares traded each day, averaged over the study period (buy-side retail trading) and 2) the ratio of the number of shares of a firm's stock sold by retail investors to the total number of a firm's shares traded each day, averaged over the study period (sell-side retail trading). While actual trading activity is the focus of this study, I also examine what effect, if any, institutional ownership[35] has on firm-specific return variation. Though it generally is believed that an investor must trade to have an effect on share price, if an existing investor holds shares in a firm when she should sell, that also could affect share prices and firm-specific stock return variation

[32] One may question whether R^2 is an appropriate metric of share price informedness at the firm level. Some firms move more in line with the overall market because they are more sensitive to general economic conditions (see Durnev et al. [2003] for a general discussion of this point). Thus, it would not be fair to say that the stock prices of such firms are "less accurate" because their fundamentals (for example, earnings) are driven largely by market-wide factors. To address this potential concern, I performed intra-industry regressions of the type described in Section 4.3 in industries that are particularly sensitive to macroeconomic factors. My overall results still hold qualitatively. Although certain firms are more sensitive to market factors than others, within groups of such "sensitive" firms, the level of retail trading and ownership has a statistically significant relationship with R^2.

[33] This is a common econometric remedy (see, for example, Morck, Yeung, and Yu 2000). The transformed variable is a continuous variable that is more normally distributed than R^2, which has values between 0 and 1 (Ashbaugh-Skaife, Gassen and LaFond 2006).

[34] Table 1 reveals that, on average, the largest firms in the sample (that is, the "Top Half") have higher R^2's than the smallest firms in the sample (that is, the "Bottom Half"). At first blush, this is counterintuitive. If the prevailing view among R^2 adherents is correct, then this finding implies that larger NYSE firms, as a group, have less accurate stock prices than smaller firms. However, recall the arguments of Lee and Liu (2007) and Dasgupta, Gan and Gao (2007) with respect to R^2. The larger firms relative to the smaller firms are more likely to operate in information-rich environments. Thus, consistent with the claims of Dasgupta, Gan and Gao (2007), these firms, as a group, appear to have less firm-specific information impounded into their prices during the study period, likely because the market largely had anticipated firm-specific news from these firms.

[35] Note that the study uses I, the measure of institutional ownership, rather than $1 – I$, what one could assume would be a proxy, though imperfect, for non-institutional or retail ownership. There is a problem with such an assumption, however, given the available data. In some instances, there are firms with institutional ownership percentage values that, when calculated, exceed 100%. This is generally due to duplicative reporting by institutions on the required Form 13-F's (all institutions with more than $100 million in securities under discretionary management are required to report their holdings to the SEC each quarter). Other researchers have found that such instances of duplicative reporting are generally rare (see, for example, Thakor, Nielsen and Gulley 2005) and, thus, the figures, though anomalous, should not bias significantly this study's results. In the instant study, 65 of the 1,129 stocks in the sample (5.8%) have institutional ownership percentages that, as calculated, exceed 100%.

(R^2). As noted in the extensive literature in this area, many other factors may affect share price accuracy. In the regression, I, therefore, control for these variables. The control variables include size (measured as a firm's average market capitalization (closing share price x number of shares outstanding) during the study period) and trading volume (average daily volume of total shares traded in a firm's stock during the study period) because larger, more liquid firms are more likely to have a large investor following and generate more interest and potentially private information. I also control for two measures to account for the effects of research analysts who disseminate firm-specific information into the marketplace: 1) the number of different analysts that cover the firm (as evidenced by the publication of earnings estimates) during the study period (research coverage) and 2) the total number of earnings per share estimates released by analysts for a firm during the study period (research activity). Because controllers or other insiders may possess superior private information about a firm's prospects, but also, conversely, may make firms less transparent (see, for example, Pizarro et al. 2007), I control for the proportion of a firm's stock held by insiders (e.g., directors and officers) (insider ownership) and for the proportion of a firm's stock held by individuals or institutions with 5% or greater stock ownership in the company (5% owner ownership).[36] Diversified conglomerates may be more difficult for investors to understand and value or may track the market more closely because they operate in more segments of the economy. I, therefore, control for firm-level diversity, measured by the number of four-digit SIC codes in which the firm operates.[37] In addition, I control for firm news coverage during the study period[38] because media attention affects the amount of firm-specific information in the marketplace. News coverage also may affect the trading behavior of retail investors, as Barber and Odean (forthcoming) find that individual investors are attracted to stocks that capture their attention for a number of reasons, including by being featured in news stories.

I also employ a number of additional control variables, as suggested by the work of Baker and Wurgler (2006), that may be related to share price accuracy. Baker and Wurgler argue that stock mispricings result from "both an uninformed demand shock and a limit on arbitrage." Investor sentiment, according to Baker and Wurgler, may vary across firms and affect prices in the following manner. Using one possible definition of investor sentiment as the "propensity to speculate," Baker and Wurgler suggest that investor sentiment may drive the demand for speculative investments. They also argue that what makes a

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[36] A more apt variable would be the proportion of trades represented by insiders or 5% holders, rather than ownership by such investors, but this information is not currently available in a comparable format to that of retail trading data.

[37] In unreported results, I use, as an alternative, four dummy variables in my regression representing the four-categories of diversification suggested by Varadarajan and Ramanujam (1987). Under this formulation, I calculate a firm's level of "broad spectrum diversity (BSD)," measured as the number of two-digit SIC code industries in which a firm operates and a firm's level of "mean narrow spectrum diversity (MNSD)," defined as the number of four-digit SIC code industries in which a firm operates. Firms with BSD levels below the mean of my sample population are characterized as "low" BSD firms, and firms with BSD levels above the mean of my sample population are characterized as "high" BSD firms. Similarly, firms with MNSD levels below the mean of my sample population are characterized as "low" MNSD firms, and firms with MNSD levels above the mean of my sample population are characterized as "high" MNSD firms. Firms that have both low BSD and low MNSD are "Category 1" firms or those with "very low diversity." Firms that have both high BSD and high MNSD are "Category 4" firms or those with "very high diversity." Firms with low BSD, but high MNSD are "Category 2" firms or "related-diversified" firms. Firms with high BSD, but low MNSD are "Category 3" firms or "unrelated-diversified" firms. My results remain qualitatively unchanged when I employ these dummy variables instead of the one based simply on the number of four-digit SIC codes.

[38] Consistent with prior studies, I calculate level of news coverage as the number of days during the study period on which a firm is featured prominently in a Dow Jones News Service story, by either being mentioned by name in the headline or lead paragraph. Number of days of coverage, rather than the number of individual news stories, is used to avoid the potential for essentially identical stories reported on the same day to affect inappropriately the calculation of the amount of information disseminated to the public marketplace. It should be noted, however, that using the raw number of news stories over the study period does not change the results of this study qualitatively.

firm's stock particularly vulnerable to investors' propensity to speculate lies in large part in the subjectivity of the firm's valuation. According to Baker and Wurgler, firms that are young and unprofitable and that have extreme growth prospects allow unsophisticated investors to defend "with equal plausibility" a wide range of valuations that are consistent with the investors' general market sentiment (that is, either general pessimism or optimism). This form of speculation is more difficult to do with firms with a long, established earnings history, tangible assets and stable dividends.

Similarly, firms with characteristics that make arbitrage (to offset any noise trading or speculative tendencies) difficult are also more subject to mispricing under Baker and Wurgler's formulation. Drawing on prior research that shows that arbitrage is particularly costly and risky for young, small, unprofitable, extreme growth or distressed stocks, Baker and Wurgler posit that such firms are more likely to be mispriced.[39] As Baker and Wurgler note, the stocks that are the hardest to value are also the most difficult to arbitrage.

In their study, Baker and Wurgler employ additional characteristics beyond those listed above that are likely to be "salient" to investors and affect mispricing. I, too, adopt these measures, with some slight modifications, as control variables. I consider firm age, measured, to the nearest month, as the number of months the firm has appeared in CRSP, and stock volatility, measured as the standard deviation of monthly stock returns over my 17-month study period.[40] I also employ variables related to profitability, including return on equity[41] and a dummy variable for whether a firm is profitable (that is, has positive earnings), as well as variables related to dividend payments, including dividends-to-equity[42] and a dummy variable for whether a firm pays dividends (that is, has positive dividends per share). Asset tangibility variables I employ include the ratio of tangible assets to total assets and the ratio of research and development expenses to total assets.[43] Finally, I employ, to proxy for characteristics indicating high growth opportunities and/or distress, variables that include book-to-market equity,[44] level of external finance,[45] and sales growth.[46]

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[39] As Baker and Wurgler (2006, 1649-50, citations omitted) explain, "First, [the stocks'] high idiosyncratic risk makes relative-value arbitrage especially risky. Moreover, such stocks tend to be more costly to trade and particularly expensive, sometimes impossible, to sell short. Further, their lower liquidity exposes would-be arbitrageurs to predatory attacks."

[40]A more appropriate measure for comparison purposes would be relative standard deviation of returns (that is standard deviation divided by the mean) rather than the raw standard deviation. I run the regression analysis using both standard deviation and relative standard deviation and find that though standard deviation is a significant variable in the regression, relative standard deviation is not. However, the relationship between retail trading (the variable of interest) and R^2 is qualitatively the same in both formulations.

[41] Return on equity is defined as earnings/book equity. Earnings (E) is income before extraordinary items (Compustat Item 18) plus income statement deferred taxes (Compustat Item 50), minus preferred dividends (Compustat Item 19). Book equity (BE) is stockholders' equity (Compustat Item 60) plus balance sheet deferred taxes (Compustat Item 35). All references to Compustat Item numbers in this note and the ones to follow, unless otherwise noted, are for the year 2004 (that is, the year immediately prior to the beginning of the study period).

[42] Dividends-to-equity is defined as dividends/book equity. Dividends are the dividends per share at the ex date (Compustat Item 26) times Compustat shares outstanding (Compustat Item 25) divided by book equity, as defined in note 41 above.

[43] Tangible assets to total assets is defined as property, plant and equipment (Compustat Item 7) divided by total assets (Compustat Item 6). Research and development expenses to total assets is defined as R&D expense (Compustat Item 46) divided by total assets (Compustat Item 6). Consistent with Baker and Wurgler (2006), missing values of R&D expense are set to zero. However, the overall regression results are qualitatively the same if I exclude firms with missing R&D values from the regression.

[44] Book to market equity is book equity (defined in note 41 above) divided by a firm's average market capitalization during the study period.

[45] External finance is defined as the change in assets from 2003 to 2004 (Compustat Item 6) minus the change in retained earnings (Compustat Item 36) over the same period divided by total assets.

After performing a regression analysis using firm-specific return variation (R^2) as the dependent variable, and all of the above explanatory variables, I run several types of regression diagnostics. A check of the normality of residuals and the existence of a linear relationship between the dependent variable and the explanatory variables reveals that a number of the independent variables are problematic. Thus, to correct for this deficiency where warranted, I express the values of certain variables in natural logarithms. The variables requiring this treatment and for which I provide the requisite transformation[47] include buy-side retail trading, sell-side retail trading, market capitalization, trading volume, research activity, insider ownership, dividends-to-equity, R&D-to-assets and age in months.[48]

Through the regression diagnostics process, I learn that two of the firms in my sample consistently have values that are outliers. However, because regression results with and without these firms are virtually identical, I leave them in the regression. As an additional check against outliers and influential data points and consistent with Baker and Wurgler (2006), all independent variables are winsorized at their 0.5% and 99.5% values.

Regression diagnostics also reveal that several of my explanatory variables are highly correlated (that is, I have a multicollinearity problem).[49] To address this problem, I perform principal component analysis. Principal component analysis derives alternative independent variables that a researcher may put into a regression equation by giving the pre-existing variables different weights and generating a "blended" explanatory variable that the researcher may use in the regression instead. In this analysis, I generate two new variables using this methodology: 1) "retail trading," which combines buy-side retail trading and sell-side retail trading and 2) "size, volume and research," which combines market capitalization, trading volume, research coverage and research activity. In addition, my model excludes 1) the profitability dummy because it is highly correlated with return on equity, 2) the dividend payer dummy because it is highly correlated with dividends to equity and 3) all the sales growth dummies because they are highly correlated with the sales growth variable.[50] Table 2 reports pairwise correlation coefficients for the independent variables used in this analysis.

My regression takes the form:

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[46] Sales growth is the change in net sales (Compustat Item 12) from 2003 to 2004 divided by 2003 net sales. In addition, the firms in the sample are divided into deciles by sales growth, with firms with the highest level of sales growth considered "extreme growth" firms. In addition, firms in the top three deciles are considered "high growth" firms, and firms in the bottom three deciles are considered "low growth firms."

[47] The variables for return on equity, sales growth, and external finance show some evidence that they require this treatment, as well, but the conclusion is not clear. I, therefore, leave these variables in the regression in their unaltered state. However, even if I transform each of these variables, my overall results remain qualitatively unchanged even though I lose almost 500 observations. I lose such a large portion of my sample because of this transformation because a significant number of the firms in my sample have negative values for these variables. One may not take the natural log of zero or a negative number.

[48] In addition, for the variables insider ownership, dividends-to-equity, and R&D-to-assets, I replace all zero values with a small constant (0.001) to allow the calculation of the natural log. However, with or without the addition of this constant, my results are qualitatively the same.

[49] One of the assumptions of the linear regression model is that "there are no exact linear relationships between the independent variables," and the presence of "perfect" multicollinearity violates this assumption (Kennedy, 2003, 50, 51). Some argue that multicollinearity is not a problem that researchers should attempt to remedy (see Kennedy 2003, 210, 213-14 for a discussion), but failing to address the problem can lead to imprecise coefficient estimates and even coefficients with the incorrect sign.

[50] In unreported results, I run one regression as described in this paragraph and another that includes each independent variable separately. My results are qualitatively identical.

$$\ln(R_i^2/(1-R_i^2)) = \alpha + \beta RETTRADE_i + \gamma_1 SIZEVOLRES_i + \gamma_2 INSOWN_i + \gamma_3 5PEROWN_i + \gamma_4 DIVERSE_i + \gamma_5 NEWSDAYS_i + \gamma_6 AGE_i + \gamma_7 STKVOL_i + \gamma_8 RETONEQ_i + \gamma_9 DIVTOEQ_i + \gamma_{10} TANGASSETS_i + \gamma_{11} RDTOASSETS_i + \gamma_{12} BKTOMKT_i + \gamma_{13} EXTFIN_i + \gamma_{14} SALESG_i + \varepsilon_i \quad (3)$$

where *RETTRADE* is the variable representing the proportion of trading by retail investors, *SIZEVOLRES* represents the combined effect of size, trading volume, research coverage and research activity, *INSOWN* is insider ownership, *5PEROWN* is five percent owner ownership, *DIVERSE* is a dummy variable that takes the value one for firms that operate in more than two industries, as indicated by four-digit SIC codes, *NEWSDAYS* is the number of days during the study period on which a firm is prominently featured in a news story, *AGE* is age, in months, *STKVOL* represents the volatility of a firm's stock, *RETONEQ* is return on equity, *DIVTOEQ* is dividends to equity, *TANGASSETS* is the ratio of tangible assets to total assets, *RDTOASSETS* is the ratio of R&D expenses to total assets, *BKTOMKT* is book-to-market equity, *EXTFIN* is level of external financing, and *SALESG* is sales growth.

Table 3 reports the results of this regression, including heteroskedasticity-robust t-statistics and robust standard errors, for the overall sample and shows that increased proportions of retail trading activity are positively associated with firm-specific return variation (that is, a lower R^2). This result is statistically significant (p-value < 0.01).

I also perform a second regression to ascertain whether the level of institutional ownership is related to R^2.[51] My institutional ownership regression, where *I* represents the proportion of a firm's stock held by institutions as of March 31, 2005, takes the form:

$$\ln(R_i^2/(1-R_i^2)) = \alpha + \beta I_i + \gamma_1 SIZEVOLRES_i + \gamma_2 INSOWN_i + \gamma_3 5PEROWN_i + \gamma_4 DIVERSE_i + \gamma_5 NEWSDAYS_i + \gamma_6 AGE_i + \gamma_7 STKVOL_i + \gamma_8 RETONEQ_i + \gamma_9 DIVTOEQ_i + \gamma_{10} TANGASSETS_i + \gamma_{11} RDTOASSETS_i + \gamma_{12} BKTOMKT_i + \gamma_{13} EXTFIN_i + \gamma_{14} SALESG_i + \varepsilon_i \quad (4)$$

Table 3 reports the results of this regression, including heteroskedasticity-robust t-statistics and robust standard errors, for the overall sample and shows that increased levels of institutional ownership are negatively correlated with firm-specific return variation. Put another way, increased levels of ownership by large institutional investors are associated with higher R^2. This result is statistically significant (p-value < 0.01).

Because of the controversy with respect to the correct interpretation of R^2, the above results must be approached with some caution. However, if a low R^2 is a sign of share price accuracy, then the results demonstrate that increased levels of retail trading and ownership[52] are associated with more accurate share prices.

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[51] Because of the collinearity between the retail trading activity and institutional ownership variables, this regression excludes the retail trading activity variable.

[52] One should note that the institutional ownership variable only represents stock owned by large institutions (that is, those with more than $100 million or more in assets under management), as described in note 35. Thus, the results of this regression suggest that ownership by both retail investors and small institutions is associated with more accurate stock prices. Given data limitations, it is not possible to know precisely what proportion of "non-large institutional ownership" is ownership by individual investors.

4.3.1 Size Effects

Though I have controlled for size in the above regressions, it is possible that retail trading or ownership in firms of different sizes is associated with R^2 in different ways. To test this possibility, I perform separate regressions including first, only the largest firms in the sample (what I term, "The Top Half") and then only the smallest firms in the sample (what I term, "The Bottom Half"). The results in Table 3 reveal that higher levels of retail trading are associated with lower R^2's in the overall sample and in the Top Half and Bottom Half size groups. However, there is no statistically significant relationship between retail trading activity and R^2 in the Top Half size group.

Also, the results in Table 3 demonstrate that lower institutional ownership (or, conversely, higher (largely) individual ownership) is associated with lower R^2 in the overall sample, the Top Half size group and the Bottom Half size group. However, again, the results are statistically significant only for the overall sample and Bottom Half, not for the Top Half size group. This outcome reveals that the relationship between retail trading and ownership, on the one hand, and R^2, on the other, is stronger for relatively smaller[53] firms.

4.3.2 Causation

Though the results described above demonstrate that retail investor trading and ownership are correlated with firm-specific return variation, I have not established that retail investor trading and ownership *cause* changes in firm-specific return variation. In fact, there may be no causal link at all or the causation may run only in the opposite direction. For example, individual investors may be attracted to firms with lower R^2's, and the presence of such investors may have no effect on a stock's R^2. Retail investors that are trying to "beat the market" may be more inclined to invest in stocks that have a great deal of firm-specific variation. It is also possible that stockbrokers' recommendations to their individual investor clients tend to consist largely of stocks that have experienced recent movement due to idiosyncratic factors. Finally, firms with greater firm-specific information may garner more publicity and, thus, attract more retail investors. Consistent with that hypothesis, Barber and Odean (forthcoming) provide evidence that individual investors are attracted to stocks that "catch the attention" of such investors through extreme price moves, abnormal trading volume and, as noted previously, news coverage.[54] Determining the direction of causation is important for interpreting the results of this study.

There is no way to know with certainty whether retail trading causes changes in R^2. The only way to have such assurances is to do a controlled experiment of the sort that is not possible in this context. However, there is one technique widely used by econometricians in an effort to determine the existence of causal relationships and address simultaneity concerns – instrumental variable (IV) estimation.[55] In this study, through the two-stage least squares method of instrumental variable (IV) estimation, I, in the first stage, predict retail trading by using a factor (instrument) that is not directly related to R^2. I then, in the second stage, use an IV estimator and the first stage "predicted" results to estimate the effect of retail

[53] I use the term "relatively smaller" because all firms in the study are NYSE firms and among the largest corporations in the United States.

[54] It should be noted that, as shown on Table 2, there is not a positive correlation between the level of retail trading and news coverage. Level of a firm's media attention is, in part, a function of size (the correlation between news coverage and market capitalization is 0.58), and size is inversely correlated with the proportion of trading in firm's stock by retail investors. However, in unreported regression results, I find strong evidence that as the level of news coverage increases, the level of retail trading increases, holding size constant.

[55] Though widely used in econometrics, it should be noted that not all econometricians and statisticians view instrumental variable estimation as a useful tool for determining the existence of causal relationships.

trading on R^2. "Stock price" is the instrument I use for retail trading. "Stock price" is equal to a firm's average stock price during the study period. Like the independent variables used in the regressions in this study, average stock price in the IV estimation is winsorized at its 0.5% and 99.5% value.

To be a valid instrument, stock price must be correlated with (i) the proportion of retail trading in a stock *(RETTRADE)* and (ii) R^2, but only indirectly through the proportion of retail trading *(RETTRADE)*. The instrument also must be sufficiently strong (that is, have a high correlation with the independent variable of interest, *RETTRADE*). Grullon, Kanatas, and Weston (2004) suggest that individual investors may prefer stocks trading within certain price ranges because of cost concerns. One can imagine an individual investor of relatively modest means who prefers to purchase stock in round lots.[56] To this investor, a stock with a price of $9 may be significantly more attractive than one trading at $90 simply because the former is viewed as more affordable (at a total cost per round lot of $900 for the former and $9,000 for the latter). Similarly, if an investor desires diversification (assuming she relies on direct investment rather than investment through intermediaries such as mutual funds for this purpose) and has limited funds available for investment, she may have little choice other than to buy stocks with lower absolute prices to achieve her diversification goals (see Dhar et al. 2004). Grullon, Kanatas, and Weston (2004) employ the reciprocal of stock price as a control variable in a regression assessing the effect of advertising on stock ownership and find a statistically significant relationship (at the 1% level) between stock price and the absolute number of total investors in a firm.[57]

The results of the instrumental variable analysis in this study for the overall sample appear in Table 4. Consistent with the findings and hypothesis of Grullon, Kanatas, and Weston, the relationship between the proportion of retail trading and stock price is negative. The first stage results suggest that stock price is a strong instrument for retail trading (F-statistic = 74.56). In addition, the correlation between retail trading and stock price (-0.45) is strong.

In addition to statistical evidence suggesting that stock price is a strong instrument, there are qualitative reasons to believe the instrument is valid. The absolute level of stock price is only indirectly correlated with R^2. It is unlikely that stock price level is directly correlated with R^2 because absolute stock price level should have no effect on share price accuracy or firm-specific return variation. Whether a stock trades at $9 or $90 is an irrelevant consideration with respect to how informative that price is or whether the stock's returns are correlated with the overall market or the firm's industry group. Absolute stock price is an arbitrary figure, devoid of informational content. It is true that the dependent variable in the main regressions in this study (R^2) is derived from a regression whose dependent variable is stock price returns. However, returns, which reflect relative stock price movements, are independent of absolute stock price levels.

Imagine two identical (with the exception of stock price) firms, each with a current market capitalization of $500 million. Firm A's stock price is $10 per share, and it has 50 million shares outstanding. Firm B, with 25 million shares outstanding, has a stock price of $20. If both Firm A and Firm B experience a negative profitability shock that changes the market's estimate of the firms' value from $500 million to

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[56] The reason for a round lot preference does not appear to be rooted in concerns about transaction cost differentials. Angel (1997, 62) notes that the odd-lot differential (that is, higher execution costs for odd lot purchases and sales) has been eliminated and further notes that some investors may pay a flat fee per trade, but states, "[n]evertheless, many investors are still reluctant to trade in odd lots." Similarly, Dhar et al. (2004, 19), which examine trading behavior around stock splits, note that though the difference in costs for odd-lot trading and round-lot trading were insignificant during their sample study period (1991-1996), "individual investors tend to like trading in hundreds of shares" and further state that approximately 82% of all common stock trades are round-lot trades.

[57] Note, however, that they fail to find a statistically significant relationship between stock price and the absolute number of institutional investors in the firm.

$450 million, the stock prices of both firms will decline by 10% (Firm A's to $9 per share and Firm B's to $18 per share). Though the "pre-shock" and "post-shock" prices are different for Firm A and Firm B, the percentage decline (the return) is the same. Prices and returns are independent, so stock price is in all likelihood a valid instrument.

One may argue that this conclusion is not free from doubt because there is some evidence that returns can be related to absolute stock price level. For example, Gaunt, Gray and McIvor (2003, 33), in a study on Australian equity market returns, find that "share price [has] significant and independent [as from firm size] effects on portfolio returns." Similarly, Bhardwaj and Brooks (1992, 553) find that "low share price stocks earn abnormal returns in January before transaction costs."[58] Bhardwaj and Brooks characterize this result as a "low price phenomenon" because they, like Gaunt, Gray and McIvor, find that the return effects appear generally in stocks with low prices. Bhardwaj and Brooks (1992, 559) suggest that arguments used in the past to explain the anomalous returns of small firms (for example, "transaction costs, degree of neglect, misassessment of risk and infrequent trading") can be applied with at least as much force to low-priced stocks. There is little reason to suspect that the "low price phenomenon" would affect the results of this study significantly. The sample in this study is comprised exclusively of the stocks of NYSE firms. Thus, with a median stock price of $32.89, this sample contains firms with relatively high share prices.[59] Therefore, the available evidence suggests that stock price is a valid instrument for retail trading in this context.[60]

The second stage regression demonstrates the effect retail trading has on R^2. This regression shows how R^2 varies *only* at those times when the level of retail trading in the stocks in the sample varies because the level of the stock price *caused* it to vary. As shown in Table 4, the coefficient for retail trading is negative; as the proportion of retail trading across firms in the sample increases, R^2 decreases. The retail trading coefficients in the instrumental variable estimations are statistically significant. The results of IV estimation analysis using the Top Half and Bottom Half size groups, also shown in Table 4, are qualitatively identical to those for the overall sample.[61]

If the assumptions described in this sub-section are correct, the stock price could not cause a firm to have low or high R^2; stock price has no direct effect on R^2. Thus, the results of this analysis make it reasonable to conclude that a firm's R^2 is caused at least in part by the effect of stock price on the level of retail

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[58] Note that these abnormal returns disappear when factoring in transaction costs and bid-ask bias to returns in the 1977-1986 period.

[59] Bhardwaj and Brooks (1992, 556) use the following five groups to segment their sample by stock price: "less than or equal to $5, $5 to $10, $10 to $15, $15 to $20, and more than $20." Under this construction, stocks whose prices exceed $20 clearly are not "low-priced." In addition, the median August 2006 (the final month of this study's analysis period) month-end stock price for the entire CRSP database is $17.09 (excluding firms with "$0" reported stock prices). Approximately 56.7% of these firms have stock prices below $20. Thus, it is reasonable to conclude that the stocks used in this study, with an overall median price of $32.89 and 865 firms (76.6% of the sample) with a price of more than $20 and only 28 firms (2.5%) with a stock price of under $5, are not, on the whole, "low-priced" stocks.

[60] One could argue that low-stock price companies are inherently more volatile, which could result in lower R^2's for such companies. Even if this were true, it would not affect the utility of stock price as an instrument. In this instance, just as described above, stock price still would be correlated with R^2 only indirectly, as it is not the price itself, but rather characteristics of firms with low prices that are correlated with volatility. In addition, just as discussed in note 59 above, few of the firms in this study's sample are "low-priced" stocks.

[61] Note that in the OLS regressions, unlike in IV estimation, the retail trading coefficient is not significant in the Top Half size group and the coefficients for all size groups are significantly larger in the second stage of the IV estimation than in OLS. Given the endogeneity problem identified in this section, it is reasonable to conclude that the OLS estimates are biased. However, just as in the OLS, the relationship between retail trading and R^2 is stronger in the Bottom Half size group than in the Top Half size group.

trading and, in turn, by the effect of retail trading on R^2. Though causality may run in both directions, through the use of this source of exogenous variation (the stock price, which causes one variable (retail trading) to change but not the other (R^2)), I am able to determine the existence of one of the directions of causation and infer the nature and strength of the relationship between retail trading and R^2. This analysis suggests that retail trading causes changes in firm-specific return variation.

I also perform an IV estimation using institutional ownership as the independent variable of interest. Again, I use stock price as the instrument for institutional ownership. This analysis is designed to determine if there is a causal relationship between institutional ownership and R^2. As reported in Table 5, I find that stock price is a strong instrument for institutional ownership (F-statistic = 29.51) and, in the second stage, that the coefficient for institutional ownership is positive, demonstrating that as the level of institutional ownership across firms in the sample increases, R^2 for such firms increases. This result is statistically significant. The results for the instrumental variable estimation analysis for the Top Half and Bottom Half sample groups are qualitatively identical to those reported for the overall sample. These IV results suggest that level of (largely) individual investor ownership has a causal effect on R^2.

5. Discussion and Conclusion

This Article demonstrates that higher levels of trading and stock ownership by retail investors are associated with more firm-specific return variation (lower R^2) to a statistically significant degree. The relationship is stronger among the smaller firms in my sample, than among the larger firms. This is reasonable given the differences in retail trading in the larger and smaller firms. As shown in the summary statistics on Table 1, though retail investors on average represent a small proportion of overall trading volume, they represent almost twice as much trading volume on a proportional basis for the relatively smaller firms as they do for the relatively larger firms. Thus, for the smaller firms, there is more opportunity for the trades of retail investors to have a meaningful impact on stock price movements. The Article also provides some evidence that the relationship between retail trading or ownership, on the one hand, and R^2, on the other, is a causal one.

Because of the controversy surrounding the correct interpretation of R^2 (that is, whether low R^2 is a sign of greater share price accuracy or greater informational inefficiency), the results of this study do not have clear policy implications. If the predominant view among R^2 adherents is correct (that is, lower R^2's imply greater share price accuracy), then the findings of this study suggest that, contrary to the received wisdom, the presence of retail investors, as a group, in equity markets *increases* share price accuracy. Therefore, the instant study not only calls into question the need for policy changes to restrict the access of retail traders, but also provides support for efforts to protect individual investors and increase their market participation. On the other hand, if the predominant view is wrong, and a low R^2 is not a sign of share price accuracy, but rather a sign of the presence of greater noise in share prices, then the results of this study could lend support to the notion that individual investors are noise traders.

This Article is not intended to, nor can it, resolve the controversy surrounding the correct interpretation of R^2. However, given the importance of understanding the mechanisms of market efficiency for public policy and the increasing use of R^2 in studies attempting to shed light on such policy considerations, it bears mention that the instant study yields insights that can add to the debate.

Dasgupta, Gan and Gao (2007) argue that the quality of information environment is important in interpreting R^2. As previously described in Section 3, Dasgupta, Gan and Gao (2007) assert that a firm in a high quality information environment is more likely to have a high R^2 during any defined study period because the firm's stock price prior to the beginning of the study period already reflected the anticipation of firm-specific news. There is less "surprise" and hence price movement when firm-specific events occur during the study period. Extending the insights of Dasgupta, Gan and Gao, one may see that there are essentially two different types of information relevant in this context: (1) the "base" of information generally available about a corporation and (2) the "flow" of information during a researcher's study period that affects the incorporation of firm-specific news. [62]

The results[63] of the regressions performed in this study are instructive and reveal that firms that are larger and older, that have higher trading volume and more research coverage, that pay dividends, and that have a higher proportion of tangible assets tend to have higher R^2's. All of these factors, as discussed previously in Section 4.3, are likely to contribute to a high quality information environment and make firms operating in this environment less likely to experience non-market-related stock movements during the study.[64] This study also reveals that firms with relatively high ownership by 5% holders, high levels of R&D, and high book-to-market ratios are associated with lower R^2's. The presence of these characteristics, as discussed previously, is often associated with a poor quality information environment. These traits all bear a statistically significant relationship with R^2, either positive or negative, that appears to be consistent with the hypothesis of Dasgupta, Gan and Gao. Firms with characteristics that are consistent with a high quality information environment tend to have higher R^2's. Conversely, firms with traits associated with low quality information environments tend to have lower R^2's. These factors all relate to the "base" of information about a firm.

As Durnev et al. (2003) note, information about firm fundamentals is incorporated into stock prices in two ways: through a general revaluation of firm value following a public news release and through investor trading activity following the attainment of private information.[65] Therefore, this Article also provides evidence on the relationship between R^2 and two firm characteristics that relate to the "flow" of information into a firm's stock price: firm-specific news disseminated and retail trading activity.

The results of this study reveal that higher numbers of news days are associated with lower R^2. Even firms in high quality information environments are not completely transparent; the market cannot anticipate fully all future firm-specific events. Therefore, the presence or absence of firm-specific news is important in explaining stock movements. News coverage reflects events affecting the firm during the study period, such as M&A activity, new customers, or new contract awards. Thus, it is not surprising to find that more firm-specific news is associated with a firm's stock returns tracking the broader market less

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[62] Dasgupta, Gan and Gao (2007) use the terms "time-variant" characteristics (that is, those factors reflecting the current state of the firm) and "time-invariant" characteristics (that is, those characteristics that do not change frequently or do not change much over time). One may think of "time-invariant" characteristics as related to the "base" of information or general information environment and "time-variant" characteristics as related to the "flow" of information.

[63] Note that this section describes only those characteristics that have a statistically significant relationship with R^2 in the OLS regressions for the overall sample. Also, note that though sales growth is also a variable that is positively associated with R^2, the meaning of this result is ambiguous. Baker and Wurgler (2006) suggest that sales growth can spur more speculation and hence may be associated with less accurate prices. However, sales growth is also a sign that a firm is not distressed, so arbitrage may be easier. This, in turn, leads to a likelihood of more accurate prices.

[64] Recall the argument of Dasgupta, Gan and Gao (2007) is that, for firms in high quality information environments, as firm-specific events occur over a defined period of time (such as a limited study period), the stock prices of such firms will move principally with the overall market because the market already will have anticipated firm-specific events, and such expectations would be reflected in the price.

[65] It is likely that traders are more influential on the incorporation of fundamentals into stock prices than is the release of news items. Roll (1988) notes that individual firm-specific stock price movements generally are not correlated with an identifiable public dissemination of news. Thus, Roll argues, trading activity based on investor knowledge and beliefs informed by private information or, alternatively, due to noise, are likely more instrumental in stock price movements than public news releases.

closely (that is, lower R^2).[66] News releases are a clear example of an item affecting the "flow" of information into stock prices.[67]

As noted above, retail trading levels also affect the "flow" of information in stock prices. A higher proportion of retail trading generally correlates with a greater number of individuals influencing asset prices.[68] This, of course, directly affects the flow of information into stock prices. This study demonstrates that, just as was the case with greater news coverage, higher levels of retail trading on a proportional basis are associated with lower R^2.

Critics of the prevailing view regarding the correct interpretation of R^2 typically point to implausible correlations between firm characteristics such as small size or less research coverage, on one hand, and low R^2 on the other if low R^2 is indeed a sign of informational efficiency. The preceding analysis, building on the work of Dasgupta, Gan and Gao (2007), takes a step toward explaining these apparent anomalies. Characteristics consistent with high quality information environments (the "base") are associated with high R^2's and characteristics consistent with increased information flow are associated with low R^2's. Though the above analysis does not prove that low R^2 is a sign of share price informedness, the evidence on the relationship between an information flow characteristic such as news coverage and R^2 suggests that one cannot rule that interpretation out as a possibility. Nor can one reject out of hand the possibility that trading by retail investors (also associated with low R^2) increases share price accuracy.

Though inconsistent with the conventional wisdom, one could construct a plausible account of how the presence of a greater proportion of individual investors increases share price accuracy. Even if individual investors occasionally or even frequently trade based on noise, they still have information that can be valuable in helping the market set prices (see, for example, La Blanc and Rachlinski 2005; Manne 2006; Surowiecki 2004). Thus, average securities prices are more accurate when markets are open, not only to a relatively limited group of investment professionals, but also to all who contribute their bit of knowledge, no matter how small. The findings of Jackson (2003) and Choe, Kho and Stulz (2001), described in Section 2, are consistent with this view.

Despite the foregoing, it is possible that low R^2 is not a sign of share price accuracy and that retail investors are associated with greater noise in market prices. However, even if individual investors, as a group, tend to be noise traders, it does not necessarily follow that market efficiency is enhanced when retail investors are excluded. Market efficiency requires not only accurate prices, but also liquidity (Goshen and Parchomovsky 2006). Of course, eliminating large numbers of investors, of any type, from the market would have significant liquidity implications, and there is evidence that retail investors perform unique market functions (see, for example, Kaniel, Saar and Titman (2008) for a discussion of ways in which individuals provide liquidity for institutional investors). However, putting that issue (though very significant) aside, noise trading itself can perform a vital role in the functioning of financial markets and contribute to market liquidity. If the only trades that occurred were those based on relevant information and all traders had access to (and could act on) the same information, no one, other than for liquidity reasons, would have reason to trade (see Black 1986). Thus, noise trading makes markets more

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[66] Of course, if Dasgupta, Gan and Gao (2007) are correct, then the firms whose stock prices will move the most in reaction to news releases are firms operating in relatively low quality (less transparent) information environments.

[67] Though news coverage is primarily a "flow" of information characteristic as it relates to firm-specific events, it is true that some companies (for example, large firms, firms in popular industries) are more apt, holding all else equal, to attract media attention.

[68] Because retail investors generally buy and sell smaller numbers of shares than institutions, for any given level of trading volume, a higher proportion of retail traders translates into more separate individuals making a judgment on a firm's prospects and stock price.

liquid as informed traders attempt to exploit inefficiencies in markets caused by noise trading (Black 1986).[69] In addition to providing liquidity benefits, noise trading indirectly aids in price accuracy, as well, as noise traders make it worthwhile for informed traders to acquire and trade on information that ultimately will make share prices more reflective of fundamental value (La Blanc and Rachlinski 2005).[70]

Assuming there is a causal relationship between individual investor market participation and R^2, no matter what the interpretation of R^2,[71] this study provides further evidence that the trading behavior of individual investors, despite their small numbers, is relevant to market efficiency. Their trades, even when small as a percentage of total volume, can have market effects. I leave to future research further exploration of these issues.

[69] On the other hand, limits to arbitrage may make informed traders less willing to trade in the face of large amounts of noise trading (De Long et al. 1990, 703) ("The unpredictability of noise traders' beliefs creates a risk in the price of the asset that deters rational arbitrageurs from aggressively betting against them.").

[70] The way that noise traders make this worthwhile for informed traders is by suffering losses in trades against informed traders. As LaBlanc and Rachlinski (2005) suggest, this may be unfair to noise traders.

[71] In addition to the interpretations of R^2 primarily described in this Article, it is possible, of course, that the R^2 metric is devoid of meaning (that is, is neither a sign of share price accuracy or increased noise) and is entirely random. Though theoretically possible, the fact that a number of different researchers have found statistically significant relationships between R^2 and a number of different variables suggests that R^2 is a meaningful metric of market functioning.

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Table 1

Summary Statistics

Dependent Variable		Overall Sample	Top Half	Bottom Half
R^2	Mean	0.287	0.326	0.247
	Std. Dev.	0.177	0.190	0.153
	Minimum	0.0005	0.036	0.0005
	Maximum	0.856	0.856	0.827
Independent Variables of Interest				
Ratio of Retail Buy-side Shares to Total Daily Volume	Mean	0.011	0.008	0.015
	Std. Dev.	0.011	0.006	0.014
	Minimum	0.001	0.001	0.002
	Maximum	0.099	0.055	0.099
Ratio of Retail Sell-side Shares to Total Daily Volume	Mean	0.017	0.012	0.021
	Std. Dev.	0.015	0.009	0.018
	Minimum	0.002	0.003	0.002
	Maximum	0.117	0.110	0.117
Institutional Ownership %	Mean	0.722	0.714	0.729
	Std. Dev.	0.216	0.199	0.231
	Minimum	0.020	0.020	0.026
	Maximum	1.723	1.723	1.267
Control Variables				
Market Capitalization (mm)	Mean	8,796	16,525	1,054
	Std. Dev.	24,056	32,207	590
	Minimum	79	2,308	79
	Maximum	375,773	375,773	2,299
Total Daily Trading Volume	Mean	1,386,455	2,332,806	438,425
	Std. Dev.	2,786,927	3,664,238	558,481
	Minimum	9,023	14,800	9,023
	Maximum	46,642,493	46,642,493	5,923,069

Research Coverage	Mean	13	18	8
	Std. Dev.	8	8	5
	Minimum	1	2	1
	Maximum	47	47	35
Research Activity	Mean	449	658	240
	Std. Dev.	404	443	210
	Minimum	1	32	1
	Maximum	2,498	2,498	1,674
Insider Ownership	Mean	0.069	0.052	0.086
	Std. Dev.	0.144	0.140	0.145
	Minimum	0	0	0
	Maximum	.9999	.9999	.9999
5% Owner Ownership	Mean	0.353	0.290	0.419
	Std. Dev.	0.223	0.203	0.224
	Minimum	0	0	0
	Maximum	.9999	.9999	.9999
Industry Groups (Four-Digit SIC Codes)	Mean	3	4	3
	Std. Dev.	1.681	1.727	1.578
	Minimum	1	1	1
	Maximum	7	7	7
News Days	Mean	34	47	22
	Std. Dev.	44	58	13
	Minimum	0	3	0
	Maximum	369	369	112
Age (in months)	Mean	311	369	252
	Std. Dev.	247	271	204
	Minimum	15	15	15
	Maximum	951	951	951
Volatility (Standard Deviation of Monthly Returns)	Mean	0.083	0.069	0.098
	Std. Dev.	0.038	0.027	0.041
	Minimum	0.021	0.021	0.022
	Maximum	0.376	0.182	0.376

Return on Equity	Mean	0.145	0.225	0.065
	Std. Dev.	1.043	1.421	0.378
	Minimum	-6.143	-1.661	-6.143
	Maximum	33.255	33.255	1.836
Dividends-to-Equity	Mean	0.055	0.066	0.044
	Std. Dev.	0.649	0.752	0.526
	Minimum	-.870	-.136	-.870
	Maximum	17.823	17.823	12.298
Tangible Assets to Total Assets	Mean	0.565	0.559	0.570
	Std. Dev.	0.396	0.399	0.394
	Minimum	0.000	0.000	0.000
	Maximum	2.709	1.868	2.709
R&D to Assets	Mean	0.027	0.029	0.025
	Std. Dev.	0.037	0.036	0.038
	Minimum	0.000	0.000	0.000
	Maximum	0.367	0.173	0.367
Book-to-Market Equity	Mean	0.491	0.414	0.568
	Std. Dev.	0.446	0.278	0.556
	Minimum	-6.769	-0.454	-6.769
	Maximum	4.092	2.305	4.092
External Financing	Mean	0.040	0.044	0.035
	Std. Dev.	0.385	0.148	0.524
	Minimum	-11.687	-1.623	-11.687
	Maximum	0.768	0.751	0.768
Sales Growth	Mean	0.153	0.152	0.154
	Std. Dev.	0.207	0.194	0.220
	Minimum	-0.903	-0.351	-0.903
	Maximum	1.846	1.846	1.683
Instrumental Variable				
Stock Price	Mean	37.80	48.80	26.77
	Std. Dev.	37.52	47.10	18.81
	Minimum	1.59	2.75	1.59
	Maximum	790.33	790.33	287.43

Table 2
Correlation Matrix for Overall Sample

	Retail Trading	Inst. Ownrshp.	Size, Vol. & Res.	Insider Ownrshp.	5% Owner Ownrshp.	Diverse	News Days	Age	Volatility	Return on Equity	Dividends -to-Equity	Tang. Assets to Total Assets	R&D to Assets	Book-to- Mkt. Equity	External Finance	Sales Growth
Retail Trading	1															
Inst. Ownrshp.	-0.465**	1														
	(0.000)															
Size, Vol. & Res.	-0.442**	0.094**	1													
	(0.000)	(0.002)														
Insider Ownrshp.	0.019	0.130**	-0.248**	1												
	(0.527)	(0.000)	(0.000)													
5% Owner Ownrshp.	0.073*	0.104**	-0.309**	0.230**	1											
	(0.015)	(0.001)	(0.000)	(0.000)												
Diverse	-0.040	-0.058^{+}	0.078**	-0.064*	-0.106**	1										
	(0.178)	(0.053)	(0.008)	(0.032)	(0.000)											
News Days	-0.148**	-0.015	0.595**	-0.204**	-0.208**	0.145**	1									
	(0.000)	(0.611)	(0.000)	(0.000)	(0.000)	(0.000)										
Age	-0.115**	-0.005	0.129**	-0.082**	-0.232**	0.284**	0.131**	1								
	(0.000)	(0.876)	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)									
Volatility	0.360**	0.029	-0.247**	0.092**	0.259**	-0.173**	-0.107**	-0.228**	1							
	(0.000)	(0.334)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)								
Return on Equity	-0.132**	0.042	0.134**	0.019	-0.064*	-0.038	-0.022	0.024	-0.226**	1						
	(0.000)	(0.159)	(0.000)	(0.524)	(0.031)	(0.198)	(0.468)	(0.413)	(0.000)							
Dividends -to-Equity	-0.099**	-0.176**	0.149**	-0.123**	-0.248**	(0.175)**	0.132**	0.368**	-0.383**	0.148**	1					
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
Tang. Assets to Total Assets	0.094**	-0.090**	0.040	-0.137**	-0.075*	0.011	-0.019	0.146**	0.104**	-0.057^{+}	0.097**	1				
	(0.002)	(0.003)	(0.175)	(0.000)	(0.011)	(0.716)	(0.531)	(0.000)	(0.000)	(0.057)	(0.001)					
R&D to Assets	-0.047	(0.037)	0.049^{+}	-0.087**	-0.046	0.043	0.097**	0.118**	0.030	-0.068*	(0.006)	-0.125**	1			
	(0.111)	(0.212)	(0.098)	(0.003)	(0.124)	(0.153)	(0.001)	(0.000)	(0.322)	(0.023)	(0.833)	(0.000)				
Book-to- Mkt. Equity	0.141**	-0.049	-0.275**	-0.023	0.094**	-0.004	-0.095**	-0.019	-0.001	-0.232**	0.026	(0.003)	-0.151**	1		
	(0.000)	(0.101)	(0.000)	(0.438)	(0.002)	(0.888)	(0.002)	(0.521)	(0.987)	(0.000)	(0.390)	(0.918)	(0.000)			
External Finance	0.095**	0.033	0.023	0.043	-0.017	-0.023	-0.015	-0.103**	0.097**	-0.020	-0.062*	-0.071	-0.051^{+}	-0.081**	1	
	(0.001)	(0.275)	(0.449)	(0.152)	(0.580)	(0.445)	(0.626)	(0.001)	(0.001)	(0.497)	(0.037)	(0.017)*	(0.086)	(0.006)		
Sales Growth	0.116**	0.016	0.080**	0.041	-0.038	-0.067*	-0.050^{+}	-0.127**	0.161**	0.152**	-0.101**	0.030	-0.016	-0.148**	0.482**	1
	(0.000)	(0.581)	(0.007)	(0.167)	(0.203)	(0.025)	(0.092)	(0.000)	(0.000)	(0.000)	(0.001)	(0.320)	(0.594)	(0.000)	(0.000)	

NOTE.—The table above reports pairwise correlation coefficients for the independent variables used in the analysis of the relationship between R^2 and retail trading and between R^2 and institutional ownership for the overall sample. The numbers in parentheses signify the probability levels at which one may reject the null hypothesis of zero correlation in two-tailed tests. $^{+}$, *, and ** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 3

Estimates of the Relationship between R^2 and Retail Trading Activity and R^2 and Institutional Ownership

	Retail Trading			Institutional Ownership		
	Overall Sample	Top Half	Bottom Half	Overall Sample	Top Half	Bottom Half
R^2	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-1.580**	-2.417**	-.825$^+$	-1.670**	-2.397**	-.959*
	(-5.33)	(-6.10)	(-1.81)	(-5.55)	(-5.90)	(-2.03)
	[.296]	[.397]	[.456]	[.301]	[.406]	[.471]
Retail Trading	-.132**	-.024	-.191**			
	(-4.38)	(-0.55)	(-4.61)			
	[.030]	[.043]	[.041]			
Institutional Ownership				.470**	.025	.563**
				(2.98)	(0.11)	(2.62)
				[.158]	[.226]	[.215]
Size, Volume & Research	.169**	.219**	.199**	.203**	.223**	.276**
	(6.98)	(5.76)	(3.97)	(8.58)	(5.97)	(5.58)
	[.024]	[.038]	[.050]	[.024]	[.037]	[.049]
Insider Ownership	.015	-.002	.033	.015	-.002	.039$^+$
	(1.03)	(-0.13)	(1.51)	(1.04)	(-0.12)	(1.74)
	[.015]	[.019]	[.022]	[.014]	[.018]	[.022]
5% Owner Ownership	-.416**	-.476*	-.405*	-.389**	-.466*	-.367*
	(-3.14)	(-2.47)	(-2.28)	(-2.93)	(-2.41)	(-2.06)
	[.132]	[.192]	[.178]	[.133]	[.193]	[.178]
Diverse	.028	.149$^+$	-.075	.030	.146$^+$	-.070
	(0.49)	(1.83)	(-0.96)	(0.51)	(1.79)	(-0.87)
	[.058]	[.081]	[.078]	[.058]	[.082]	[.080]
News Days	-.207**	-.213**	-.224**	-.231**	-.219**	-.228**
	(-4.15)	(-3.28)	(-2.75)	(-4.66)	(-3.49)	(-2.74)
	[.050]	[.065]	[.082]	[.050]	[.063]	[.083]
Age	.147**	.158**	.177**	.145**	.160**	.181**
	(4.44)	(3.37)	(3.52)	(4.30)	(3.39)	(3.44)
	[.033]	[.047]	[.050]	[.034]	[.047]	[.053]

Volatility	-1.09	3.813*	-3.870*	-2.227*	3.654*	-5.439**
	(-0.93)	(2.51)	(-2.46)	(-1.98)	(2.41)	(-3.75)
	[1.176]	[1.521]	[1.573]	[1.126]	[1.517]	[1.452]
Return on Equity	-.181	-.162	-.135	-.191	-.155	-.158
	(-1.29)	(-0.84)	(-0.66)	(-1.31)	(-0.80)	(-0.73)
	[.141]	[.193]	[.205]	[.146]	[.194]	[.216]
Dividends-to-Equity	.036**	.040*	.033+	.040**	.039*	.042*
	(2.91)	(2.49)	(1.91)	(3.25)	(2.41)	(2.37)
	[.012]	[.016]	[.018]	[.012]	[.016]	[.018]
Tangible Assets to Total Assets	.636**	.616**	.495**	.622**	.611**	.484**
	(7.39)	(5.66)	(4.00)	(7.19)	(5.63)	(3.80)
	[.086]	[.109]	[.124]	[.087]	[.109]	[.127]
R&D to Assets	-.061**	-.080**	-.036*	-.061**	-.079**	-.038*
	(-6.03)	(-6.00)	(-2.46)	(-5.94)	(-5.90)	(-2.55)
	[.010]	[.013]	[.015]	[.010]	[.013]	[.015]
Book-to-Market Equity	-.205*	.126	-.373**	-.223*	.133	-.419**
	(-1.99)	(0.92)	(-2.94)	(-2.10)	(0.96)	(-3.19)
	[.103]	[.137]	[.127]	[.106]	[.138]	[.131]
External Finance	.224	.482	-.034	.161	.465	-.092
	(0.99)	(1.60)	(-0.11)	(0.71)	(1.53)	(-0.30)
	[.227]	[.302]	[.306]	[.226]	[.303]	[.308]
Sales Growth	.600**	.527*	.499*	.530**	.508*	.412
	(3.23)	(2.26)	(1.80)	(2.90)	(2.22)	(1.55)
	[.186]	[.233]	[.277]	[.182]	[.229]	[.265]
F-Statistic	27.06	19.80	11.17	26.73	19.77	10.29
R^2	0.31	0.33	0.32	0.31	0.33	0.30
No. of observations	1129	565	564	1129	565	564

NOTE.—The table above reports ordinary least squares regression results for the overall sample and for segments of the sample determined by size (based on average market capitalization during the study period). The segments are “Top Half” (largest - top 50%) and “Bottom Half” (smallest - bottom 50%). $^+$, *, and ** indicate significance at the 10%, 5% and 1% levels, respectively. Numbers in parentheses are heteroskedasticity-robust t-statistics. Numbers in brackets are robust standard errors.

Table 4

Instrumental Variable Estimates of the Relationship between R^2 and Retail Trading Activity

	Overall Sample		Top Half		Bottom Half	
	First Stage Retail Trading	Second Stage R^2	First Stage Retail Trading	Second Stage R^2	First Stage Retail Trading	Second Stage R^2
Constant	.401	-2.793**	.071	-4.006**	.990+	-1.548**
	(1.02)	(-6.51)	(0.13)	(-5.42)	(1.93)	(-2.96)
	[.395]	[.429]	[.539]	[.739]	[.512]	[.523]
Retail Trading		-.847**		-1.112**		-.800**
		(-6.58)		(-3.44)		(-5.40)
		[.129]		[.323]		[.148]
Size, Volume & Research	-.300**	-.086	-.190**	.003	-.548**	-.173+
	(-11.98)	(-1.57)	(-4.69)	(0.04)	(-13.49)	(-1.67)
	[.025]	[.055]	[.040]	[.088]	[.041]	[.104]
Insider Ownership	-.037*	-.013	-.028	-.031	-.034	.004
	(-2.42)	(-0.71)	(-1.38)	(-1.06)	(-1.59)	(0.16)
	[.015]	[.019]	[.020]	[.029]	[.022]	[.025]
5% Owner Ownership	-.453**	-.792**	-.440+	-.947**	-.401*	-.741**
	(-3.01)	(-4.26)	(-1.88)	(-2.74)	(-2.16)	(-3.23)
	[.150]	[.186]	[.234]	[.346]	[.185]	[.229]
Diverse	.064	.064	.144+	.296*	-.005	-.077
	(1.02)	(0.89)	(1.70)	(2.30)	(-0.06)	(-0.85)
	[.062]	[.072]	[.085]	[.129]	[.085]	[.091]
News Days	.224**	-.008	.298**	.141	-.070	-.243*
	(4.39)	(-0.11)	(4.68)	(0.98)	(-0.82)	(-2.59)
	[.051]	[.073]	[.064]	[.144]	[.084]	[.094]
Age	-.053	.102*	-.114*	.037	-.086+	.107+
	(-1.47)	(2.46)	(-2.35)	(0.49)	(-1.73)	(1.90)
	[.036]	[.042]	[.049]	[.075]	[.050]	[.057]

Volatility	6.000**	5.028**	5.330**	10.427**	6.898**	2.190
	(5.81)	(2.74)	(3.52)	(3.38)	(5.28)	(0.91)
	[1.032]	[1.833]	[1.513]	[3.082]	[1.307]	[2.402]
Return on Equity	.087	-.246	-.239	-.512^{+}	.116	-.200
	(0.58)	(-1.44)	(-1.38)	(-1.84)	(0.65)	(-0.92)
	[.151]	[.171]	[.173]	[.278]	[.177]	[.217]
Dividends-to-Equity	.042**	.050**	.059**	.087**	.017	.028
	(3.43)	(3.32)	(3.45)	(3.10)	(1.10)	(1.49)
	[.012]	[.015]	[.017]	[.028]	[.016]	[.019]
Tangible Assets to Total Assets	.164*	.788**	.213*	.903**	.127	.591**
	(2.08)	(7.68)	(2.06)	(5.12)	(1.13)	(4.35)
	[.079]	[.103]	[.103]	[.176]	[.112]	[.136]
R&D to Assets	-.025*	-.073**	-.031*	-.106**	-.029^{+}	-.049**
	(-2.22)	(-5.72)	(-2.11)	(-4.96)	(-1.82)	(-2.89)
	[.011]	[.013]	[.014]	[.021]	[.016]	[.017]
Book-to-Market Equity	-.121	-.144	-.375*	-.151	-.080	-.280*
	(-1.31)	(-1.37)	(-2.56)	(-0.71)	(-0.74)	(-2.20)
	[.093]	[.106]	[.147]	[.212]	[.108]	[.127]
External Finance	.276	.426	.657*	1.236*	.179	.056
	(1.17)	(1.43)	(2.07)	(2.41)	(0.62)	(0.15)
	[.237]	[.297]	[.318]	[.512]	[.289]	[.370]
Sales Growth	.985**	1.081**	1.003**	1.357**	1.100**	.981**
	(5.40)	(4.42)	(3.68)	(3.03)	(4.65)	(2.98)
	[.183]	[.245]	[.272]	[.448]	[.237]	[.329]
Stock Price	-.492**		-.359**		-.543**	
	(-8.63)		(-4.19)		(-7.30)	
	[.057]		[.086]		[.074]	
F-Statistic	74.56		17.55		53.30	
No. of observations:	1129		565		564	

NOTE.—The table above reports the results of a regression of R^2 on retail trading for the overall sample and for segments of the sample determined by size (based on the average market capitalization during the study period), estimated using 2SLS (two-stage least squares regression). The segments are "Top Half" (largest – top 50%) and "Bottom Half" (smallest – bottom 50%). Stock price is used as an instrument for retail trading. Numbers in parentheses are heteroskedasticity-robust t-statistics or z-scores. Numbers in brackets are robust standard errors. $^{+}$, *, and ** indicate significance at the 10%, 5% and 1% levels, respectively.

Table 5
Instrumental Variable Estimates of the Relationship between R^2 and Institutional Ownership

	Overall Sample		Top Half		Bottom Half	
	First Stage Institutional Ownership	Second Stage R^2	First Stage Institutional Ownership	Second Stage R^2	First Stage Institutional Ownership	Second Stage R^2
Constant	.381**	-5.484**	.343**	-6.321**	.313*	-4.021**
	(4.16)	(-5.02)	(2.83)	(-3.78)	(2.43)	(-3.41)
	[.091]	[1.092]	[.121]	[1.672]	[.129]	[1.178]
Institutional Ownership		6.175**		6.526**		5.367**
		(4.59)		(2.77)		(3.93)
		[1.346]		[2.353]		[1.366]
Size, Volume & Research	.019**	.048	.023**	.063	.060**	-.059
	(3.78)	(0.89)	(2.78)	(0.68)	(6.80)	(-0.50)
	[.005]	[.054]	[.008]	[.093]	[.009]	[.119]
Insider Ownership	.011**	-.051	.014**	-.093$^+$	.005	.007
	(2.96)	(-1.64)	(2.93)	(-1.88)	(0.84)	(0.20)
	[.004]	[.031]	[.005]	[.049]	[.005]	[.034]
5% Owner Ownership	.081*	-.906**	.036	-.691$^+$	.096$^+$	-.934**
	(2.07)	(-3.13)	(0.63)	(-1.70)	(1.86)	(-2.67)
	[.039]	[.290]	[.056]	[.406]	[.052]	[.349]
Diverse	-.019	.125	-.017	.250$^+$	-.008	-.032
	(-1.37)	(1.25)	(-0.93)	(1.67)	(-0.42)	(-0.27)
	[.014]	[.100]	[.019]	[.150]	[.018]	[.119]
News Days	-.019$^+$	-.081	-.032*	.022	.024	-.315*
	(-1.73)	(-0.86)	(-2.41)	(0.14)	(1.24)	(-2.47)
	[.011]	[.094]	[.014]	[.153]	[.019]	[.127]
Age	.020*	.023	.033**	-.051	.027*	.033
	(2.26)	(0.34)	(2.97)	(-0.46)	(2.11)	(0.39)
	[.009]	[.067]	[.011]	[.111]	[.013]	[.086]

Volatility	.348	-2.202	.634+	.363	-.127	-2.642
	(1.43)	(-1.32)	(1.89)	(0.12)	(-0.37)	(-1.20)
	[.243]	[1.668]	[.336]	[3.020]	[.340]	[2.200]
Return on Equity	.021	-.450+	.013	-.333	.044	-.528
	(0.58)	(-1.68)	(0.26)	(-0.78)	(0.92)	(-1.53)
	[.037]	[.268]	[.052]	[.426]	[.048]	[.346]
Dividends-to-Equity	-.017**	.121**	-.016**	.128**	-.016**	.101**
	(-6.46)	(4.73)	(-4.48)	(3.19)	(-4.47)	(3.70)
	[.003]	[.026]	[.004]	[.040]	[.004]	[.027]
Tangible Assets to Total Assets	-.025	.805**	-.048*	.980**	-.028	.640**
	(-1.58)	(6.55)	(-2.37)	(4.76)	(-1.20)	(3.91)
	[.016]	[.123]	[.020]	[.206]	[.023]	[.164]
R&D to Assets	.005+	-.080**	-.002	-.056*	.011**	-.087**
	(1.96)	(-4.63)	(-0.80)	(-2.26)	(3.48)	(-3.53)
	[.002]	[.017]	[.003]	[.025]	[.003]	[.025]
Book-to-Market Equity	.041*	-.296*	-.014	.357	.065**	-.565**
	(1.99)	(-1.98)	(-0.39)	(1.24)	(2.62)	(-3.25)
	[.021]	[.149]	[.036]	[.288]	[.025]	[.174]
External Finance	.055	-.147	.038	.259	.049	-.349
	(1.08)	(-0.37)	(0.53)	(0.45)	(0.74)	(-0.72)
	[.051]	[.395]	[.071]	[.575]	[.066]	[.486]
Sales Growth	-.083*	.761**	-.023	.390	-.160**	.959*
	(-2.27)	(2.63)	(-0.53)	(1.06)	(-2.94)	(2.34)
	[.037]	[.289]	[.042]	[.367]	[.054]	[.411]
Average Price	.067**		.061**		.081**	
	(5.43)		(3.30)		(5.02)	
	[.012]		[.019]		[.016]	
F-Statistic	29.51		10.91		25.24	
No. of observations:	1129		565		564	

NOTE.—The table above reports the results of a regression of R^2 on institutional ownership for the overall sample and for segments of the sample determined by size (based on the average market capitalization during the study period), estimated using 2SLS (two-stage least squares regression). The segments are "Top Half" (largest – top 50%) and "Bottom Half" (smallest – bottom 50%). Stock price is used as an instrument for institutional ownership. Numbers in parentheses are heteroskedasticity-robust t-statistics or z-scores. Numbers in brackets are robust standard errors. $^{+}$, *, and ** indicate significance at the 10%, 5% and 1% levels, respectively.