Idiosyncratic Volatility, Institutional Ownership, and Investment Horizon

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Abstract

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Abstract

Existing literature suggests that growing institutional ownership has contributed to the increase in aggregate idiosyncratic volatility over time. However, this link has come into question over the last decade when idiosyncratic risk has declined, while institutional ownership maintained the upward trend. Although total institutional ownership no longer explains idiosyncratic volatility in this later period, we document that short-term (long-term) institutional ownership is positively (negatively) linked to idiosyncratic volatility in the cross-section. These opposite effects persist after controlling for institutional preferences and information-based trading and remain qualitatively unchanged in the pre- and post-2001 period. Furthermore, long-term institutional ownership consistently dominates its short-term counterpart after 2001, suggesting that institutions with longer horizon contribute to the recent decrease in idiosyncratic risk. We interpret our results as consistent with the notion that conditioning institutional ownership measures on investment horizon results in a better proxy for institutional trading.

Introduction

This article investigates the cross-sectional relation between institutional ownership and idiosyncratic volatility, accounting for differences in the trading horizon of institutional investors. Over the past few decades, aggregate institutional trading experienced dramatic growth and the effects of this growth on idiosyncratic volatility have been extensively studied in the literature with mixed results. On one hand, Sias (1996), Campbell, Lettau, Malkiel, and Xu (2001), Xu and Malkiel (2003), and Dennis and Strickland (2004) argue that the upward trend in institutional ownership is primarily responsible for the increase in aggregate idiosyncratic risk. They support this conjecture by showing a positive cross-sectional relationship between the idiosyncratic volatility (IV) of the stocks in the S&P 500 index and the percentage of total institutional ownership. On the other hand, Zhang (2010) shows that after 2001 idiosyncratic volatility consistently declined, while institutional ownership maintains the upward trend.

Furthermore, Brandt, Brav, Graham, and Kumar (2009) argues that, given the reverse in the trend of aggregate idiosyncratic volatility, the episodic increase in IV is more likely to be caused by retail rather than institutional investors.[2]

We attempt to reconcile the seemingly contradictory evidence by exploring the cross-sectional relation between idiosyncratic risk and institutional ownership *conditional on the investment horizon of institutional investors.* Today's trading environment is not only characterized by a significant increase in the presence of institutional investors[3], but also by large variation in their trading behavior, caused by their different objectives, characteristics, limits, etc. The fact that we often see institutions on both sides of the same trade is the best supporting evidence that not all institutional trades are similarly motivated. We argue that ignoring the heterogeneity of institutions and studying them as a group can only produce confounding results.

There are at least two reasons to believe that the relation between institutional ownership and idiosyncratic risk is conditional on the investment horizon of the institutional investors. First, the average investment horizon of the shareholders is indicative of the amount of trading a particular stock will face. Ownership by institutions with different investment horizons indicates different trading frequencies. Particularly, stocks with primarily short-term institutional ownership will be exposed to higher trading activity, while the opposite is true for stocks with primarily long-term institutional ownership. In this case, short and long-term institutional ownership represent trading (or lack thereof) of a stock and, hence, should have opposite effects on the level of idiosyncratic risk in the cross-section. In addition, the positive relation between

[2] Brandt, Brav, Graham, and Kumar (2009) show that by 2003, aggregate idiosyncratic volatility has decreased to pre-1990s levels.

[3] See Jones and Lipson (2003) and or Kaniel, Saar and Titman (2008) for evidence of institutional investors dominance in the financial market.

trading volume and volatility has long been documented in the literature.[4] Therefore, if institutional ownership is indicative of stock trading volume, then we expect short-term institutional ownership to increase idiosyncratic risk and long term institutional ownership to decrease it. We refer to this argument as the trading conjecture in the remainder of our study.

Alternatively, it has been documented in the literature that institutions' investment horizon is a good indicator of how well informed their trades are. For example, Yan and Zhang (2009) document a significant relation between institutions' investment horizon and their informational role. They provide evidence suggesting that short-term institutions are better informed and their trading forecasts future stock returns. On the contrary, Cremers and Pareek (2011) study the effect of institutional investment horizon on the efficiency of stock prices and conclude that short-term institutions are behaviorally biased, mostly overconfident and that their presence helps to explain many stock returns anomalies. Regardless of whether this behavior is generated by overconfidence or better information, this line of thinking provides convincing reasons to believe that institutions' investment horizon will affect the relation between institutional ownership and idiosyncratic volatility. This argument also raises an important point, namely that institutions with different horizons may have different attitudes (preferences) towards idiosyncratic risk exposure. Whether they are better informed (Yan and Zhang 2009) or overconfident (Cremers and Pareek 2011), short-term institutions are more likely to prefer stocks with higher idiosyncratic volatility because they can take advantage of the (perceived) mispricing. The opposite is true for institutions with longer investment horizons. Hence, the investment horizon of institutional investors could capture their different preferences and thus

[4] See Schwert (1989), Gallant, Rossi, and Tauchen (1992), and Karpoff (1987) for a detailed review of the empirical research in this area.

influence the relation between institutional ownership and idiosyncratic volatility. We refer to this as the preference conjecture .

We follow Yan and Zhang (2009) and use quarterly institutional holdings to construct an investment horizon measure based on institutions' portfolio turnover. Based on this measure, we classify institutions into short-term (high turnover) and long-term (low-turnover) investors and then calculate the percentage ownership of short and long-term institutions at the stock level. Using daily data, we follow Ang, Hodrick, Xing, and Zhang (2006) (hereafter AHXZ) to estimate quarterly idiosyncratic volatility relative to the Fama-French three factor model. We start by examining institutional ownership and IV during the 1980 to 2010 period and then study the dynamics of aggregate idiosyncratic risk in relation to short and long-term institutional ownership over time.

Consistent with Campbell, Lettau, Malkiel, and Xu (2001), Xu and Malkiel (2003) we observe that aggregate IV constantly increases until 2001, as institutional ownership doubled (from 20% in 1980 to almost 40% in 2001). This corresponds to a period where short-term institutional ownership dominates long-term on average. Similar to Brandt, Brav, Graham, and Kumar (2009) and Zhang (2010) we find that after 2001 the idiosyncratic risk trend reverses, with the exception of the 2008 financial crisis. Even though the total institutional ownership continued to increase (from 40% in 2001 to almost 55% in 2010), we document that the long-term institutional ownership component consistently dominates its short-term counterpart after 2001. This supports our argument that treating institutional investors as a whole group can produce misleading results. If these two types of institutional ownership indeed have opposite effects on idiosyncratic risk, the type that dominates at any given point will determine the net effect. In other words, during periods when short-term (long-term) institutional ownership is

higher on average, the relation between total institutional ownership and idiosyncratic volatility will be positive (negative). Therefore, prior to 2001 the positive relation between total institutional ownership and idiosyncratic volatility is likely driven by short-term institutional ownership. However, after 2001, long-term ownership becomes dominant and the trading pattern of this type of investors decreases idiosyncratic volatility. Our results suggest that, the dominance of long-term institutional ownership in the post-2001 period can potentially contribute to the decreasing trend in volatility documented by Brandt, Brav, Graham, and Kumar (2009) and Zhang (2010).

Since the focus of our analysis is the cross-sectional relation between institutional ownership and idiosyncratic volatility, we continue the analysis by examining average idiosyncratic volatility of portfolios sorted independently on their previous quarter institutional ownership and size. Univariate analysis consistently shows that for the 1980 to 2010 time period there is a negative relation between net institutional ownership and IV, and this relation is driven by long-term institutional ownership. Specifically, stocks with short-term (long-term) institutional ownership have higher (lower) subsequent quarter IV, and looking at total institutional ownership misrepresents these effects. This relation is less pronounced among small stocks, which can be explained by the low level of institutional presence in these stocks overall. At the same time, consistent with the preference theory, independent sorts on idiosyncratic volatility and size show that short-term (long-term) institutions prefer stocks with high (low) idiosyncratic volatility.

Motivated by the above results, we use a standard Fama and MacBeth (1973) approach to test whether our conclusions persist after controlling for other determinants of idiosyncratic volatility such as size, illiquidity, past returns and past idiosyncratic volatility. Long-term (short-

term) institutional ownership is persistently negatively (positively) linked to future idiosyncratic volatility in the cross-section, providing additional support to our trading theory. We further document that the positive relation between total institutional ownership and idiosyncratic volatility documented in previous literature is primarily driven by the short-term institutional ownership when this component dominates (the period before 2001). In contrast, long-term ownership captures reduced trading and, therefore, decreases future idiosyncratic risk. We also show that although the relation between IV and total institutional ownership becomes considerably weaker after 2001, the relation with long-term and short-term ownership remains relatively unchanged. This further strengthens our claim that the dynamic changes between long-term and short-term institutional ownership are mostly responsible for the relation between IV and total institutional ownership over time. In an attempt to isolate the informational advantage of institutions, we also run several models where we control for the change in our various measures of institutional ownership. While the changes in ownership are consistently negatively related to idiosyncratic volatility, lagged levels of long and short-term ownership continue to exert opposite effects. To the extent that changes in ownership capture information based trades, we interpret these results as supportive of the idea that ownership levels signal trading activity (or lack thereof), which in turn produces increases (decreases) in idiosyncratic volatility.

We further document that long-and short-term institutions have different appetite (preferences) for idiosyncratic risk. Specifically, short-term institutions prefer stocks with higher idiosyncratic risk, while long-term institutions prefer the opposite. Without specifically accounting for this feedback effect, the highly autocorrelated nature of our variables of interest exposes the possibility that the results supporting our trading theory are only an artifact of

institutional preferences. To control simultaneously for both effects, we employ a three-stage least squares (3SLS) approach. Overall, the evidence points to the conclusion that there is a feedback effect; however, even after controlling for preferences using the 3SLS methodology, idiosyncratic risk is differently affected by long and short-term institutions. Overall, we confirm that while short-term institutions increase IV, long-term institutions tend to have the opposite effect.

Separating the group of institutional investors is paramount for both sides of this two-directional relation between institutional ownership and idiosyncratic risk. On one hand, they have different preferences for idiosyncratic risk, and on the other hand, they have different effects on the idiosyncratic risk of their holdings. The point of this paper is that we cannot disentangle and understand this two-directional relation if we ignore the composition of institutional investor base and consider total institutional ownership as a group.

Our results present several contributions to the current literature. First, we reconcile seemingly contradictory evidence regarding the relation between institutional ownership and idiosyncratic volatility by showing that this relation is conditional on the institutions' investment horizon. The results support our trading hypothesis, namely that short (long) investment horizon indicates more (less) trading intensity and, hence, increases (decreases) future idiosyncratic volatility. These findings help explain both the cross-sectional and aggregate time series relation between idiosyncratic risk and institutional ownership. Second, our results potentially help to shed light on the controversial connection between idiosyncratic risk and returns and open the door to investigating whether this relation is different for stocks traded primarily by short-term versus long-term institutions. Finally, our results have important implications for corporate managers who attempt to manage the volatility of their stock price – in the same spirit as Bushee

(1998), Bushee and Noe (2000) we show that different types of institutional investors have different effects on volatility. Given the documented feedback effect, high idiosyncratic volatility potentially attracts more short-term investors, which in turn maintain the high volatility through their trading.

The remainder of the paper is organized as follows. Section II discusses the background and related literature. Section III describes the data and general methodology employed in the analysis and provides some preliminary empirical results. Section IV reports our main empirical results and discusses their implications. Section V concludes.

II. Background and Hypotheses Development

Our paper contributes to the rich stream of research that studies the determinants of idiosyncratic volatility. The time trend in aggregate idiosyncratic volatility has produced vast interest, starting with Campbell et al 2001, who document the steady increase between the early 1960s to the late 1990s. After 2001 this trend reversed (Brandt, Brav, Graham, and Kumar (2009)), causing a reexamination of previously proposed explanations. As summarized by Zhang (2010), theories on what causes variation in idiosyncratic volatilities can be categorized as either based on (1) uncertainty about fundamental variables or (2) trading volume. Institutional ownership belongs to the second category (i.e. ownership by itself does not affect volatility, but it is a good proxy for institutional trading, which in turn affects volatility). Zhang (2010) concludes that although both fundamental-based and trading-volume based theories explain the upward trend in average volatility up to 2001, the trading volume variables (including institutional ownership) lose their explanatory power for the period after 2001, when volatilities fell dramatically.

Therefore, the literature considers institutional ownership as a cross-sectional determinant of idiosyncratic volatility. Campbell, Lettau, Malkiel, and Xu (2001) and Xu and Malkiel (2003) show a positive cross-sectional relationship between the volatility of the stocks in the S&P500 index and the percentage of institutional ownership. Dennis and Strickland (2004) provide additional support to this hypothesis using a larger sample of firms. Kang, Kondor, and Sadka (2011) focus on the cross-sectional distribution of idiosyncratic volatilities and find that the trading activity of hedge funds reduce the volatility of low-idiosyncratic stocks but amplify that of high-idiosyncratic volatility stocks.

The institutional literature has recently started to acknowledge the differences generated by the presence of institutional investors with different investment horizons. Yan and Zhang (2009) document a significant relation between institutions' investment horizon (measured based on their portfolios' turnover) and their informational role and provide evidence that short-term institutions are better informed and their trading forecasts future stock returns. Khurana and Moser (2009) examine whether investment horizons of institutions affect firms' tax aggressiveness behavior. Derrien, Kecskes, and Thesmar (2011) argue that longer investor horizons attenuate the effect of mispricing on corporate policies. In addition, Harford, Kecskes, and Mansi (2012) study the effect of investor horizons on corporate cash holdings and Hovakimian and Li (2010) find that institutions with short and long investment horizons have different effects on corporate payout policy.

However, in relation to idiosyncratic risk, the investment horizon is much less represented as a variable of interest. A notable exception is Cremers and Pareek (2011), who examine the cross-sectional effect of the average stock duration on the efficiency of stock prices. Using a measure of average stock duration, the authors document a significantly negative

relation with idiosyncratic volatility, which they interpret as support in favor of a behavioral bias argument (i.e. shorter horizon investors are overconfident and hence increase idiosyncratic volatility).

Short and long-term institutions exhibit opposite trading patterns – only short-term institutional ownership should involve increased trading. Considering the positive relation between trading volume and volatility (Schwert (1989), Gallant, Rossi, and Tauchen (1992), and Karpoff (1987)), a higher short-term institutional ownership would suggest higher volatility. Long-term institutional ownership should signal the opposite (lack of trading) and thus produce lower idiosyncratic volatility. In this study we propose that investment horizon of institutional investors, as a proxy for trading volume, would determine the relation between institutional ownership and idiosyncratic volatility. In addition, short and long-term institutions can have different preferences towards idiosyncratic risk (long-term institutions prefer larger stocks, while short-term institutions are indifferent). This preference hypothesis needs to be accounted for to uncover the true relation between idiosyncratic risk and institutional ownership. If our argument is correct, opposite effects in the cross-section from the two types of institutional ownership would cancel each other out, and total institutional ownership will have explanatory power in aggregate only to the extent that one part dominates the other. This can potentially explain why total institutional ownership loses explanatory power in aggregate after 2001.

Our paper differs from Cremers and Pareek (2011) on several important dimensions. First, we do not take a stance on what generates the different behavior of institutions with different investment horizons (behavioral bias/overconfidence or better information). Regardless of the underlying factors generating their different behavior, we build on the simple idea that investors with shorter horizons trade more than investors with longer horizons. Second, since we

are interested in capturing trading effects (or lack thereof) we use a much simpler measure of investment horizon (following Yan and Zhang (2009)), which is based on the turnover of institutions' portfolios. Third, we consider a feedback effect between institutional preferences for high and low volatility stocks and the influence they exert on the volatility of their holdings through their trading. Finally, we propose an explanation, which can explain both the cross-sectional and aggregate time series relation between idiosyncratic risk and institutional ownership and reconciles the seemingly contradictory evidence existent so far in the literature.

This paper makes important contributions to the literature connecting firm-ownership structure and stock price volatility (see for example Sias (2004), Bushee and Noe (2000), Koch, Ruenzi, and Starks (2010), Greenwood and Thesmar (2011), Kang, Kondor, and Sadka (2011)). Our main innovations to this literature are that we document that (1) the relation between institutional ownership and idiosyncratic risk is conditional on the type of institutional ownership and (2) there is a feedback effect between idiosyncratic volatility and types of institutional ownership.

III. Data and Methodology

The quarterly institutional holdings for all common stock traded on NYSE, AMEX, and NASDAQ, for the period from March 1980 through December 2010 come from Thomson Financial and is derived from institutional investors' 13F filing.[5] Returns, volume, shares outstanding, and capitalization are from the Center for Research in Security Prices (CRSP). We

[5] The Securities and Exchanges Commission (SEC) requires that all institutional investors with $100 million or more under management in exchange-traded or NASDAQ-quoted equity securities report all equity positions greater than 10,000 shares or $200,000 in market value to the SEC at the end of each quarter. They are required to file 13F reports within 45 days of the end of the calendar quarter. Because 13F reporting is aggregated across different units within an institution, the number of institutions reflects the number of unrelated institutions buying or selling the security.

eliminate any position where we cannot observe the institution's holdings at the beginning and end of the quarter (e.g., we do not count a manager in the first quarter they file a 13F report). In our sample we only keep securities with a Center for Research in Security Prices (CRSP) share code of 10 or 11, non-missing capitalization data at the beginning and end of the quarter, and begin of quarter price greater than two dollars. In addition, we adjust institutional holdings for stock splits and dividends by using the CRSP price adjustment factor. We also correct the data for known errors following studies like Blume and Kleim (2011) and Gutierrez and Kelley (2009).

To calculate idiosyncratic risk, we follow AHXZ and estimate idiosyncratic volatility relative to the Fama and French (1993) three-factor model. We estimate quarterly idiosyncratic volatility using daily return data (we use quarterly series because institutional ownership data is only available at quarterly frequency).[6] Specifically, for quarter *t* and stock *i*, we estimate the following regression model:

$$r_{i,s} = \alpha_i + \beta_{i,MKT} MKT_s + \beta_{i,SMB} SMB_s + \beta_{i,HML} SML_s + \epsilon_{i,s}, \quad (1)$$

where $r_{i,s}$ is the return (excess of the risk free rate) of stock *i* on day *s* during quarter *t*. The idiosyncratic volatility of stock *i* during the period *t* is defined as the sum of the squared residuals of the regression over the number of trading days in period *t*, $D_{i,t}$:

$$IV_{i,t} = \sum_{s=1}^{D_{i,t}} \epsilon_{i,s}^2, \quad (2)$$

We use daily return data from CRSP and daily risk-free rate and Fama-French factors from Kenneth French's website. We also require that stocks have more than 25 trading days for our quarterly estimation.

[6] Kang, Kondor, and Sadka (2011) show that the quarterly and monthly idiosyncratic volatility series display similar trends.

The total institutional ownership measure for each stock *i*, $IO_{i,t}$ is calculated as the ratio of shares of *i* held by all institutions in quarter *t*, to the total number of shares outstanding for stock *i* in quarter *t.*

$$IO_{i,t} = \frac{\text{Shares held by institutions}_{i,t}}{\text{Total shares outstanding}_{i,t}}, \tag{3}$$

Next, following Yan and Zhang (2009) each institutional investor is classified into short-term and long-term institutional investors on the basis of their portfolio turnover over the past four quarters. Specifically, for each institution *k* in each quarter *t*, we compute the institution's churn rate based on its aggregate buy and sale quantities as:

$$CR_{k,t} = \frac{min(Buy_{k,t}, Sell_{k,t})}{\sum_{i=1}^{N_k} \frac{S_{k,i,t}P_{i,t} + S_{k,i,t-1}P_{i,t-1}}{2}}, \tag{4}$$

where the aggregate buy and sell are calculated as:

$$\text{Buy}_{k,t} = \sum_{i=1, S_{k,i,t} > S_{k,i,t-1}}^{N_k} \left| S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\delta P_{i,t} \right| \tag{5}$$

$$\text{Sell}_{k,t} = \sum_{i=1, S_{k,i,t} \le S_{k,i,t-1}}^{N_k} \left| S_{k,i,t}P_{i,t} - S_{k,i,t-1}P_{i,t-1} - S_{k,i,t-1}\delta P_{i,t} \right|, \tag{6}$$

and where $P_{i,t}$ is the share price for stock *i* at the end of quarter *t*, and $S_{k,i,t}$ is the number of shares of stock *i* held by investor *k* at the end of quarter *t*. Next, we calculate each institution's average churn rate over the past four quarters as

$$AVG\_CR_{k,t} = \frac{1}{4}\sum_{j=0}^{3} CR_{k,t-j}, \tag{7}$$

Each quarter, institutional investors are sorted into terciles based on their calculated average churn rate measure.[7] Then, institutional investors in the top tercile are classified as short-term institutions and those ranked in the bottom tercile are classified as long-term institutions. For each stock, we define short-term (long-term) ownership as the ratio of the number of shares held by short-term (long-term) institutional investors and the total number of shares outstanding (we refer to these as SIO and LIO, respectively). We use quarterly returns, size (market value of equity), and illiquidity as control variables. We estimate the illiquidity of firm *i* during quarter *t* using the Amihud (2002) measure $\mathrm{ILLIQ_{i,t}} = \frac{1}{\mathrm{D}_{i,t}} \sum_{\mathrm{s} \in \mathrm{t}} \frac{|\mathrm{R}_{i,s}|}{\mathrm{P}_{i,s}\mathrm{Vol}_{i,s}}$, where $\mathrm{D}_{i,t}$ is the number of trading days during quarter *t*, $\mathrm{R}_{i,s}$ is the raw return on day *s*, and *P* and *Vol* are stock price and trading volume, respectively.

For our final sample, we only retain the observations from CRSP that have a match in the 13F Thomson database. For the entire sample period from 1980:Q2 to 2010:Q4, we have a total of 537,490 stock-quarter observations, for which we have both Thomson and CRSP data. For each quarter, we calculate the cross-sectional mean, median, 25th and 75th percentiles, and standard deviation. Panel A of Table 1 reports the time-series means of these cross-sectional descriptive statistics for our variables of interest, calculated over the 123 quarters in our sample period. Our results are comparable to results reported in previous literature.

[Insert Table 1 here]

The average total institutional ownership is 34.37% over our sample period (versus 25.1% reported by Yan and Zhang (2007) for the period from 1980 to 2003). We find that short-term institutions hold 9.36% of total shares outstanding, while long-term institutions hold 10.34% of all shares (compared to 7.91% and 6.56% reported by Yan and Zhang (2009),

[7] We require data for at least two quarters hence the first cross-section of our final sample is 1980:Q2.

respectively). The average firm has a market capitalization of $1,698 million and quarterly idiosyncratic volatility of about 7.5% (our merge with Thomson basically tilts our sample towards larger stocks). The average number of stocks per quarter in our sample is 4,369. In comparison, Yan and Zhang (2009) report an average of 5,911 stocks per quarter for their sample period.

Panel B of Table 1 reports the time-series average of the cross-sectional correlations between institutional ownership measures and main firm characteristics. The obvious positive relation between institutional ownership and size and negative relation with illiquidity are to be expected. It is interesting to note that in the overall sample there is a negative cross-sectional contemporaneous relation between idiosyncratic volatility and total institutional ownership, as well as its components. While this does not seem to support our initial hypothesis, we cannot draw any conclusion without looking at multivariate regressions, which control for other firm-specific characteristics (size, in particular).

IV. Empirical Results

Aggregate Trends

We start our empirical investigation by depicting the evolution of aggregate, long-term, and short-term institutional ownership in relation to the aggregate idiosyncratic volatility (Figure 1). If the two types of institutional ownership indeed have opposite effects on idiosyncratic risk, the type that dominates should determine the net effect of institutional ownership on IV that is empirically observed in the data. Aggregate trends suggest that when the composition of institutional ownership changes, the aggregate idiosyncratic risk trend changes as well.

[Insert Figure 1 here]

Figures 1a and 1b confirm the findings of previous studies: (1) idiosyncratic volatility increases in the pre-2001 period and its trend reverses after that, and (2) aggregate institutional ownership has significantly increased over our sample period. These graphs illustrate how looking at aggregate institutional ownership would lead to the conclusion that it cannot be related to idiosyncratic risk since the two trends diverge after 2001 (this conclusion has been put forth in studies such as Brandt, Brav, Graham, and Kumar (2009), Bennett and Sias (2006)). However, this kind of conclusion may be premature. Figure 1c shows that while the overall trend may be increasing continuously after 2001, long-term ownership clearly dominates short-term ownership. Moreover, their relative contribution to total institutional ownership (Figure 1d) shows the same pattern, i.e. long-term starts dominating in importance after 2001 and continues to do so until the end of our sample period. Although these graphs do not provide conclusive evidence, our explanation based on different trading intensities would be consistent with the reverse trend of idiosyncratic volatility after 2001.

Independent Sorts

The premise of this paper is that not all institutions are the same in terms of their effect on idiosyncratic volatility. We argue that different trading patterns or different informational roles lead different types of institutions to have a different (opposite) effect on the next period idiosyncratic volatility. Therefore, studying the effect of total institutional ownership may be convoluted due to diverse types of institutions represented in the sample (only the net effect would be captured by looking at total institutional ownership).

To investigate whether this is indeed the case, we first report the average natural log of idiosyncratic volatility (ln(IV)) of five 25 portfolios sorted independently on their total institutional ownership and size during the previous quarter. We also report the differences

between the extreme deciles and then repeat the analysis for short and long-term institutional ownership. Results are presented in Table 2.

[Insert Table 2 here]

According to Panel A, higher total institutional ownership is associated with relatively lower ln(IV) the following quarter across every size category except the smallest stocks. For large stocks (group 5), we find that the difference in ln(IV) between high and low institutional ownership portfolios is -0.20 with a *t*-statistics of -4.93. This difference declines as we move towards smaller stocks and becomes insignificant for the smallest stocks portfolios. This finding is in contrasts with previously documented results by Campbell, Lettau, Malkiel, and Xu (2001) and Xu and Malkiel (2003) that institutions tend to increase IV.

Panel B of Table 2 presents the same analysis; however, in this case, we sort on short-term (rather than total) institutional ownership and size. We document that higher short-term institutional ownership increases ln(IV) in the next quarter. This result is consistent with the hypothesis that ownership of short-term institutions proxies for increased level of trading and, therefore, it generates higher IV. Specifically, Panel B of Table 2 shows that for the largest size group the difference in ln(IV) between high and low short-term ownership is 0.49 with a t-statistics of 8.61. Again, this relation decreases with size and becomes insignificant for the smallest group.

Finally, Panel C of Table 2 presents the sorts based on long-term institutional ownership and size. In this case, we observe that long-term institutions tend to decrease future IV. This result is also consistent with the trading hypothesis i.e. long-term institutional ownership signifies decreased trading, which decreases IV on average. Specifically, the difference in ln(IV) between high and low long-term institutional ownership is -0.77 with a t-statistics of -17.40.

Overall, independent sorts consistently show that long-term and short-term institutional ownership have opposite effects on future IV, and that looking at total institutional ownership misrepresents these effects. Ownership effects on IV are diminished for small stocks, which can be explained by the low level of institutional presence in these stocks overall. For example, in our sample institutions hold on average 12.22% of the shares of small stocks. At the same time, they own 55.60% of the shares of large stocks. We also find that across all three panels large stocks have lower IV on average, which is consistent with previously documented results (see Ang, Hodrick, Xing, and Zhang (2006)).

While we document different effects of long and short-term ownership on future idiosyncratic risk, it is important to consider the feedback effect i.e. to account for the fact that in turn idiosyncratic risk might have an effect on institutional ownership in the next period. As previously discussed, these different types of institutions may prefer stocks with different idiosyncratic risk. For example, Cremers and Pareek (2011) argue that short-term institutional investors prefer investments with higher idiosyncratic risk. Taking into account that short-term institutions are potentially more informed, they may attempt to take advantage of the mispriced stocks. At the same time, since long-term institutions have a longer investment horizon, they are more likely to avoid high IV stocks.

To test this hypothesis we independently sort stocks into quintiles based on lagged ln(IV) and size (5x5 sorts) and report the corresponding institutional ownership measures (Total IO, LIO, and SIO) for the subsequent quarter. The results of this analysis are presented in Table 3.

[Insert Table 3 here]

Panel A of Table 3 shows that institutions are more attracted to large stocks with low IV. However, their preferences are not linear across all size groups. For example, among large stocks

institutional ownership is 9% larger for low IV stocks than high IV stocks. This effect is diminishing as we move towards smaller stocks. To test whether short and long-term institutional ownerships have different preferences, we repeat the analysis separately for each type in Panels B and C, respectively. Short-term institutional ownership is consistently higher in stocks with higher idiosyncratic risk (panel B of Table 3); while long-term institutional ownership is lower in stocks with lower idiosyncratic risk (panel C of Table 3), with the exception of smallest stocks where the estimate is statistically insignificant. This suggests that short-term institutions seem to be attracted to stocks with higher IV, while long-term institutions seem to prefer stocks with lower IV.

The fact that long and short-term institutions have different preferences emphasizes that we cannot treat total institutional ownership as a homogenous group when studying the connection with idiosyncratic volatility. Thus far, the evidence supports the idea that there is a feedback effect, where idiosyncratic volatility attracts different types of institutional ownership, and in turn, these different types of ownership generate different trading patterns, which differently affect future idiosyncratic volatility. We continue our investigation in the next section by introducing multivariate tests.

Fama MacBeth Regressions

To examine the determinants of idiosyncratic volatility we present quarterly Fama MacBeth regressions, where the dependent variable is the ln(IV) at quarter t, and the explanatory variables are ownership measures (total institutional ownership, as well as long-term and short-term institutional ownership separately), as well as control variables at the beginning of the

quarter (time t-1). We present the average coefficients and Newey-West corrected *t*-stats for several models of interest in Table 4.

[Insert Table 4 here]

We consider lagged size, illiquidity, and past returns as controls for current idiosyncratic risk. Additionally, the lagged level of idiosyncratic risk is included to control for possible time trends in this variable and for capturing the preference effect. Given that the average trend in idiosyncratic risk is declining after 2001 (and this fact has been used in the literature as the main argument against a causality relation between total institutional ownership and idiosyncratic volatility), we report our results for the overall sample (Panel A of Table 4), and for the before and after 2001 periods (panels B and C of Table 4, respectively).

We start by examining the relation between IV and overall institutional ownership. Model 1 shows that lagged institutional ownership has a weak positive relationship with current IV (the coefficient is 0.047 and it is significant at 10% level). If our hypothesis is correct and different types of institutional ownership have different effects on idiosyncratic volatility, we expect to observe much stronger results once we decompose the total institutional ownership into long-term and short-term ownership, because long/short-term ownership affects idiosyncratic volatility in opposite directions. The coefficient of total ownership is not representative, because it only captures the net effect of whichever type dominates. Models 2 and 3 support this argument – the coefficient on SIO is positive and both economically and statistically significant (0.419, significant at 1 percent level), while the coefficient on LIO is negative and statistically significant (-0.292, significant at 1 percent level). When we control for both SIO and LIO (Model 4) the results persist with effects of similar magnitude (0.422 and -0.301, respectively), making the point that short-term institutional ownership leads to increases in idiosyncratic

volatility, while long-term institutional ownership leads to decreases in idiosyncratic volatilities. These opposite effects confound the interpretation of the coefficient on total institutional ownership and support our original idea that within the cross-section not all institutional owners are the same in terms of their effect on the idiosyncratic volatility of their holdings.

Further, we also proposed that the confounding effect of long-term and short-term ownership is potentially responsible for the apparent change in the relation between IV and total IO after 2001, when the average idiosyncratic volatility starts decreasing, but the average total institutional ownership continues to grow (see Figure 1). Splitting our sample into two periods (before and after 2001) should help to shed light on this relation. If our hypothesis is correct, we should observe that although the relation with total IO becomes considerably weaker after 2001, the relation with LIO and SIO remain relatively unchanged (i.e. the change in their relative contribution to total institutional ownership creates a change in the net effect captured by the coefficient on IO). The results in Panels B and C of Table 4 support this hypothesis. Before 2001 (Panel B), when the effect of SIO mostly dominates, we can see a strong and significant coefficient on lagged institutional ownership (Model 1). Models 2, 3, and 4 confirm that the negative effect of LIO is much smaller in magnitude than the positive effect of SIO. After 2001, aggregate numbers show that the relative contribution of LIO to total ownership has overcome SIO's contribution. Interestingly, this coincides with the point at which the aggregate level of IV starts decreasing, which would provide support to the idea that institutional ownership composition is at least partly responsible for the trend in idiosyncratic volatility. The cross-sectional results after 2001 are presented in Panel C of Table 4. As expected, the connection between total IO and IV during this period is virtually non-existent (coefficient on IO in model 1 is 0.018 and it is not statistically significant). Models 2, 3 and 4 show that this is mainly because

the opposite effects of LIO and SIO cancel each other out (LIO has become relatively more important, hence it now almost perfectly counteracts the positive effect of SIO). This helps us strengthen the point that looking at total institutional ownership can be misleading, as it would point us to believe that there is no relation between institutional ownership and idiosyncratic volatility.

In an attempt to isolate the informational advantage of institutions, we also run several Fama MacBeth models where we control for the change in our various measures of institutional ownership. We report our results in Table 5.

[Insert Table 5 here]

Gompers and Metric (2001) suggest decomposing the total institutional ownership into lagged institutional ownership and changes in institutional ownership and interpret the changes in institutional ownership as informational advantage trades and lagged institutional ownership as demand shocks (i.e., non-information motivated trades). Consistent with this interpretation, the changes in (total, short-term, and long-term) ownership in our tests are consistently negatively related to idiosyncratic volatility, suggesting that information based trades decrease future idiosyncratic risk. However, lagged levels of long and short-term ownership continue to exert opposite effects (statistically significant at the 1 percent level). To the extent that changes in ownership do capture information based trades, we interpret these results as supportive of the proposition that short-term (long-term) ownership levels signal trading activity (or lack thereof), which in turn generates increases (decreases) in idiosyncratic volatility. These results persist even after accounting for information based trading from institutional investors.

Preferences or Determinants of Idiosyncratic Volatility?

As we discussed above, institutional preferences also influence the observed relationship between ownership and idiosyncratic volatility. While it is generally documented that institutions prefer larger stocks with lower IV (Lakonishok and Shleifer (1992)), different type of institutions may have different preferences, which means that the same confounding effect exists when studies of institutional preferences look at all institutions as a whole. For example, Yan and Zhang (2009) show that in general, short-term institutions prefer firms that are younger and in general are much less concerned about prudence than long-term institutions. Additionally, they also show that long-term institutions prefer S&P500 firms, while short-term institutions are indifferent. Following the argument that short-term institutions are potentially better informed we would expect that they are more likely to prefer stocks with higher IV, which would reflect higher arbitrage opportunities. On the other hand, long-term institutional investors are more likely attracted to larger stocks with lower idiosyncratic volatility. Table 6 investigates whether this is indeed the case.

[Insert Table 6 here]

Each of the models in Table 6 looks at the preferences of a particular category of institutions, more specifically at how certain stock characteristics affect future institutional ownership. Model 1 examines the determinants of overall institutional ownership. Although it is evident from the model that institutions prefer larger, more liquid stocks, the coefficient of lagged idiosyncratic volatility seems to indicate that they have no particular preference in terms of idiosyncratic volatility. However, when we investigate long-term and short-term institutions separately, we observe the expected effect: short-term institutions prefer stocks with larger idiosyncratic risk (coefficient on lag IV is .012 and largely statistically significant), while long-

term institutions prefer stocks with lower IV (coefficient on lag IV is -0.011 and largely statistically significant).

One potential concern that we have at this point is whether our results from Table 4 indeed capture the effect of ownership on idiosyncratic volatility or whether our results are just an artifact of institutional preferences (i.e., endogeneity issue). Given the high degree of autocorrelation of our variables of interest, it is theoretically possible that our results capture this preference hypothesis (although using lags for our independent variables and the lag of IV as a control guards for this possibility to some extent). To make sure that this is not the case, we continue our investigation by simultaneously estimating our models using a three stage least squares methodology.

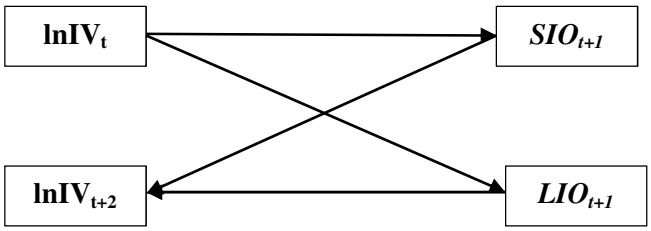
Three-stage Least Squares

Thus far, we tested the preferences and trading hypotheses separately and found support for both of these theories. One may argue that they are two sides of the same coin and that after controlling for preferences, institutional ownership no longer affects future idiosyncratic risk. If institutional ownership and idiosyncratic volatility are jointly determined, the single-equation approach used so far to analyze this relation can be problematic. We need a method that allows us to treat institutional ownership and idiosyncratic volatility as endogenous variables that can be determined by a set of exogenous variables (and allow for the possibility that there can be variables that affect institutional ownership but do not affect idiosyncratic volatility and vice versa).

To control for this intertwined relation between IV and IO we repeat our analysis using a three-stage least squares (3SLS) methodology. This procedure is designed to estimate a system of structural equations, where some equations have endogenous variables as explanatory

variables. Since some of the independent variables are the dependent variables of the other equations in the system, the residuals of the equations will be correlated by construction, which clearly violates OLS assumptions. Thus, the estimation of this system requires using instrumental variables to produce consistent estimates, which adjusts for the correlation structure of the disturbances in the system. Typically, the exogenous variables are treated as instruments for endogenous variables. Similar approaches were applied in Chen and Steiner (2000) and Ackert and Athanassakos (2003).

For our purposes, we treat lnIV, SIO and LIO as endogenous variables, with relations that can be described using the following structural model:



To capture these relations, we consider three-stage least square as a methodology for estimating the following system of simultaneous equations:

$$\begin{cases} LnIV_t = \beta_0 + \beta_1 SIO_{t-1} + \beta_2 LIO_{t-1} + \beta_3 Controls + \varepsilon_1 & (8) \\ SIO_t = \beta_4 + \beta_5 LnIV_{t-1} + \beta_6 Controls + \varepsilon_2 & (9) \\ LIO_t = \beta_7 + \beta_8 LnIV_{t-1} + \beta_9 Controls + \varepsilon_3 & (10) \end{cases}$$

Our econometric model links idiosyncratic volatility at time t ($lnIV_t$) with the lagged short (SIO_{t-1}) and long-term institutional ownership (LIO_{t-1}), to capture the effect we describe in what we call the trading hypothesis (Eq. 8). Simultaneously, contemporaneous short-term ownership (SIO_t) and long-term ownership (LIO_t) are related to lag idiosyncratic volatility ($lnIV_{t-}$

$_1$) – equations 9 and 10, respectively – to capture the preference effect. We estimate this system of equations for every cross-section in our sample from the second quarter of 1983 to the last quarter of 2010. The results of this analysis are presented in Table 7.

[Insert Table 7 here]

We report the time-series averages of cross-sectional coefficients together with the Fama-MachBeth *t*-statistics, as well as the number of positive (negative) and statistically significant (at the 10 percent level or better) cross-sectional coefficients. The results from this analysis are consistent with our previous findings. First, we document that current levels of IV are affected differently by lagged institutional ownership. Specifically, stocks with relatively higher short-term (long-term) institutional ownership tend to have higher (lower) IV in the future. The β_1 coefficient is positive (2.197 with a *t*-statistics of 16.63) and significant for the vast majority of cross-sections (112 out of 121), while the β_2 coefficient is negative and significant (-1.973 with a *t*-statistics of -17.69) for the vast majority of cross-sections (113 out of 121). This results confirm that, even after accounting for their difference in preferences, short and long-term institutional ownership have in fact opposite effects on the future levels of IV.

At the same time, we also document that current level of IV affect future ownership (preferences do exist). In particular, we find that stocks with relatively higher IV today should have relatively higher short-term institutional ownership next period. For example, the β_4 coefficient is positive and significant (0.019 with a *t*-statistics of 15.63). In other words, short-term institutions prefer stocks with high idiosyncratic risk. On the other hand, long-term institutions tend to prefer stocks with lower level of idiosyncratic risk. The β_8 coefficient is negative and significant (-0.013 with a *t*-statistics of 20.06). Note that this system of equations controls for these effects simultaneously.

Overall, the evidence points to the conclusion that there is a feedback effect and that, even after controlling for preferences using the 3SLS methodology, idiosyncratic risk is differently affected by long and short-term institutions. We confirm that while short-term institutions increase idiosyncratic volatility, long-term institutions tend to have the opposite effect. Given that long-term institutions start dominating short-term institutions in 2001 (see Fig 1), this result helps to explain the decline in aggregate idiosyncratic risk starting around that point.

V. Conclusion

Previous literature on the relation between institutional demand and idiosyncratic volatility primarily concentrate on institutional investors as a group. We argue that not all institutional ownership is the same in terms of its effect on idiosyncratic risk, and focusing on total institutional ownership can produce misleading results. We propose that the relation between institutional ownership and idiosyncratic volatility is conditional on institutions' investment horizon.

Supporting this proposition, we show that short-term (long-term) institutional ownership is positively (negatively) linked to idiosyncratic volatility in the cross-section. We document that the positive relation between total institutional ownership and idiosyncratic volatility documented in previous literature is mainly driven by the short-term institutional ownership when this component mostly dominates (the pre-2001 period). In contrast, when long-term ownership dominates (the post-2001 period), the relation with total institutional ownership disappears, while the relation with long- and short-term ownership remains qualitatively unchanged. Furthermore, there is a bi-directional relation between type of institutional ownership

and idiosyncratic risk: on one hand, institutions with short (long) investment horizons have different preferences regarding idiosyncratic risk, and on the other hand, they have different effects on the idiosyncratic risk of their holdings.

Our results are consistent with the notion that institutional ownership per se only affects volatility to the extent that it proxies for institutional trading. Given that ownership by institutions with short investment horizons is likely to indicate high trading activity and ownership by long-term institutions is likely to indicate low trading activity, these opposite effects would cancel out when looking at total institutional ownership. Mixed results provided in previous literature can be accounted by the fact that total institutional ownership captures only the net dominating effect. The results support our rationale that categorizing total ownership into long-term and short-term ownership provides a better proxy for institutions' trading patterns and, thus, it explains the pattern of idiosyncratic volatility better.

The conclusions in this paper have implications for many asset pricing and corporate finance issues. First, our results suggest that the impact of institutional presence on stock markets is heterogeneous among institutions with different investment horizons. A simple measure like institutional ownership can capture this heterogeneity, as long as the investment horizon of the respective institutions is taken into account. Second, accounting for heterogeneity among institutional investors reconciles seemingly contradictory evidence regarding the relation between total institutional ownership and idiosyncratic volatility. Additionally, the empirical facts documented here could potentially help to resolve the contradictory results from the literature on idiosyncratic risk and expected returns. Third, these results should be useful for corporate managers who attempt to manage the volatility of their stock price by managing their firm ownership structure. Finally, our results are helpful for investors who are not fully

diversified and who seek to reduce their investment risk by avoiding stocks that have high volatility in their fundamentals. For these investors, an additional concern should be the composition of the ownership structure, which can further increase or decrease the idiosyncratic risk of their investments.

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Figure 1
Average Time Series of Idiosyncratic Risk and Institutional Ownership Measures

This figure presents the time trends of our main variables of interest during our sample period (1983:Q2 to 2010:Q4). Figure 1a plots the evolution of equal weighted average of the idiosyncratic volatilities estimated following Ang, Hodrick, Xing, and Zhang (2006). Figure 1b plots the evolution of the equal weighted average total institutional ownership (IO is calculated as the number of shares held by institutional investors divided by the total number of shares outstanding for each stock). Figure 1c presents the evolution of the average short-term and long-term institutional ownership (SIO and LIO, respectively), calculated following Yan and Zhang (2007). Figure 1d presents the evolution of the relative contributions of SIO and LIO to total IO (calculated as SIO/IO and LIO/IO, respectively).

Fig 1a. Average Idiosyncratic Volatility over Time

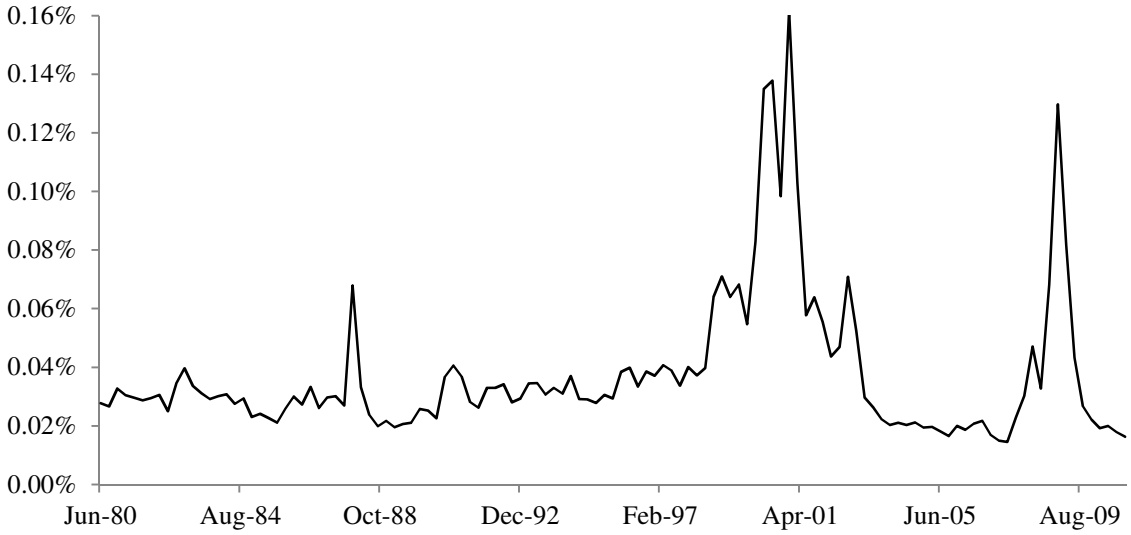

Fig 1b. Average Institutional Ownership over Time

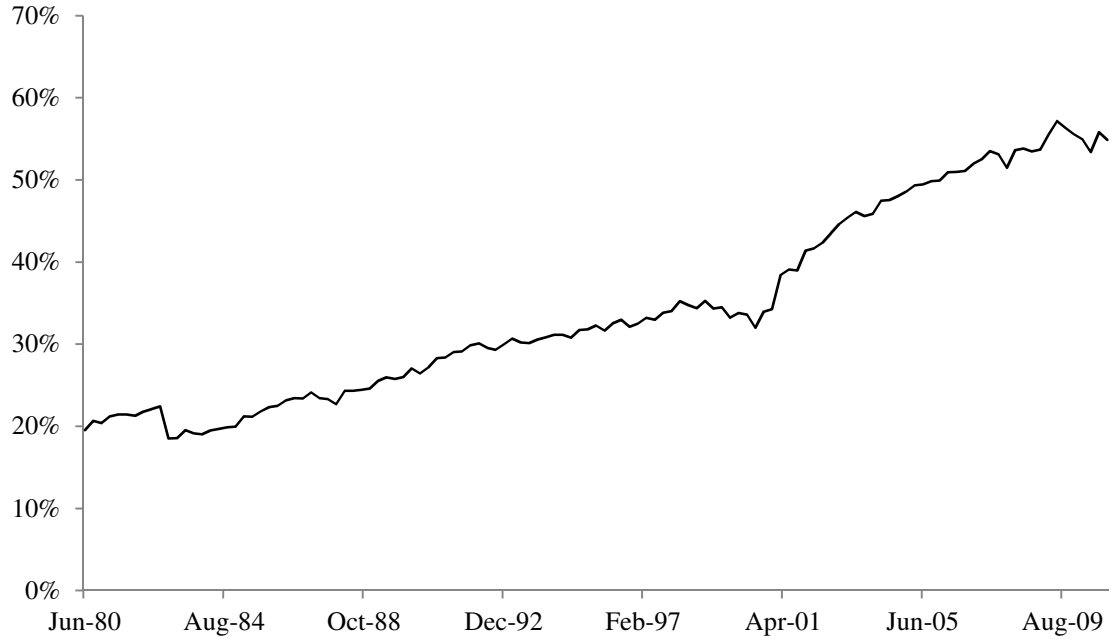

Figure 1
Average Time Series of Idiosyncratic Risk and Institutional Ownership Measures (continued)

Fig 1c. Average Long-term and Short-term Institutional Ownership

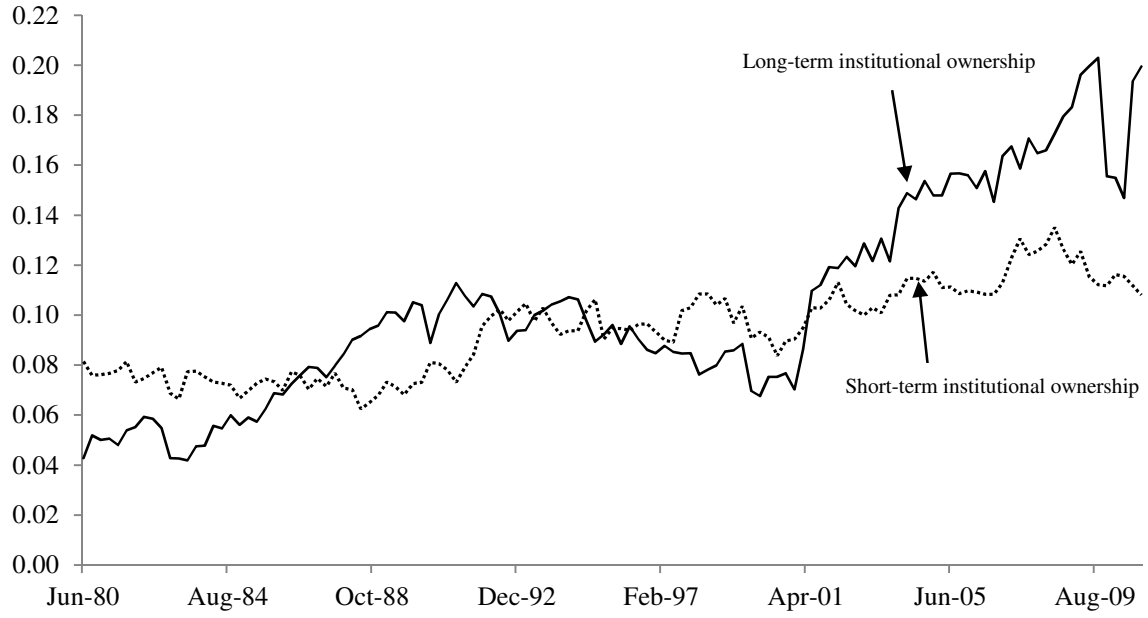

Fig 1d. Average contribution of Long and Short-term Institutional Ownership to Total Ownership

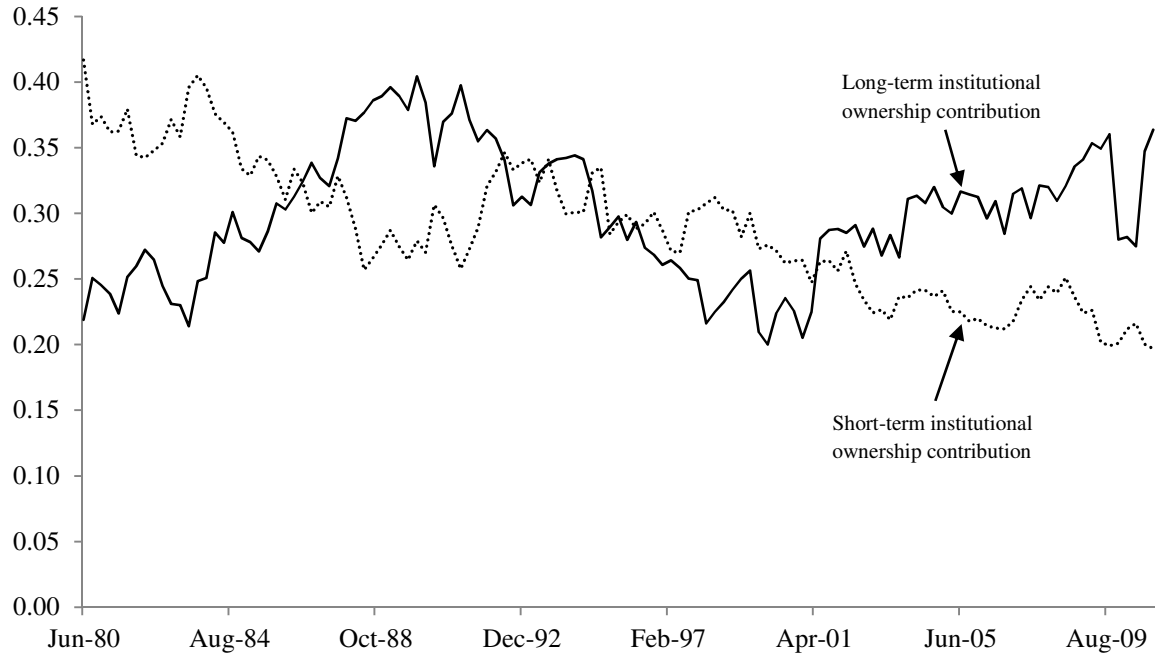

Table 1
Descriptive Statistics

Descriptive statistics are reported for the sample period 1983:Q2 to 2010:Q4. Institutional holdings are obtained from Thomson Financial (13F Filings). Stock characteristics are from the CRSP and COMPUSTAT databases. IO is total institutional ownership, calculated as the number of shares held by institutional investors divided by the total number of shares outstanding for each stock. SIO is short-term institutional ownership. LIO is long-term institutional ownership. Following Yan and Zhang (2007), an institutional investor is classified as a short-term investor if its past 4-quarter turnover rate ranks in the top tercile. An institutional investor is classified as a long-term investor if its past 4-quarter turnover rate ranks in the bottom tercile. MKTCAP is market capitalization. ILLIQ is the quarterly illiquidity estimated using the Amihud (2002) measure. Idiosyncratic volatilities (IV) are estimated following Ang, Hodrick, Xing, and Zhang (2006). Specifically, for each stock-month, daily returns are regressed on Fama-French three factors. Residuals from the regressions are squared and averaged over the month to measure idiosyncratic volatility. Panel A represents the time-series averages of the cross-sectional means, medians, 25th and 75th percentiles, and standard deviations of the respective variables. Panel B presents the time-series averages of the cross-sectional correlations between institutional ownership measures and stock characteristics.

Panel A: Time-series statistics of cross-sectional averages

Variable	Mean	Median	P25	P75	StdDev
Total Institutional Ownership – IO (%)	34.37	31.97	13.59	53.16	23.78
Short-term Inst. Ownership – SIO (%)	9.36	6.44	1.49	14.18	9.80
Long-term Inst. Ownership – LIO(%)	10.34	8.39	3.36	14.89	9.30
Idiosyncratic Volatility – IV (%)	7.40	4.13	1.89	8.68	14.36
Size – MktCap ($ millions)	1,698	175	54	711	8,029
Illiquidity - Illiq (Amihud*10,000)	0.02	0.00	0.00	0.01	0.07
Returns – RET (%)	3.55	1.79	-9.89	14.09	24.45

Panel B: Time-series means of cross-sectional correlations between institutional ownership and stock characteristics

Variable	IV	Size	Illiq	Ret
Total Institutional Ownership – IO	-0.2409	0.1819	-0.2606	0.0434
Short-term Inst. Ownership – SIO	-0.1270	0.0447	-0.1975	0.0749
Long-term Inst. Ownership – LIO	-0.2023	0.2202	-0.1819	0.0112

Table 2
Independent Double Sorts
Average Contemporaneous IV Sorted by Lagged Ownership and Lagged Size

Each quarter, we perform independent sorts of the cross-section of stocks into 5x5 groups based on the stocks' size and their respective institutional ownership measure (at the beginning of the period). We report average ln(IV) during the quarter for each of the 25 resulting categories, as well as differences between the highest and lowest quintiles. Panel A reports average lnIV for portfolios sorted by total institutional ownership (Total IO) and size (market value of equity). Panel B reports average lnIV for portfolios sorted by short-term institutional ownership (SIO) and size. Panel C reports average lnIV for portfolios sorted by long-term institutional ownership (LIO) and size. Numbers in parenthesis are t-statistics. Averages followed by *, **, and *** are significantly different than 0 at 10%, 5% and 1% level, respectively.

Panel A: Average $\ln IV_t$ by Total IO_{t-1} and $Size_{t-1}$

	$Size_{t-1}$					
IO_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	-6.73***	-7.02***	-7.21***	-7.48***	-7.94***	-1.21***
	(-148.65)	(-160.45)	(-148.55)	(-143.15)	(-123.50)	(-22.95)
2	-6.82***	-7.06***	-7.24***	-7.65***	-8.19***	-1.37***
	(-153.72)	(-170.84)	(-169.82)	(-155.84)	(-138.08)	(-26.75)
3	-6.82***	-7.06***	-7.27***	-7.69***	-8.42***	-1.60***
	(-148.32)	(-182.33)	(-187.21)	(-174.50)	(-161.84)	(-33.62)
4	-6.76***	-7.07***	-7.35***	-7.69***	-8.27***	-1.51***
	(-131.53)	(-184.46)	(-195.22)	(-188.69)	(-192.03)	(-32.41)
5 (High)	-6.81***	-7.10***	-7.40***	-7.69***	-8.13***	-1.32***
	(-91.99)	(-146.71)	(-191.72)	(-192.66)	(-191.34)	(-20.44)
High - Low	-0.08	-0.08**	-0.18***	-0.21***	-0.20***	
	(-1.47)	(-2.24)	(-5.97)	(-7.40)	(-4.93)	

Panel B: Average $\ln IV_t$ by SIO_{t-1} and $Size_{t-1}$

	$Size_{t-1}$					
SIO_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	-6.80***	-7.17***	-7.48***	-7.88***	-8.37***	-1.58***
	(-141.36)	(-156.25)	(-155.44)	(-156.50)	(-129.66)	(-27.64)
2	-6.70***	-7.04***	-7.37***	-7.90***	-8.50***	-1.80***
	(-165.67)	(-163.39)	(-168.62)	(-169.96)	(-175.80)	(-41.18)
3	-6.75***	-7.01***	-7.27***	-7.79***	-8.43***	-1.67***
	(-156.73)	(-177.29)	(-188.03)	(-183.23)	(-191.20)	(-40.26)
4	-6.71***	-6.95***	-7.21***	-7.65***	-8.23***	-1.52***
	(-148.96)	(-180.72)	(-186.78)	(-185.86)	(-192.88)	(-40.70)
5 (High)	-6.79***	-6.99***	-7.19***	-7.49***	-7.91***	-1.12***
	(-123.45)	(-170.14)	(-180.31)	(-179.13)	(-171.98)	(-25.99)
High - Low	0.01	0.18***	0.29***	0.40***	0.49***	
	(0.42)	(5.80)	(8.90)	(12.95)	(8.61)	

Table 2
Independent Double Sorts
Average Contemporaneous IV Sorted by Lagged Ownership and Lagged Size (continued)

Panel C: Average $\ln IV_t$ by LIO_{t-1} and $Size_{t-1}$						
	$Size_{t-1}$					
LIO_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	-6.80***	-7.05***	-7.09***	-7.25***	-7.62***	-0.87***
	(-146.83)	(-168.61)	(-146.88)	(-125.28)	(-107.76)	(-14.54)
2	-6.68***	-6.97***	-7.12***	-7.38***	-7.80***	-1.12***
	(-160.84)	(-168.65)	(-170.53)	(-143.89)	(-131.80)	(-23.42)
3	-6.75***	-7.04***	-7.25***	-7.57***	-7.99***	-1.24***
	(-145.42)	(-170.83)	(-183.79)	(-170.27)	(-153.17)	(-26.76)
4	-6.80***	-7.16***	-7.45***	-7.77***	-8.16***	-1.37***
	(-143.26)	(-179.78)	(-199.74)	(-188.37)	(-175.59)	(-30.20)
5 (High)	-6.83***	-7.18***	-7.55***	-7.93***	-8.39***	-1.56***
	(-122.78)	(-159.28)	(-191.04)	(-208.30)	(-204.49)	(-36.37)
High - Low	-0.03	-0.14***	-0.46***	-0.68***	-0.77***	
	(-1.01)	(-4.33)	(-13.94)	(-18.21)	(-17.40)	

Table 3
Independent Double Sorts
Average Contemporaneous Ownership Measures Sorted by Lagged IV and Lagged Size

Each quarter, we perform independent sorts of the cross-section of stocks into 5x5 groups based on the stocks' size and their idiosyncratic volatility (at the beginning of the period). We report average ownership measures during the quarter for each of the 25 resulting categories, as well as differences between the highest and lowest quintiles. Panel A reports average total institutional ownership; Panel B reports average short-term institutional ownership; Panel C reports average long-term institutional ownership. Numbers in parenthesis are t-statistics. Averages followed by *, **, and *** are significantly different than 0 at 10%, 5% and 1% level, respectively.

Panel A: Average Total IO_t by IV_{t-1} and $Size_{t-1}$

	$Size_{t-1}$					
IV_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	0.13***	0.21***	0.33***	0.45***	0.54***	0.41***
	(27.64)	(25.36)	(28.78)	(32.75)	(53.92)	(63.98)
2	0.13***	0.23***	0.38***	0.50***	0.59***	0.46***
	(28.09)	(27.64)	(29.50)	(34.53)	(50.27)	(57.42)
3	0.14***	0.25***	0.39***	0.49***	0.57***	0.44***
	(28.80)	(24.82)	(26.77)	(32.70)	(44.26)	(49.00)
4	0.13***	0.25***	0.36***	0.45***	0.53***	0.40***
	(27.08)	(22.50)	(23.71)	(29.52)	(38.76)	(42.63)
5 (High)	0.12***	0.21***	0.30***	0.38***	0.44***	0.33***
	(27.18)	(20.42)	(20.72)	(24.50)	(26.69)	(25.01)
High - Low	-0.01***	0.00	-0.04***	-0.06***	-0.09***	
	(-4.00)	(0.32)	(-4.89)	(-11.52)	(-10.98)	

Panel B: Average SIO_t by IV_{t-1} and $Size_{t-1}$

	$Size_{t-1}$					
IV_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	0.03***	0.05***	0.07***	0.10***	0.11***	0.08***
	(18.24)	(15.73)	(23.28)	(46.18)	(88.64)	(41.49)
2	0.03***	0.06***	0.09***	0.13***	0.15***	0.13***
	(23.28)	(33.43)	(49.05)	(62.39)	(70.09)	(50.67)
3	0.03***	0.07***	0.11***	0.16***	0.18***	0.15***
	(26.51)	(31.08)	(44.87)	(61.69)	(51.68)	(38.73)
4	0.03***	0.07***	0.12***	0.16***	0.18***	0.15***
	(29.11)	(26.73)	(33.73)	(51.12)	(47.57)	(37.64)
5 (High)	0.03***	0.06***	0.10***	0.14***	0.14***	0.12***
	(24.48)	(20.90)	(24.52)	(33.51)	(34.50)	(30.28)
High - Low	0.00**	0.02***	0.03***	0.04***	0.04***	
	(2.61)	(5.80)	(7.64)	(11.28)	(8.40)	

Table 3
Independent Double Sorts
Average Contemporaneous Ownership Measures Sorted by Lagged IV and Lagged Size
(continued)

	Panel C: Average LIO_t by IV_{t-1} and $Size_{t-1}$					
	$Size_{t-1}$					
IV_{t-1}	1(Small)	2	3	4	5(Large)	Large - Small
1 (Low)	0.04***	0.07***	0.12***	0.15***	0.20***	0.16***
	(22.17)	(24.60)	(25.96)	(30.27)	(45.27)	(42.75)
2	0.04***	0.08***	0.12***	0.15***	0.18***	0.14***
	(25.49)	(23.13)	(23.28)	(29.34)	(40.88)	(37.69)
3	0.04***	0.08***	0.11***	0.13***	0.15***	0.11***
	(25.81)	(21.52)	(21.62)	(25.89)	(32.43)	(28.98)
4	0.04***	0.07***	0.10***	0.11***	0.13***	0.09***
	(24.65)	(19.81)	(20.20)	(22.73)	(27.10)	(23.95)
5 (High)	0.04***	0.06***	0.08***	0.09***	0.11***	0.08***
	(24.70)	(18.93)	(18.85)	(21.50)	(20.92)	(16.73)
High - Low	0.00	-0.01***	-0.04***	-0.06***	-0.08***	
	(0.08)	(-3.91)	(-19.90)	(-26.44)	(-27.29)	

Table 4
Fama MacBeth Regressions
Determinants of Idiosyncratic Volatility – Lagged Levels

This table presents the time-series averages of the slopes of quarterly cross-sectional regressions obtained using Fama and MacBeth (1973) methodology. Numbers in parentheses are Newey-West corrected t-statistics (using 3 lags). The sample period is from 1983:Q2 to 2010:Q4. The dependent variable is natural logarithm of idiosyncratic volatility - $Ln(IV)_t$ – calculated as described in Table 1; *IO* is total institutional ownership; *SIO* and *LIO* are short-term institutional ownership and long-term institutional ownership, respectively (calculated as in Yan and Zhang 2007); *ln(Size)* is the natural logarithm of market capitalization; $Illiq_{t-1}$ is the Amihud (2002) illiquidity measure at the beginning of the quarter. Ret_{t-1} are the returns for the previous quarter. Variable definitions follow those presented in Table 1. Coefficients followed by *, **, and *** are significant at 10%, 5% and 1% level, respectively. Panel A presents the results for the entire sample period (1983:Q2 to 2010:Q4). Panels B and C present the results before and after year 2001, when the trend of average idiosyncratic volatility in the market starts decreasing.

Panel A: Entire Sample Period (1983:Q2 to 2010:Q4)

	MODEL1	*MODEL2*	*MODEL3*	*MODEL4*
	$\ln IV_t$	$\ln IV_t$	$\ln IV_t$	$\ln IV_t$
Intercept	0.106	0.135	0.013	0.072
	(1.24)	(1.49)	(0.14)	(0.78)
IO_{t-1}	0.047*			
	(1.98)			
SIO_{t-1}		0.419***		0.422***
		(7.40)		(7.13)
LIO_{t-1}			-0.292***	-0.301***
			(-4.89)	(-5.14)
$LnIV_{t-1}$	0.717***	0.710***	0.713***	0.706***
	(36.94)	(36.94)	(38.76)	(38.26)
$lnSize_{t-1}$	-0.089***	-0.095***	-0.078***	-0.088***
	(-10.95)	(-13.30)	(-8.59)	(-11.21)
Ret_{t-1}	-0.439***	-0.448***	-0.445***	-0.452***
	(-5.63)	(-5.88)	(-5.77)	(-5.90)
$Illiq_{t-1}$	0.228**	0.289***	0.212*	0.307***
	(2.24)	(2.84)	(1.83)	(2.86)
Adj-R^2	*65.7%*	*65.8%*	*65.7%*	*65.9%*

Table 4
Fama MacBeth Regressions
Determinants of Idiosyncratic Volatility – Lagged Levels (continued)

Panel B: Early period (1983:Q2 to 2001:Q4)

	MODEL1	*MODEL2*	*MODEL3*	*MODEL4*
	$lnIV_t$	$lnIV_t$	$lnIV_t$	$lnIV_t$
Intercept	0.148	0.089	0.046	0.059
	(1.50)	(0.81)	(0.35)	(0.47)
IO_{t-1}	0.116***			
	(3.66)			
SIO_{t-1}		0.375**		0.380**
		(2.47)		(2.43)
LIO_{t-1}			-0.089**	-0.114**
			(-2.36)	(-2.31)
$LnIV_{t-1}$	0.666***	0.658***	0.667***	0.656***
	(35.20)	(36.83)	(33.08)	(36.73)
$lnSize_{t-1}$	-0.109***	-0.105***	-0.095***	-0.102***
	(-12.04)	(-11.14)	(-7.16)	(-9.33)
Ret_{t-1}	-0.219***	-0.232***	-0.227***	-0.234***
	(-10.98)	(-11.79)	(-11.57)	(-12.27)
$Illiq_{t-1}$	0.180***	0.280***	0.060	0.269***
	(3.71)	(4.88)	(1.10)	(4.53)
Adj-R^2	*60.4%*	*60.5%*	*60.3%*	*60.6%*

Table 4
Fama MacBeth Regressions
Determinants of Idiosyncratic Volatility – Lagged Levels (continued)

Panel C: Late period (2002:Q1 to 2010:Q4)

	MODEL1 $\ln IV_t$	*MODEL2* $\ln IV_t$	*MODEL3* $\ln IV_t$	*MODEL4* $\ln IV_t$
Intercept	0.088	0.155	-0.001	0.077
	(0.80)	(1.38)	(-0.01)	(0.68)
IO_{t-1}	0.018			
	(1.42)			
SIO_{t-1}		0.438***		0.440***
		(11.17)		(10.59)
LIO_{t-1}			-0.377***	-0.379***
			(-9.61)	(-8.60)
$LnIV_{t-1}$	0.738***	0.732***	0.733***	0.727***
	(40.69)	(42.92)	(42.40)	(44.59)
$lnSize_{t-1}$	-0.081***	-0.090***	-0.071***	-0.083***
	(-9.69)	(-11.11)	(-7.47)	(-9.62)
Ret_{t-1}	-0.531***	-0.538***	-0.537***	-0.544***
	(-7.85)	(-8.16)	(-8.04)	(-8.29)
$Illiq_{t-1}$	0.248*	0.292**	0.275*	0.322**
	(1.76)	(2.05)	(1.84)	(2.16)
Adj-R^2	*67.9%*	*68.0%*	*67.9%*	*68.1%*

Table 5
Fama MacBeth Regressions
Determinants of Idiosyncratic Volatility – Lagged Levels and Changes

This table presents the time-series averages of the slopes of quarterly cross-sectional regressions obtained using Fama and MacBeth (1973) methodology. Numbers in parentheses are Newey-West corrected t-statistics (using 3 lags). The sample period is from 1983:Q2 to 2010:Q4. The dependent variable is natural logarithm of idiosyncratic volatility at the end of quarter t - $Ln(IV)_t$; $\Delta SIOt$ is the change in short-term institutional ownership during quarter t (SIO_t-SIO_{t-1}), where SIO_{t-1} is the lagged short-term institutional ownership. ΔLIO_t is the change in long-term institutional ownership during quarter t (LIO_t-LIO_{t-1}), where LIO_{t-1} is the lagged long-term institutional ownership; *ln(Size)* is the natural logarithm of market capitalization. $Illiq_{t-1}$ is the Amihud (2002) illiquidity measure at the beginning of the quarter. Long and short-term institutional ownership is calculated following Yan and Zhang (2007) (see detailed variable definitions in Table 1). Coefficients followed by *, **, and *** are significant at 10%, 5% and 1% level, respectively.

	MODEL1 $lnIV_t$	*MODEL2* $lnIV_t$	*MODEL3* $lnIV_t$
Intercept	0.089*	0.128**	0.009
	(1.86)	(2.54)	(0.17)
IO_{t-1}	0.021		
	(1.24)		
ΔIO_t	-0.707***		
	(-7.03)		
SIO_{t-1}		0.386***	
		(8.58)	
ΔSIO_t		-0.480***	
		(-3.01)	
LIO_{t-1}			-0.316***
			(-8.40)
ΔLIO_t			-0.806***
			(-6.36)
$LnIV_{t-1}$	0.715***	0.709***	0.713***
	(72.66)	(71.96)	(75.77)
$lnSize_{t-1}$	-0.087***	-0.094***	-0.078***
	(-18.22)	(-21.21)	(-14.94)
Ret_{t-1}	-0.426***	-0.439***	-0.446***
	(-11.04)	(-11.62)	(-11.18)
$Illiq_{t-1}$	0.228***	0.299***	0.207***
	(3.33)	(4.23)	(2.86)
Adj-R^2	*65.8%*	*65.9%*	*65.7%*

Table 6
Fama MacBeth Regressions
Determinants of Institutional Ownership

This table presents the time-series averages of the slopes of quarterly cross-sectional regressions obtained using Fama and MacBeth (1973) methodology. Numbers in parentheses are Newey-West corrected t-statistics (using 3 lags). The sample period is from 1983:Q2 to 2010:Q4. The dependent variable for Models 1, 2 and 3 are total institutional ownership, short-term institutional ownership and long-term institutional ownership, respectively. $Ln(IV)_{t-1}$ is natural logarithm of idiosyncratic volatility at the beginning of the quarter; ln(Size) is the natural logarithm of market capitalization. $Illiq_{t-1}$ is the Amihud (2002) illiquidity measure at the beginning of the quarter. Long and short-term institutional ownership is calculated following Yan and Zhang (2007) (see detailed variable definitions in Table 1). Coefficients followed by *, **, and *** are significant at 10%, 5% and 1% level, respectively.

	MODEL1	*MODEL2*	*MODEL3*
	IO_t	SIO_t	LIO_t
Intercept	-0.632***	-0.129***	-0.226***
	(-43.69)	(-9.21)	(-20.98)
$LnIV_{t-1}$	-0.004	0.012***	-0.011***
	(-1.27)	(7.76)	(-14.06)
$lnSize_{t-1}$	0.080***	0.022***	0.024***
	(36.79)	(20.26)	(22.83)
Ret_{t-1}	-0.010**	0.027***	-0.018***
	(-1.98)	(9.19)	(-9.82)
$Illiq_{t-1}$	-0.253***	-0.201***	0.032
	(-2.71)	(-5.48)	(1.17)
Adj-R^2	*41.1%*	*18.6%*	*29.6%*

Table 7
3 Stage Least Square Regressions
Idiosyncratic Volatility and Institutional Ownership

This table presents the estimates a system of structural equations, where equations contain endogenous variables among the explanatory variables. To obtain consistent estimates we run a separate 3SLS model for each cross-section in our sample period (1983:Q2 to 2010:Q4). The first row presents the time-series averages of the 3SLS coefficients, while the second row presents the time-series t-statistics of these coefficients in parenthesis. On the third row we present the number of cross-sections with positive and significant coefficients (first number) relative to the number of cross-sections with negative and significant coefficients (second number), out of a total of 121 cross-sections.

	EQUATION1	*EQUATION2*	*EQUATION3*
	$LnIV_t$	SIO_t	LIO_t
Intercept	-4.319	-0.041	-0.275
	(-47.22)	(-4.07)	(-47.87)
	0 / 121	31 / 82	0 / 121
SIO_{t-1}	2.197		
	(16.63)		
	112 / 5		
LIO_{t-1}	-1.973		
	(-17.69)		
	5 / 113		
$Ln(MktCap)_{t-1}$	-0.265	0.023	0.023
	(-35.51)	(35.40)	(38.34)
	2 / 118	120 / 0	121 / 0
Ret_{t-1}	-0.415	0.026	-0.018
	(-6.22)	(9.50)	(-10.06)
	38 / 78	89 / 12	5 / 83
$Illiq_{t-1}$	3.073	-0.258	0.018
	(20.96)	(-8.76)	(0.94)
	119 / 0	0 / 111	58 / 29
ΔSIO_{t-1}	0.757	0.059	0.021
	(9.17)	(4.74)	(5.76)
	79 / 6	72 / 26	44 / 12
ΔLIO_{t-1}	1.033	0.025	0.317
	(9.43)	(2.30)	(13.30)
	65 / 4	42 / 26	105 / 6
$LnIV_{t-1}$		0.019	-0.013
		(15.64)	(-20.07)
		109 / 5	3 / 111