Adding Value Through Information Interpretation: News Tangibility and Mutual Funds' Trading

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Abstract

We study how ability of asset managers to process different types of information affects mutual fund performance. We characterize information environment of each stock by constructing a proxy of the degree to which the information about the company is quantitative ("tangible"). By using media news reports, we distinguish between quantitative news (expressed by numeric characters) and qualitative news (expressed by verbal content). We relate mutual funds' trading to changes in tangibility of the stocks held by the funds, conditioning on the overall amount of news as well as other sources of information, such as market prices and analyst reports. We show that funds adjust their positions in response to changes in the information environment as proxied by the tangibility measure. Funds that rely more heavily on such strategies earn higher alphas. Fund managers that are more sensitive to fluctuations in tangibility tend to manage fewer funds and work in smaller teams. This result is consistent with the view that focused fund managers are better able to take advantage of the innovations in information.

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Introduction

The use of information within complex organizations and markets is one of the most debated topics in finance (e.g. Marshak and Radner (1972), Millon and Thakor (1985), Petersen and Rajan (2002), Dessein and Santos (2006), Alonso, Dessein, and Matouschek (2008)).

In asset pricing, standard theories of information economics (Kyle (1985), Admati and Pfleiderer (1988)) model information as a signal about a company's future cash flows or a liquidating dividend. While convenient, such view is too restrictive, since it implies a clear divide between informed and uninformed agents. In reality, the nature of information is substantially more complex. The same information event can be interpreted differently by different market participants, depending on their prior information set, expertise, analytical ability, and even attention span. Consequently, differentiating between the *types* of information could improve our understanding of the role of information in financial markets.

In corporate finance, Stein (2002) distinguishes between “hard” and “soft” information, defining hard information as the objective and quantifiable information and soft information as the one that is based on direct personal interactions between the managers of the firm. It has traditionally been assumed that hard information can be better used inside complex organizational structures, such as banks, since it is easier to transmit to the top of the hierarchy. In contrast, soft information cannot be easily conveyed and is more valuable when used close to its point of origin. This classification of information links the success in using information to the complexity of the company's organizational structure. Flat structures are better suited to soft information; “...a decentralized approach – with small, single-manager firms – is most likely to be attractive when information about projects is “soft” and cannot be credibly transmitted. In contrast, large hierarchies perform better when information can be costlessly “hardened” and passed along inside the firm” (Stein (2002)).

However, more quantitative information is not only easy to codify and transfer but it may also imply a different type of consensus within a team. Indeed, research in decision sciences suggests that quantifying information and expectations leads to greater agreement and less ambiguity (e.g. Bass, Cascio, and O’Connor (1974), Beyth-Marom (1982), Budescu and Karerlitz (2004)). This produces two effects. On the one hand, more quantitative information makes it easier to reach an objective solution of the problem, accelerating the speed at which the decision is found. On the other hand, more quantitative information lowers the space left to potentially different priors of different participants, reducing the benefits of expert decision-making.

In this paper, we investigate the link between changes in the information environment of public companies and the ability of financial professionals to add value by trading in such informationally volatile stocks. We focus on the mutual fund industry and examine whether those funds that utilize changes in public information in their investment decisions earn superior returns. We hypothesize that some managers or managerial teams are better equipped to interpret public information signals and we explore this conjecture by relating fund managers' propensity to trade on changes in information to their individual characteristics.

Our study lays out a novel approach to understanding value-creation in the mutual fund industry. Most of the literature on delegated portfolio management agrees that funds do not earn abnormal returns, when these are adjusted for the factor exposure and fees (e.g. Carhart (1997)). But even where fund managers are expected to add value, the sources of this value remain vague. It is natural to attribute successful strategies of a fund manager to his superior information set. Indeed, informativeness of managers was shown to affect trading outcomes in specific cases (Cohen, Frazzini, and Malloy (2008)). However, it is unreasonable to restrict the entire investment acumen of finance professionals to access to private information. A fund holding a diversified portfolio of over 100 stocks inevitably relies on public information sources. The ability of a fund manager to make the best use of such sources can constitute a strategic advantage and form the basis for value-creation.

We proceed as follows. First, we construct a measure of the degree to which information about a company/stock is quantitative ("tangible") by analyzing news articles that feature in the media. We distinguish between tangible and intangible news by examining the prevalence of numeric characters in the media articles about the company. We define tangibility as the average (across all the news articles about the company in the period) of the ratio of the number of numerical symbols in the article to the total number of symbols in the article. We then relate mutual funds' changes in positions to the changes in tangibility of the underlying investments, conditioning on the total volume of media coverage as well as on alternative sources of information, such as market prices and analyst reports.

For our main analysis, we adopt a methodology similar to that employed by Kacperczyk and Seru (2007). The general idea is to measure the correlation (regression R^2) between the fund's change in holdings in a particular stock and the change in tangibility of this stock over the previous period (quarter). First, for each fund-quarter-stock we define a measure of a change in holdings to be used on the left hand-side of the regression. For robustness, we consider several versions of this variable: some based on the percentage change in the number of shares of the stock held, and others based on the change of the weight of the stock in the portfolio. Next, for each fund-quarter, we regress these quarterly changes in holdings on a set of control variables that capture other facets of public information, namely upgrades or downgrades in analyst recommendations, previous stock return, and changes in the number of news articles about the firm. We retain the residuals from this regression and then regress these residuals on the absolute value of the change in our tangibility measure over quarter *t-1*. Finally, we take the R^2 of the last regression to measure how closely the fund's investment strategy follows the changes in the information environment of the company. We refer to this measure as the "*Reliance on Tangibility of Information*", or *RTI*.[4]

Intuitively, *RTI* captures the fraction of variance in fund trades explainable by the fluctuations in tangibility of the constituent stocks. For example, a fund that does not adjust its positions in response to changes in its stocks' information environments will have a low *RTI*. The meaning of the "information environment" in this context is narrow but specific: it is characterized by the degree of ambiguity of the public news about the company in a given quarter. The first-stage regression plays an important part in our methodology since it allows us to control for several effects that can both influence fund managers' behavior and correlate with the media activity. For example, we include the change in the volume of articles about a company to ensure that the *RTI* measure is not entirely driven by the fact that funds managers tend to pay more attention to the stocks featured in the media. For the same reason, we include the change in analysts' recommendations to control for the propensity of fund managers to rely naively on public information, as defined in Kacperczyk and Seru (2007).

Our main analysis relates various versions of the *RTI* measure to fund performance. We regress fund risk-adjusted returns on *RTI* and observe a strong positive relation between these returns and the fund's *RTI*: an increase in the *RTI* of one standard deviation translates into an increase in the fund's annual alpha of 0.15%-0.20% in the panel and 0.55%-0.80% in the Fama-Macbeth specification. These results are consistent across multiple definitions of *RTI* and are robust to the inclusion of style fixed effects and control variables, such as fund size, fund age, expense ratio, and holdings' illiquidity.

We note that these results are directionally different from both those in Kacperczyk and Seru (2007) and those in Fang, Peress, and Zheng (2013), thus further alleviating concerns that our *RTI* measure is nothing but a proxy for attention to public news. While both of these earlier studies document lower returns among funds that make extensive use of public information, we find a positive association between funds' *RTIs* and their performance. It is also worth stressing that we are not assuming that quantifiable news is *more accurate*, but rather that is causes less disagreement in interpretation. This is important, because as long as everyone derives the same signal from a news release, there is little room for finance professionals, such as fund managers, to add value through superior information processing and intuition.

Next, we investigate whether our results are evidence of a persistent strategy employed by

[4] This name was chosen to draw a parallel with the *RPI* ("*Reliance on Public Information*") measure defined by Kacperczyk and Seru (2007).

fund managers. We document that past and currents *RTIs* are strongly positively related and that there is a long-term persistence in funds' tangibility-driven strategies. For example, on average, out of every 20 funds belonging to the top quintile of *RTI* in a given quarter, 11 funds are still in either quintile 1 or quintile 2 after one year, whereas only 4 funds have moved to the bottom two quarters. Similarly, out of every 20 funds that fall in the bottom quintile of *RTI* in a given quarter, 10 funds remain in the bottom two quintiles after one year, whereas only 3 funds have moved to the top two quintiles.

Finally, we investigate which funds are more likely to adopt strategies fueled by the changes in the stocks' public information. In a pooled regression, we relate fund's reliance on tangibility to its manager characteristics. We consider the following proxies for the managerial experience and attention: the number of managers in charge of the fund, tenure of the manager at the fund, the number of funds the manager manages at the time of the observation, and the number of different investment styles of all such funds. Our hypothesis predicts that more experienced and more focused managers – i.e. those with a longer tenure and managing fewer funds and styles – are better able to interpret information events associated with tangibility changes. Consistent with these predictions, we find that reliance on tangibility is positively related to our measures of expertise and focus. The results are statistically significant and economically relevant. For example, an increase of one standard deviation in the manager's tenure (number of managed funds) is associated with an increase in the fund's *RTI* of 3.0% (3.3%) of standard deviation.

This study is distinctly different from several recent papers that investigate the effect of media on the behavior of mutual fund managers. Solomon, Soltes, and Sosyura (2013) show that funds can attract additional flows by holding media-featured stocks with high past returns. The authors conclude that media enhances window-dressing propensity of mutual fund managers. Fang, Peress, and Zheng (2013) find evidence that mutual fund managers follow laymen strategies and trade excessively in stocks covered by the media, thus adding little or no value for the fund investors. The current paper is agnostic about the usage of media by fund managers, either strategic or behavioral. Instead, we rely on the content of media articles to characterize a particular aspect of the informational environment of the firm. This environment can change because of or independent of the media activity, but as long as some media activity occurs, we can construct the required measures of information tangibility. For example, a media article published on Friday can contain a report on an (unobservable) announcement by a company on Wednesday. Due to the inherent endogeneity of media coverage, it is difficult to ascribe changes in investors' behavior to one of these events, making a causal inference about the media effects problematic. However, to the extent that both the initial announcement and the follow-up news article are similar in the type of information they reveal (quantitative or verbal), our measurement strategy is effective. In fact, while the tendency of public media to be late to the market and print news that has already been incorporated into prices is normally a nuisance for researchers, it is exactly this effect that makes our identification possible. If the media mostly published material that had little to do with fundamental corporate events, it would be difficult to test whether fund managers can create value by reacting expertly to changes in the firms' information environments.

Our study contributes to a vast body of research about the value of mutual funds. Most of the earlier studies aimed to identify funds with consistent superior performance and determine the factors of such performance (e.g. Brown and Goetzmann (1995), Elton, Gruber, and Blake (1996), Carhart (1997)). In this paper, we recognize the ability of a fund manager to properly utilize public information as a source of advantage. In this regard, our work is related to a recent study by Engelberg, Reed, and Ringgenberg (2012) who adopt a similar view in the context of the short selling market. The authors show that it is not the ex ante informativeness of short sellers that allows them to earn excess profits but their superior ability to interpret information after it is made public. In this paper, we contribute to this argument by documenting that a proper reaction to changes in the (public) information environment of firms constitutes a consistent performance driver in the delegated portfolio management industry.

Second, our work relates to the literature on the decision-making within groups (e.g. Marshak and Radner (1972), Stein (2002), Dessein and Santos (2006), Alonso, Dessein, and Matouschek (2008)) that focuses on the decision-making processes in complex organizations. In general, the analysis is cast in terms of different organizational structures. Stein (2002) links them to the type of information available, Kuhnen (2004, 2009) discusses contractual relationships in the mutual fund industry, while Chen, Hong, Huang, and Kubik (2004) investigate the effects of size and structure of the fund. We contribute to these studies by considering a proxy of “codifiability” of information that is inferred from the media content.

Third, we contribute to the literature on the role of media in finance. A close relationship between media and the stock market has been well documented (e.g. Tetlock (2007, 2010), Fang and Peress (2009), Engelberg and Parsons (2011)). These studies mainly focus on how financial media affects investors’ attention and their perception of information. We consider another dimension of the information relayed by the media and show its relevance for the mutual fund industry. Our main focus is not the volume of media coverage, for which we explicitly control, but the codification of information within media news.

The remainder of the paper is organized as follows. Section II describes the data used in this study. Section III explores the link between fund performance and its reliance on tangibility. Section IV relates this effect to fund characteristics. A brief conclusion follows.

II. Data and Main Variables

In this section, we describe the data used in our study and explain the construction of the key variables.

A. Stock Sample

We begin constructing our sample of stocks by considering all U.S.-incorporated firms in CRSP that ranked in the top 1000 by market capitalization at any time during the period between 1999 and 2008. This filter is motivated by the availability of the media data, both in the cross-section and time-series. For each of the 1,581 companies that pass the filter, we obtain news articles from Factiva, a subsidiary of Dow Jones & Company that collects data from over 28,000 news sources worldwide.[5]

To download the articles, we first match the company name to the Factiva intelligent indexing code, which are assigned by the system to assist in finding articles that mention a particular company in a meaningful context. Where code assignment is ambiguous, e.g. where different codes identify the same company over different time periods, we analyze several articles returned by the Factiva engine to determine the proper match. We eliminate company-years for which the Factiva-CRSP link cannot be reliably established. For each Factiva code we download all articles that are categorized under "Major News and Business Publications", "Press-release Wires", or "Reuters Newswires". Finally, we limit our search to all articles in the English language appearing between January 1999 and December 2008. Overall, there are 1,801,440 news articles in our sample.

In addition to the text of the article, we are able to obtain information about the exact date and time of publication (where indicated), the author of the piece (if applicable), the number of words in the article, the name of the source (e.g. *The Wall Street Journal*), and the title. After the download, we eliminate duplicate articles. We further eliminate articles that contain empty bodies or for which the number of words is smaller than five. Finally, we reassign dates to articles in such a way that all articles appearing after the market closure correspond to the next trading day (e.g. all articles that appeared between 4:00 pm and 23:59 am are assigned to the next trading day). Articles appearing on Saturday or Sunday are assigned to the following Monday.

Table I, Panel A shows the breakdown of the sample composition by years. In earlier years, some smaller companies have no coverage in Factiva, limiting the size of our sample to fewer than 1000 stocks in the pre-2000 period. The number of news articles grew from 113 thousand in

[5] Companies outside of the top 1000 are covered very sparsely by Factiva and the intelligent indexing codes become less reliable for these smaller firms.

1999 to 257 thousand in 2008. Table I, Panel B shows the most common sources of news articles, as classified by Factiva. The Dow Jones and Associated Press Newswires combined constitute over 40% of our media sample.

To construct other stock-level variables, we obtain stock market data from CRSP and balance sheet and income data from Compustat files. In addition, we use the I/B/E/S database to construct measures of analyst following and dispersion. We exclude stocks covered by fewer than 3 analysts. Illiquidity is defined as the percentile rank (from 1 to 100) of the Amihud illiquidity measure over the entire set of firms in the CRSP universe in a particular quarter.

We provide stock-level descriptive statistics for our sample in Table I, Panel C. Overall, our analysis focuses on bigger and more liquid companies. The average (median) size of a company in our sample is $15.54 ($5.39) billion. These companies consistently rank in the bottom 10 percent by Amihud illiquidity.

B. Fund Sample

Our primary source of mutual fund data is the CRSP Survivorship-Bias-Free U.S. Mutual Fund Database for the period from December 1998 to January 2009. We obtain data on fund monthly returns, total assets under management, and annual fund characteristics (such as expense ratio load fees, and turnover) for all U.S. equity funds. We define equity funds as those funds for which the reported percentage of total assets invested in equities is above 80%. We limit our analysis to actively managed funds and exclude index funds. To guard against potential outliers, we additionally exclude funds with less than $5 million or more than $20 billion of TNA, funds with an expense ratio higher than 2%, and funds that are younger than 2 or older than 36 years. We also exclude observations where fund quarterly flow falls outside of the interval between -1.5% and 3.5%.

We aggregate the multiple share classes of the same fund every month to create a single fund observation. Total Net Assets (TNA) is the sum of TNAs of all share classes, while the other characteristics (expense ratio, load, turnover, and return) are the weighted averages of the characteristics weighed by the TNA of the respective share classes. Fund age is defined as the age of the oldest share class. Net return is the return received by the investors net of the expense ratio. We use the Morningstar investment objective code (3x3 style box) from Morningstar Direct to classify funds into different styles.

For each fund and time period (month or quarter) we estimate the fund's abnormal return using the standard two-stage estimation method (e.g. Carhart (1997), Kacperczyk and Seru (2007)). We first estimate the factor loadings for the fund by running the following regression using past 36 months of data:

$$R_{it} - R_{ft} = \alpha_i + \beta_i^{MKTRF} * MKTRF_t + \beta_i^{SMB} * SMB_t + \beta_i^{HML} * HML_t + \beta_i^{UMD} * UMD_t + \varepsilon_{it}$$

where R_{it} is the net return of fund *i* at time *t* and the factors are the standard Fama-French and momentum factors. The estimated β_i^{MKTRF} , β_i^{SMB}, β_i^{HML} and β_i^{UMD} are the factor loadings. Then, we calculate the periodic abnormal return (alpha) of fund *i* at time *t* as:

$$\alpha_{it} = (R_{it} - R_{ft}) - (\hat{\beta}_i^{MKTRF} * MKTRF_t + \hat{\beta}_i^{SMB} * SMB_t + \hat{\beta}_i^{HML} * HML_t + \hat{\beta}_i^{UMD} * UMD_t)$$

Table I, Panel D contains some summary statistics for our sample of funds. The average quarterly gross return of the funds is 1.21%, the average quarterly alpha is 0.06%, and the average annual expense ratio is 1.36%. The average fund size and age are $830.3M and 10.6 years, respectively.

We obtain all variables pertaining to fund managers from Morningstar Direct which provides more accurate and consistent data than CRSP. Managers are identified by their name. We construct the following variables at the fund level by averaging across the characteristics of different managers in charge of the fund: *Tenure*, defined as the time (in years) elapsed since the manager started managing the fund; *FundAffiliation*, defined as the total number of funds managed by the manager; *Styles*, defined as the total number of fund styles managed by the manager; and *NrManagers*, defined as the number of managers linked to the fund by Morningstar at the time of the observation. We take a closer look at these variables and their summary statistics in Section IV.

C. Measures of Tangibility

For each article in our sample, we perform automated textual analysis and count the number of digits (symbols from 0 to 9) and the total number of characters. Then, for each company *i* and quarter *t* we construct our measure of tangibility as

$$TG_{it} = \frac{\sum_{j=1}^{N} numeric\_characters_{it}^{j}}{\sum_{j=1}^{N} total\_characters_{it}^{j}} * 100 \qquad (1)$$

where *j* indexes articles, *i* is the company, and *t* is the quarter. This measure captures the percentage of numeric characters (over total characters) in all articles (from 1 to *N*) about company *i* during calendar quarter *t*. We complement this variable with an alternative measure of tangibility defined as

$$ATG_{it} = \frac{\sum_{j=1}^{N} \frac{numeric\_characters_{it}^{j}}{total\_characters_{it}^{j}} * 100}{N_{it}} \qquad (2)$$

where j indexes articles, i is the company, and t is the quarter. N_{it} denotes the number of articles about company i in quarter t. Variables *TG* and *ATG* are different in how they assign weights to observations: where *TG* treats all characters as equal, *ATG* treats all articles as equal, even though some articles are ostensibly smaller than others. Appendix 1 shows three examples of articles that fall into the top, the middle, and the bottom tercile by the ratio of numeric characters to total characters (tangibility ratio).

We also construct a measure of dispersion of tangibility defined as

$$\sigma(ATG)_{it} = \sqrt{\frac{\sum_{j=1}^{N}\left(\frac{numeric\_characters_{it}^{j}}{total\_characters_{it}^{j}} * 100 - averageATG_{it}\right)^{2}}{N_{it} - 1}} \qquad (3)$$

where j indexes articles, i is the company, and t is the quarter. This variable captures the consistency of the information environment: for example, it is low if all the articles about the company contain similar ratios of numeric to total symbols. The notation, *σ(ATG)*, reflects structural similarity between the dispersion variable and the level variable *ATG*: whereas *ATG* measures the average tangibility of the news, *σ(ATG)* captures the standard deviation of this tangibility.

In Table II, Panel A we report summary statistics on the tangibility variables at the stock level at quarterly frequency. The average value of *TG* (*ATG*) is 3.05 (3.48) and the standard deviation is 2.17 (2.21). The most quantitatively rich articles, where the information is usually presented in a table format, contain around 27% of numeric characters. In Table IV, Panel A we examine correlations between our tangibility measures and some common stock characteristics. Tangibility tends to be negatively related to market capitalization and trading volume while being positively related to stock return and illiquidity. Also, there is an 81% correlation between *TG* and *ATG*, suggesting that the weighting scheme is unlikely to play a major part in our analysis.

Next, we aggregate our tangibility measures to the fund level by computing the weighted average tangibility of the fund holdings. The weight of each portfolio position is proportional to the dollar value of that investment in the fund portfolio at the end of the quarter. Importantly, the weighted average is taken only across those stocks for which the stock-level tangibility variables are non-missing. Consequently, stocks for which the media data is unavailable (smaller and more illiquid stocks) do not affect the fund-level tangibility measure, regardless of their aggregate prevalence in the fund portfolio. Such methodology ensures that our fund-level measures are not mechanically correlated with the fund's propensity to hold stocks outside of our sample.

In Table II, Panel B we report summary statistics on the fund-level tangibility variables at quarterly frequency as well as their distribution by the Morningstar fund style. We observe that the average degree of tangibility of fund holdings falls between 2.7 and 3.2 with a standard deviation ranging from 0.9 to 1.2. Not surprisingly, funds investing in smaller companies tend to have higher holdings' tangibility ranging from 3.6 to 3.9 while those investing in bigger firms remain at around 2.5. The pattern on the dispersion of tangibility is less clear, although funds investing in larger stocks tend to have a somewhat higher dispersion (2.6) relative to funds investing in smaller stocks (2.0-2.2).

Table IV, Panel B reports fund-level correlations of the tangibility variables. Tangibility, as well as its dispersion, are strongly negatively related to fund size (TNA) and fund age. The relationship of tangibility with illiquidity, flow, and turnover is positive, while the dispersion of tangibility is negatively related to illiquidity and turnover. At this point, we do not consider the relationship between tangibility and fund management characteristics since it is the subject of a separate section.

III. Tangibility and Performance

A. Fund Performance and Variations in Holdings' Tangibility

We begin our analysis by examining the relationship between fund performance and fund portfolio composition as characterized by the volatility of the information environment of the fund portfolio holdings. If trading in stocks that experience tangibility changes is profitable, we could expect funds that are invested more heavily in such stocks to earn higher returns. However, this analysis is only preliminary. Indeed, the hypothesized relationship between fund performance and fund holdings would be strong only if funds have a preferred habitat of stocks in which they trade or if most of their profits come from timing the purchases, as opposed to sales, of the stocks. Consider a fund manager who is able to infer a negative signal about a company from the public news. This manager would sell the stock and therefore reduce the fund's exposure to informationally volatile assets at the end of the reporting period. This effect would attenuate the results of any analysis which is based on the observed level of fund holdings.

To perform the test, we construct a pair of variables that capture the volatility of the stock's information tangibility over a given time period. First, we compute *TG* and *ATG* for every stock-month following the approach outlined in the previous section. Second, we calculate the standard deviations of these variables over the 24-month period preceding the observation month. Third, we aggregate the results to the fund level by computing the weighted averages of these standard deviations across all the fund holdings for which these standard deviations are non-missing. In this procedure, the weights are proportional to the weights of the respective stocks in the fund's portfolio at the end of the quarter before the quarter containing the observation month. We call the resulting variables *VTG* and *VATG*.

In Table IV we report the results of the regressions of fund monthly alphas on *VTG* and *VATG* and a set of controls. All the specifications include time effects and select specifications includes style fixed effects, as indicated. The standard errors of all the estimates are clustered at the fund level. Overall, we observe a positive relationship between the informational volatility of holdings and fund performance, although this relationship is weak and is significant at the 10% level at best. Although this evidence suggests some benefits to trading stocks that undergo information changes, a more detailed analysis of this effect is in order.

B. Fund Performance and Reliance on Tangibility

In this section we seek to identify funds whose trading strategies are tied to changes in the information environment of the stocks comprising their portfolios. Unlike some earlier studies that utilize media data (Tetlock (2007, 2010), Fang and Peress (2009), Engelberg and Parsons (2011)), we do not attempt to establish causality between media activity and actions of economic agents. Instead, we use media data to *measure* the characteristics of the information about the company while acknowledging that public media channels are not the only way to disseminate such information. Specifically, we are interested in how sensitive the funds' trades are to the changes in the firms' information environment and whether funds that adopt a more active stance with respect to such varying information are doing better or worse.

To address this question, we adapt the methodology proposed by Kacperczyk and Seru (2007) to our empirical setting. Since we aim to capture the strength of the relationship between funds' trading and the fluctuations in the stock tangibility, we could directly regress funds' changes in holdings on the changes in stock tangibility and retain the R^2 of this regression. However, this approach poses a problem since it could single out managers who simply rely on public news more often than others. In particular, a manager who makes use of his own private information, would not condition his investment decisions on public news releases and would have a low R^2. Another possibility is that exceptionally strong or weak past performance of the stock creates a spike in the media attention that influences funds managers' strategies. Managers that are more prone to be affected by such events would have a high R^2, whether they reacted to the media activity itself or to the stock performance that triggered such activity.

Because the goal of this study is to explore the reaction of funds to the type, rather than the volume, of public information, we need to control for such confounding effects. Accordingly, we run our analysis in two stages. In the first stage, for each fund and each quarter, we regress our reaction variable, change in holdings, on a set of potential drivers of fund managers' behavior.

These include the change in the intensity of media activity, stock return, and the update in analysts' recommendations – the key variable in the paper of Kasperczyk and Seru (2007). Formally,

$$\Delta Holdings_{imt} = \beta_{0t} + \beta_{1t}\Delta Rec_{it-1} + \beta_{2t}\Delta freq_{it-1} + \beta_{3t} Return_{it-1} + \varepsilon_{imt} \tag{4}$$

where $\Delta Holdings_{imt}$ is the change in stock split-adjusted holdings of stock *i*, for fund *m*, during period (quarter) *t*; ΔRec_{it} is the change in the average analyst recommendation (these range from 1 (most pessimistic) to 5 (most optimistic)) from period *t-1* to *t*; $\Delta freq_{it}$ is the change in news frequency (number of articles on company *i*) from period *t-1* to *t*; and $Return_{it}$ is the company *i*'s stock return from period *t-1* to *t*.

For robustness, we consider 3 types of the change-in-holdings variable. The first one is defined as in Kacperczyk and Seru (2007) and is a simple percentage increase or decrease in the number of shares of the stock held by the fund from quarter *t-1* to *t*.

$$\Delta Holdings^{K}_{imt} = \frac{NumShares_{imt} - NumShares_{imt-1}}{NumShares_{imt-1}} \tag{5}$$

The problem with this variable is that it can assume extremely high values when funds increase their position from a small stake to a large. The second measure is based on the change in the weight of the fund portfolio in the stock and is calculated as:

$$\Delta Holdings^{CW}_{imt} = \frac{dollar\_position_{imt}}{fund\_TNA_{mt}} - \frac{dollar\_position_{imt-1}}{fund\_TNA_{mt-1}} \tag{6}$$

The third measure is a standardized version of the percentage change in holdings, which is constrained to lie between -1 and 1, thus eliminating concerns about unnaturally large values of the change variable. This measure is computed as

$$\Delta Holdings^{MT}_{imt} = \frac{NumShares_{imt} - \dfrac{NumShares_{imt-1} + NumShares_{imt}}{2}}{\dfrac{NumShares_{imt-1} + NumShares_{imt}}{2}} \tag{7}$$

and is equal to 1 (-1) in all cases in which the fund increased (decreased) its share ownership of the stock from 0 (some positive number) to some positive number (0). We mark the three measures with the following indexes: *K*, *CW*, and *MT*.

We retain the residuals from these regressions and then regress these residuals on the absolute change in tangibility as follows:

$$\varepsilon_{imt} = \beta_{0t} + \beta_{1t}\,|\Delta Tangibility_{it-1}| + u_{imt} \tag{8}$$

The R^2 of this regression measures the degree of dependence of the fund's trading on the fluctuations in tangibility of the stocks that compose the fund's portfolio. We call this measure *Reliance on the Tangibility of Information* and refer to it as *RTI* hereafter. *RTI* is low for funds whose trades are not related to changes in the stocks' information environment and are high for funds whose trading strategies are tied to the variations in the type of information, where "type" is captured by tangibility. By combining our two tangibility measures with the three definitions of the change in holdings, we obtain six *RTI* variables indexed by *TG* or *ATG* and by *K*, *CW*, or *MT*. All of these *RTIs* are computed at quarterly frequency.

There are several reasons why we concentrate on the R^2 rather than the coefficient. First, the coefficient is likely estimated with a significant noise and contains many outlier values that can skew the inferences of our study. On the contrary, R^2 is constrained to lie between 0 and 1, somewhat alleviating measurements concerns. More importantly, R^2 fits better with the objectives of our analysis. Similar to Kasperczyk and Seru (2007), we aim to measure how tightly fluctuations in a particular public variable are linked to funds' investment decisions. There is little reason to believe that one can systematically make money by buying or selling stocks that experienced an increase in tangibility. A strategy based on following a particular buy/sell rule with respect to the stock tangibility is on weak theoretical ground, since tangible information can convey both positive and negative signals. Instead, by considering R^2 we do not provide any directional investment advice but rather ex post separate funds that systematically react to the change in tangibility from those that don't.

However, this identification does not elaborate on how funds managers interpret the news and why they decide to increase or reduce their investment in a company. As a result, the conclusions of our analysis do not represent a market anomaly whereby one can execute an automatic strategy by following a specific rule based on a public variable. This reasoning is consistent with our working hypothesis that fund managers create value through their interpretation of public information, where the exact nature of such interpretation depends on the specifics of the company, the background of the manager, and his prior information set. Successful managers can interpret changes in the company's information environment and either buy or sell the stock depending on where the signal falls relative to the expectations of the general market. In either case, the *RTI* measure will be high for such mangers, while the coefficient, both its sign and magnitude, can be ambiguous.

In Table VI, we report summary statistics on our *RTI* variables. The mean *RTIs* in our sample are clustered around 0.03 with the standard deviation ranging from 0.05 to 0.06. Funds from styles that invest in smaller stocks have uniformly higher *RTIs* (0.04-0.05) compared to funds from styles that focus on larger firms (0.02-0.03). In Table VII we report correlations of *RTIs* among themselves as well as with some common fund characteristics. All of our six *RTI* measures are strongly positively correlated with the lowest correlation coefficient of 0.50. All six *RTIs* are strongly negatively related to fund size and positively related to flows, holdings' illiquidity, and fund expense ratio. It is also evident that *RTI* is positively related to fund risk-adjusted performance, although a more careful examination of this effect is in order.

In Table VIII, we report the results of our main analysis. We regress fund monthly alpha on the previous quarter *RTI* and a set of control variables. All the specifications include time fixed effects and some specifications include style fixed effects, as indicated. The results show that fund performance and reliance on tangibility are strongly positively related. All but one coefficient are significant at 10% or better. To illustrate the economic effect, consider the coefficients on RTI_K^{TG} and RTI_{MT}^{TG}. An increase in the *RTI* measure by one standard deviation results in an increase in monthly alpha of 0.0133% (0.0105%) or 0.160% (0.125%) on an annualized basis.

In Panel B of Table VIII we replicate the analysis using the Fama-Macbeth specifications. The results remain statistically significant but become economically stronger. For example, a one standard deviation increase in RTI_K^{ATG} improves monthly (annual) risk-adjusted return by 0.069% (0.85%).

The other evidence in Table VIII is largely consistent with the previously documented facts about mutual fund performance. The degree of illiquidity of the holdings in the fund portfolio is strongly positively related to fund returns, suggesting that funds earn a premium for holdings stocks that are difficult to sell off. Smaller funds tend to do better, arguably because of the diminishing returns to scale that make it difficult to deploy large capital effectively. Older funds are apparently more experienced and earn higher returns. At the same time, active trading doesn't pay off, since higher fund turnover detracts from performance. On the whole, the significance of the control variables indicates the importance of their inclusion in the model. Even then, the *RTIs* remain relevant, suggesting that their effect on fund performance is independent from that of other commonly considered fund characteristics.

We note that our results are in stark contrast with the findings of Kasperczyk and Seru (2007) and Fang, Peress, and Zheng (2013) who document that funds that follow public-information signals do worse than their more independently minded counterparts. Our evidence indicates that funds whose investment decisions are closely tied to the changes in the information environments of their holdings deliver stronger performance. This further confirms that the observed effect is not driven by the mere availability of public news and the naive interpretation of such news by fund managers. Rather, it appears that funds are able to add value by paying closer attention to firm-specific information.

Are tangibility-driven strategies persistent features of individual funds or this relationship arises spontaneously and fades quickly over time? To answer this question, we perform a test on the persistence of our *RTI* variables. In Table X, we regress *RTI* on its lagged value and a set of controls, including lagged fund performance. The results indicate a strong positive relationship between past and future *RTI* and no relationship between future *RTI* and past performance. This evidence is consistent with the idea that *RTI* is not a reactionary measure and that investment policies captured by high *RTI* values are likely to persist.

In addition, in Table XI, we examine transition frequencies by splitting funds into quintiles by *RTI* in the current quarter and tracking the composition of these quintiles over time. The intersection between row *r* and column *c* shows how many funds moved from quintile *r* to quintile *c* in the indicated period (one quarter in Panel A and one year in Panel B) as well as the probability that a fund from quintile *r* would move to quintile *c*. We observe little turnover among the quintiles both in the short and the long run. On average, out of every 20 funds from the top quintile of *RTI* in a given quarter, 11 funds are still in either quintile 1 or quintile 2 after one year, whereas only 4 funds have moved to the bottom two quarters. Similarly, out of every 20 funds that fall in the bottom quintile of *RTI* in a given quarter, 10 funds are still in the bottom two quintiles after one year, whereas only 3 funds have moved to the top two quintiles. These results indicate that *RTIs* likely capture consistent investment policies of the funds that are based on innovations in firm-level information.

IV. Drivers of *RTI*

In this section, we investigate which fund management characteristics are responsible for the level of the fund's *RTI*. This section serves several purposes in our analysis. First, it helps validate the assumption that high *RTI* values reflect a meaningful action on the part of fund managers. In other words, we need to verify that the variable we constructed does not appear spontaneously in some funds and not others but rather is driven by some fundamental differences in the funds' organizational structures. Secondly, while the link between fund performance and fund management characteristics (e.g. tenure) is normally expected, the question about the nature of this relationship remains open. For example, one possibility is that managers accumulate more private information as they get older. Our analysis seeks to determine whether public information plays any part in the process of value-creation. Finally, some management variables can have opposing effects on the efficacy of the information analysis. For example, it is not clear whether a higher number of managers in charge of the fund facilitates interpretation of qualitative information or, in fact, makes it more difficult to reach an informed decision. Evidence in either direction will help us shed more light on the decision-making practices inside a managerial team.We consider the following fund-level variables: *Tenure* (calculated as the number of years that the current fund manager has spent with the fund; on average, 3.97 years), *FundAffiliation* (calculated as the total number of funds linked to the manager in the current quarter in Morningstar; on average, 2.8 funds), *NrManagers* (calculated as the total number of managers linked to the fund in the current quarter; on average, 2.6 managers) and *ManagerStyles* (calculated as the number of distinct Morningstar styles that the fund manager manages funds in; on average, 1.9 styles). These variables are designed to proxy for the experience and focus of the fund managers and can account for superior attention or information processing abilities.

We regress funds' quarterly *RTIs* on our four managerial characteristics and a standard set of controls. We run the regressions individually for every characteristic as well as jointly for all of them. The results are reported in Table IX. All specifications include time fixed effects for consistency with the previous analysis and select specifications include style fixed effects.

The evidence strongly indicates a positive relationship between manager's tenure with the fund and the fund's *RTI*. To illustrate, an increase in tenure by 5 years results in an increase in RTI_K of 0.0028 or 5% of the standard deviation. To the extent that tenure proxies for experience, more experiences managers tend to trade more aggressively when public information environment of a company undergoes changes.

Managers running more funds tend to have lower *RTIs*: an increase in the number of managed funds by 1 results in a decrease in RTI_K of 0.00068 or 1.2% of the standard deviation.[6] Similarly, an increase in the number of managed styles by 1 reduces RTI_K by 0.00209 or 3.7% of the standard deviation. These results are consistent with an idea that a lack of focus detracts from managers' ability to add value through information interpretation.

Finally, an increase in the number of managers of the fund by 1 reduces RTI_K by 0.00074 or 1.3% of the standard deviation. In light of the previous discussion, it is conceivable that a managerial team cannot reach consensus on how to interpret information changes and therefore abstains from trading more often than a single manager would.

Overall, these results indicate that funds whose strategies are more reliant on innovations in stock-specific information are run by more senior managers who concentrate on managing relatively few funds and styles. This provides evidence in favor of our working hypothesis and suggests that more experienced and focused managers are better able to interpret changes in information environment.

[6] The results are directionally identical and quantitatively similar for the other *RTI* measures.

Conclusion

We study how asset managers make use of qualitative and quantitative information about their portfolio's holdings. We distinguish between tangible and intangible information by counting the number of numerical symbols used in media articles about the firm. For each stock, we define its degree of tangibility and track how it changes as news comes out. We then relate mutual funds' trading activity to changes in tangibility, controlling for the overall amount of media coverage and other sources of information such as market prices and analyst reports.

We find that funds that are rebalancing their position in the stock more actively following a change in tangibility deliver stronger performance. We hypothesize that managers of these funds possess better information processing abilities and are better able to utilize the value of the new information. Consistent with this prediction, we find that managers with a longer tenure at the fund and managers who work with fewer funds and investment styles are more responsive to tangibility changes. On the other hand, our results do not supply a directional prediction on profitable trades. Since updates in tangibility can be related to both good and bad news, it is not clear whether one should buy or sell a stock after such events. We however find that those funds who do not react to these updates at all exhibit inferior performance. This result is in stark contrast with the findings in the prior literature that fund managers who ignore public information signals earn higher returns.

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Table I. Sample descriptive statistics.

This table shows some descriptive statistics for the samples of news articles, stocks, and mutual funds. The main sample of media articles consists of 1,801,440 news publications that cover 1,581 companies over the period between 1999 and 2008. Panel A reports the number of articles (in thousands), the number of stocks featuring in these articles, and the number of funds, broken down by year. Panel B shows the prevalence rank of each media source in our sample in each year. Panel C reports the descriptive statistics for the following variables computed for each stock-quarter: *MCap* is the market capitalization of the company in billions USD, *BM* is the ratio of the company's book value of equity to its market capitalization, *Leverage* is the ratio of the company's long-term debt to the book value of its equity, *Illiq* is the percentile rank (from 1, most liquid, to 100, least liquid) of the Amihud illiquidity measure over the entire set of firms in the CRSP universe in the observation quarter. Panel D reports the descriptive statistics for the following variables computed either for each fund-quarter or each fund-year as indicated in the table: *TNA* is the aggregate total net assets of all the fund's share classes in millions USD, *Return* is the fund return net of fees over the observation period computed as the TNA-weighted average of the net returns of the fund's shareclasses, *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Age* is the number of years that elapsed between the initiation of the fund's oldest shareclass and the observation period, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period, *Illiq* is the weighted average of the stock-level illiquidity percentile rank computed across all the equity holdings of the fund's portfolio at the end of the observation period.

Panel A: News, stocks, and funds by year

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Number of articles (x 000)	113	91	118	183	179	188	196	223	249	257
Number of stocks	861	873	920	1037	1049	1034	1036	1071	1095	1141
Number of funds	2964	3219	3399	3517	3589	3530	3618	3519	3571	3357

Panel B: Rank of media sources by the number of articles by year

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
1	DJN	DJN	DJN	DJN	APN	APN	APN	APN	APN	APN
2	FT	FT	ASN	APN	DJN	DJN	DJN	DJN	DJN	DJN
3	B	WSJ	WSJ	WSJ	WSJ	WSJ	WSJ	WSJ	FT	WSJ
4	NYT	NYT	FT.com	NP	FT	GM	GM	GM	WSJ	FT
5	TT	GM	NYT	NYT	NP	NYT	FT	FT	FT.com	FT.com

DJN: Dow Jones Newswires; APN: Associated Press Newswires; FT: Financial Times; WSJ: Wall Street Journal; B: Barron's; TT: The Times; NYT: The New York Times; GM: The Globe and Mail; FT.com: www.ft.com; NP: National Post

Panel C: Descriptive statistics for the stock sample

	Mean	**Std. Dev.**	**P25**	**P50**	**P75**
MCap ($ B)	15.54	35.00	2.77	5.39	13.03
BM	0.54	7.45	0.23	0.38	0.59
Leverage	0.32	11.59	-0.27	0.07	0.77
Illiq	10.13	9.44	4.00	8.00	13.00

Panel D: Descriptive statistics for the mutual fund sample

	Mean	**Std. Dev.**	**P25**	**P50**	**P75**
TNA ($ M)	830.27	1,840.61	63.00	213.70	724.00
Return (%, quarterly)	1.21	11.10	-4.11	1.83	7.03
Alpha (%, quarterly)	0.06	4.28	-1.94	-0.11	1.80
ExpRatio (%, annual)	1.36	0.49	1.04	1.30	1.61
Age (years)	10.59	6.78	5.50	8.96	13.99
Turnover (%, quarterly)	28.32	25.46	8.59	23.32	41.09
Flow (%, quarterly)	0.48	7.92	-4.27	-1.02	3.32
Illiq (quarterly)	11.46	10.16	3.79	8.14	15.97

Table II. Summary statistics for the level and dispersion of information tangibility.

This table shows the summary statistics for the measures of information environment at the stock level (Panel A) and the fund level (Panel B). To construct these measures, we perform automated textual analysis and count the number of digits (symbols from 0 to 9) and the total number of characters in each news article in our sample.

Panel A. Stock-level variables

The following variables are defined for each stock *i* and quarter *t* (*j* indexes news articles).

Information tangibility:

$$TG_{it} = \frac{\sum_{j=1}^{N} numeric\_characters_{it}^{j}}{\sum_{j=1}^{N} total\_characters_{it}^{j}} * 100$$

Information tangibility (alternative definition):

$$ATG_{it} = \frac{\sum_{j=1}^{N} \frac{numeric\_characters_{it}^{j}}{total\_characters_{it}^{j}} * 100}{N_{it}}$$

Dispersion of tangibility:

$$\sigma(ATG)_{it} = \sqrt{\frac{\sum_{j=1}^{N} \left(\frac{numeric\_characters_{it}^{j}}{total\_characters_{it}^{j}} * 100 - averageATG_{it} \right)^{2}}{N_{it} - 1}}$$

Summary statistics

	Obs.	Mean	Std. Dev.	P25	P50	P75
TG	30,859	3.05	2.17	1.80	2.44	3.54
ATG	30,859	3.48	2.21	2.09	2.83	4.10
σ(ATG)	27,066	2.83	1.70	1.67	2.28	3.51

Panel B. Fund-level variables

The stock-level tangibility measures are aggregated to the fund level as the weighted average tangibility of the fund holdings. The weight of each portfolio position is proportional to the dollar value of that investment in the fund portfolio at the end of the quarter. The weighted average is taken only across those stocks for which the stock-level tangibility variables are non-missing. Fund style classification is based on the Morningstar equity-style 3x3 matrix.

Summary statistics

	Obs.	**Mean**	**Std. Dev.**	**P25**	**P50**	**P75**
TG	58,210	2.76	0.94	2.21	2.52	3.06
ATG	58,210	3.14	1.17	2.47	2.82	3.42
σ(ATG)	57,727	2.51	1.02	2.03	2.31	2.76

Mean of the variables by fund style

	TG	*ATG*	*σ(ATG)*
Large Blend	2.49	2.91	2.63
Large Growth	2.47	2.87	2.57
Large Value	2.49	2.89	2.57
Mid Blend	3.13	3.55	2.54
Mid Growth	3.10	3.50	2.50
Mid Value	3.01	3.36	2.51
Small Blend	3.54	3.86	2.18
Small Growth	3.57	3.90	2.20
Small Value	3.33	3.60	2.04

Table III. Correlations of tangibility measures with company and fund characteristics.

This table shows the correlation matrices between company (Panel A) and fund (Panel B) characteristics and the tangibility variables computed at the stock and the fund level, respectively. *MCap* is the market capitalization of the company in billions USD, *BM* is the ratio of the company's book value of equity to its market capitalization, *Leverage* is the ratio of the company's long-term debt to the book value of its equity, *Illiq* (stock) is the percentile rank (from 1, most liquid, to 100, least liquid) of the Amihud illiquidity measure over the entire set of firms in the CRSP universe in the observation quarter. *TNA* is the aggregate total net assets of all the fund's share classes in millions USD, *Return* is the fund return net of fees over the observation period computed as the TNA-weighted average of the net returns of the fund's shareclasses, *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Age* is the number of years that elapsed between the initiation of the fund's oldest shareclass and the observation period, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period, *Illiq* (fund) is the weighted average of the stock-level illiquidity percentile rank computed across all the equity holdings of the fund's portfolio at the end of the observation period. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

Panel A: Stock tangibility measures and company characteristics

	TG	*ATG*	*σ(ATG)*	*MCap*	*Leverage*	*BM*	*Illiq*
TG	1.00						
ATG	0.81***	1.00					
σ(ATG)	0.50***	0.74***	1.00				
MCap	-0.14***	-0.14***	-0.04***	1.00			
Leverage	0.00	0.00	0.00	-0.01*	1.00		
BM	-0.01	-0.01	-0.01	-0.01**	0.00	1.00	
Illiq	0.15***	0.14***	0.10***	-0.30***	0.01*	0.03***	1.00

Panel B: Fund tangibility measures and fund characteristics

	TG	*ATG*	*σ(ATG)*	*TNA*	*Return*	*Alpha*	*ExpRatio*	*Age*	*Turnover*	*Flow*	*Illiq*
TG	1.00										
ATG	0.75***	1.00									
σ(ATG)	0.32***	0.70***	1.00								
TNA	-0.04***	-0.04***	-0.01**	1.00							
Return	0.07***	0.08***	0.04***	0.01**	1.00						
Alpha	0.06***	0.07***	0.06***	0.02***	0.39***	1.00					
ExpRatio	0.06***	0.02***	-0.01	-0.22***	0.03***	0.00	1.00				
Age	-0.05***	-0.06***	-0.04***	0.27***	0.01*	0.00	-0.15***	1.00			
Turnover	0.01**	0.01*	-0.02***	-0.06***	0.00	-0.02***	0.11***	-0.01**	1.00		
Flow	0.06***	0.04***	0.02***	0.02***	0.15***	0.14***	-0.05***	-0.15***	-0.06***	1.00	
Illiq	0.39***	0.28***	-0.10***	-0.08***	0.06***	0.02***	0.17***	-0.07***	0.00	0.04***	1.00

Table IV. Fund performance and variations in holdings' tangibility.

This table shows the results of the regression of fund monthly *Alpha* on the measures of variations in the fund holdings' tangibility plus a set of control variables. *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period. Variables *VTG* and *VATG* are constructed as follows. First, we compute *TG* and *ATG* for every stock-month following the approach described in Table II. Second, we calculate the standard deviations of these variables over the 24-month period preceding the observation month. Third, we aggregate the results to the fund level by computing the weighted averages of these standard deviations across all the fund holdings for which these standard deviations are non-missing. In this procedure, the weights are proportional to the weights of the respective stocks in the fund's portfolio at the end of the quarter before the quarter containing the observation month. *MCap* (*BM*, *Illiq*) is the weighted average of the company-level variable *MCap* (*BM*, *Illiq*) defined as in Table I computed across all the equity holdings of the fund's portfolio (the weights are proportional to the weights of the respective stocks in the fund's portfolio at the end of the quarter before the quarter containing the observation month), *Size* is defined as the natural log of *MCap* measured in millions USD, *LogTNA* is the natural logarithm of the fund TNA measured in millions USD, *LogAge* is the natural logarithm of the age of the fund's oldest shareclass measured in years, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period. The coefficients for *MCap*, *BM*, *Illiq*, *LogTNA*, *LogAge*, *ExpRatio*, *Turnover*, and *Flow* were scaled by 10^3. T-statistics are reported in parentheses. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

	(1)	(2)
VTG_{t-1}	0.016	
	(1.37)	
$VATG_{t-1}$		0.028*
		(1.92)
$Size_{t-1}$	-108.326***	-110.781***
	(-6.73)	(-6.90)
BM_{t-1}	19.196**	18.833**
	(3.09)	(3.05)
$Illiq_{t-1}$	7.883**	7.252**
	(3.00)	(2.77)
$LogTNA_{t-1}$	-12.990***	-12.912***
	(-3.47)	(-3.45)
$LogAge_{t-1}$	46.532***	47.001***
	(3.88)	(3.89)
$ExpRatio_{t-1}$	-47.065**	-46.337**
	(-2.91)	(-2.86)
$Turnover_{t-1}$	-0.346	-0.357
	(-1.32)	(-1.36)
$Flow_{t-1}$	4.683***	4.718***
	(5.80)	(5.84)
Style FE	Yes	Yes
Time FE	Yes	Yes
Clustering	Fund	Fund
Observations	161,329	161,542
Adjusted R^2	0.025	0.025

Table III. Summary statistics for the fund *RTI*

This table shows the summary statistics for different measures of reliance on tangibility of information (*RTI*) for mutual funds. The *RTI* measures are constructed as described below.

1. Several measures of a change in holdings ($\Delta Holdings_{imt}$) are defined:

$$\Delta Holdings_{imt}^{K} = \frac{NumShares_{imt} - NumShares_{imt-1}}{NumShares_{imt-1}}$$

$$\Delta Holdings_{imt}^{CW} = \frac{dollar\_position_{imt}}{fund\_TNA_{mt}} - \frac{dollar\_position_{imt-1}}{fund\_TNA_{mt-1}}$$

$$\Delta Holdings_{imt}^{MT} = \frac{NumShares_{imt} - \frac{NumShares_{imt-1} + NumShares_{imt}}{2}}{\frac{NumShares_{imt-1} + NumShares_{imt}}{2}}$$

Here, *i* indexes stocks, *m* indexes funds, and *t* indexes time periods (quarters).

2. These measures are regressed on several control variables:

$$\Delta Holdings_{imt} = \beta_{0t} + \beta_{1t}\Delta Rec_{it-1} + \beta_{2t}\Delta freq_{it-1} + \beta_{3t} Return_{it-1} + \varepsilon_{imt}$$

where ΔRec_{it} is the change in the average analyst recommendation (these range from 1, most pessimistic, to 5, most optimistic) from quarter *t-1* to *t*; $\Delta freq_{it}$ is the change in news frequency (number of articles on company *i*) from quarter *t-1* to *t*; and $Return_{it}$ is the company *i*'s stock return from quarter *t-1* to *t*.

3. The residuals from the previous regression are now regressed on the absolute change in tangibility:

$$\varepsilon_{imt} = \beta_{0t} + \beta_{1t}|\Delta Tangibility_{it-1}| + u_{imt}$$

RTI is defined as the R^2 of this regression.

RTI summary statistics

	Obs.	Mean	Std. Dev.	P25	P50	P75
RTI_K^{TG}	38,784	0.029	0.057	0.002	0.008	0.029
RTI_K^{ATG}	38,784	0.029	0.056	0.002	0.008	0.030
RTI_{CW}^{TG}	38,784	0.027	0.049	0.001	0.008	0.029
RTI_{CW}^{ATG}	38,784	0.027	0.049	0.002	0.008	0.029
RTI_{MT}^{TG}	38,784	0.029	0.056	0.002	0.009	0.031
RTI_{MT}^{ATG}	38,784	0.030	0.055	0.002	0.009	0.032

Mean _RTI_ by fund style

	RTI_K^{TG}	RTI_K^{ATG}	RTI_{CW}^{TG}	RTI_{CW}^{ATG}	RTI_{MT}^{TG}	RTI_{MT}^{ATG}
Large Blend	0.021	0.022	0.020	0.021	0.023	0.024
Large Growth	0.027	0.027	0.024	0.024	0.028	0.028
Large Value	0.026	0.026	0.024	0.024	0.027	0.028
Mid Blend	0.034	0.035	0.034	0.034	0.036	0.035
Mid Growth	0.032	0.033	0.031	0.031	0.033	0.034
Mid Value	0.030	0.029	0.029	0.029	0.031	0.031
Small Blend	0.044	0.043	0.041	0.041	0.043	0.040
Small Growth	0.052	0.049	0.049	0.049	0.050	0.048
Small Value	0.053	0.052	0.048	0.046	0.052	0.047

Table IV. *RTI* and fund characteristics.

This table shows the correlation coefficients between different *RTI* measures and fund characteristics. *TNA* is the aggregate total net assets of all the fund's share classes in millions USD, *Return* is the fund return net of fees over the observation period computed as the TNA-weighted average of the net returns of the fund's shareclasses. *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Age* is the number of years that elapsed between the initiation of the fund's oldest shareclass and the observation period, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period, *Illiq* is the weighted average of the stock-level illiquidity percentile rank computed across all the equity holdings of the fund's portfolio at the end of the observation period. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

	RTI_K^{TG}	RTI_K^{ATG}	RTI_{CW}^{TG}	RTI_{CW}^{ATG}	RTI_{MT}^{TG}	RTI_{MT}^{ATG}	*TNA*	*Return*	*Alpha*	*ExpRatio*	*Age*	*Turnover*	*Flow*	*Illiq*
RTI_K^{TG}	1.00													
RTI_K^{ATG}	0.69^{***}	1.00												
RTI_{CW}^{TG}	0.70^{***}	0.49^{***}	1.00											
RTI_{CW}^{ATG}	0.50^{***}	0.68^{***}	0.68^{***}	1.00										
RTI_{MT}^{TG}	0.82^{***}	0.58^{***}	0.76^{***}	0.54^{***}	1.00									
RTI_{MT}^{ATG}	0.58^{***}	0.81^{***}	0.53^{***}	0.74^{***}	0.68^{***}	1.00								
TNA	-0.03^{***}	-0.03^{***}	-0.04^{***}	-0.04^{***}	-0.03^{***}	-0.03^{***}	1.00							
Return	0.00	0.01^{*}	0.01	0.01^{*}	0.01	0.01^{**}	0.01^{**}	1.00						
Alpha	0.01	0.02^{***}	0.01^{*}	0.02^{***}	0.01^{*}	0.02^{***}	0.02^{***}	0.39^{***}	1.00					
ExpRatio	0.08^{***}	0.08^{***}	0.08^{***}	0.08^{***}	0.08^{***}	0.07^{***}	-0.22^{***}	0.03^{***}	0.00	1.00				
Age	-0.00	-0.01	-0.00	-0.00	0.00	-0.00	0.27^{***}	0.01^{*}	0.00	-0.15^{***}	1.00			
Turnover	0.00	-0.00	-0.00	-0.01	0.00	-0.00	-0.06^{***}	0.00	-0.02^{***}	0.11^{***}	-0.01^{**}	1.00		
Flow	0.02^{***}	0.02^{***}	0.02^{***}	0.02^{***}	0.03^{***}	0.02^{***}	0.02^{***}	0.15^{***}	0.14^{***}	-0.05^{***}	-0.15^{***}	-0.06^{***}	1.00	
Illiq	0.29^{***}	0.28^{***}	0.30^{***}	0.30^{***}	0.29^{***}	0.27^{***}	-0.08^{***}	0.06^{***}	0.02^{***}	0.17^{***}	-0.07^{***}	0.00	0.04^{***}	1.00

Table VII. Relationship between fund performance and *RTI*.

This table shows the results of the regression of fund monthly *Alpha* on the fund *RTI* and a set of control variables. *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period. *Illiq* is the weighted average of the stock-level illiquidity percentile rank computed across all the equity holdings of the fund's portfolio (the weights are proportional to the weights of the respective stocks in the fund's portfolio at the end of the quarter before the quarter containing the observation month), *LogTNA* is the natural logarithm of the fund TNA measured in millions USD, *LogAge* is the natural logarithm of the age of the fund's oldest shareclass measured in years, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period. Panel A (Panel B) shows the output of the OLS (Fama-Macbeth) regression. The coefficients for *Illiq*, *LogTNA*, *LogAge*, *ExpRatio*, *Turnover*, and *Flow* are scaled by 10^3. T-statistics are reported in parentheses. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

Panel A: Evidence from the OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
RTI_K^{TG}	0.234**	0.249**										
	(2.00)	(2.35)										
RTI_K^{ATG}			0.288**	0.298**								
			(2.25)	(2.74)								
RTI_{CW}^{TG}					0.219	0.211*						
					(1.52)	(1.75)						
RTI_{CW}^{ATG}							0.485**	0.492***				
							(3.29)	(3.97)				
RTI_{MT}^{TG}									0.187	0.189*		
									(1.53)	(1.77)		
RTI_{MT}^{ATG}											0.282**	0.279**
											(2.22)	(2.57)
$Illiq_{t-1}$	6.797***	22.85***	6.739***	22.80***	6.812***	22.86***	6.468***	22.50***	6.874***	22.93***	6.785***	22.83***
	(6.77)	(14.30)	(6.70)	(14.27)	(6.73)	(14.28)	(6.41)	(14.06)	(6.79)	(14.35)	(6.73)	(14.30)
$LogTNA_{t-1}$	-14.25***	-13.76***	-14.18***	-13.68***	-14.20***	-13.73***	-13.65***	-13.15***	-14.22***	-13.73***	-14.06***	-13.58***
	(-3.66)	(-3.54)	(-3.64)	(-3.52)	(-3.64)	(-3.53)	(-3.51)	(-3.38)	(-3.64)	(-3.54)	(-3.61)	(-3.50)
$LogAge_{t-1}$	30.88**	19.79*	30.91**	19.84*	30.89**	19.86*	30.21**	19.13*	30.85**	19.79*	30.60**	19.56*
	(2.75)	(1.94)	(2.76)	(1.94)	(2.76)	(1.94)	(2.70)	(1.87)	(2.75)	(1.94)	(2.73)	(1.92)
$ExpRatio_{t-1}$	-65.87***	-82.12***	-66.45***	-82.63***	-65.63***	-81.71***	-67.70***	-83.74***	-65.52***	-81.70***	-66.34***	-82.38***
	(-4.06)	(-5.11)	(-4.08)	(-5.14)	(-4.05)	(-5.08)	(-4.19)	(-5.21)	(-4.04)	(-5.08)	(-4.07)	(-5.12)
$Turnover_{t-1}$	-0.708**	-0.671**	-0.706**	-0.669**	-0.704**	-0.669**	-0.681**	-0.643**	-0.711**	-0.675**	-0.703**	-0.667**
	(-2.56)	(-2.65)	(-2.56)	(-2.64)	(-2.55)	(-2.64)	(-2.47)	(-2.54)	(-2.58)	(-2.66)	(-2.55)	(-2.63)
$Flow_{t-1}$	5.116***	4.499***	5.096***	4.479***	5.131***	4.516***	5.113***	4.499***	5.120***	4.504***	5.113***	4.498***
	(5.31)	(5.63)	(5.29)	(5.60)	(5.32)	(5.65)	(5.30)	(5.63)	(5.31)	(5.64)	(5.30)	(5.63)
Style FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	No	Fund	No	Fund	No	Fund	No	Fund	No	Fund	No
Observations	109,677	109,677	109,677	109,677	109,677	109,677	109,677	109,677	109,677	109,677	109,677	109,677
Adjusted R^2	0.024	0.026	0.024	0.026	0.024	0.026	0.024	0.026	0.024	0.026	0.024	0.026

Panel B: Evidence from the Fama-Macbeth regressions

	(1)	(2)	(3)	(4)	(5)	(6)
RTI_K^{TG}	0.641					
	(1.56)					
RTI_K^{ATG}		1.221**				
		(2.23)				
RTI_{CW}^{TG}			0.819*			
			(1.69)			
RTI_{CW}^{ATG}				1.939**		
				(3.21)		
RTI_{MT}^{TG}					0.848	
					(1.64)	
RTI_{MT}^{ATG}						1.233**
						(2.22)
$Illiq_{t-1}$	21.93**	20.97**	22.15**	20.97**	21.72**	21.11**
	(2.13)	(2.07)	(2.14)	(2.05)	(2.10)	(2.07)
$LogTNA_{t-1}$	-14.03	-14.07	-14.13	-12.04	-13.65	-13.22
	(-0.52)	(-0.52)	(-0.53)	(-0.44)	(-0.50)	(-0.49)
$LogAge_{t-1}$	26.84	27.98	28.10	27.72	25.65	25.57
	(0.45)	(0.47)	(0.47)	(0.47)	(0.43)	(0.43)
$ExpRatio_{t-1}$	-71.56	-80.11	-73.18	-84.40	-70.52	-73.05
	(-0.69)	(-0.77)	(-0.71)	(-0.83)	(-0.67)	(-0.70)
$Turnover_{t-1}$	-1.315	-1.229	-1.387	-1.316	-1.379	-1.302
	(-0.63)	(-0.60)	(-0.68)	(-0.64)	(-0.67)	(-0.63)
$Flow_{t-1}$	18.43**	18.21**	18.45**	18.33**	18.57**	18.38**
	(2.76)	(2.72)	(2.80)	(2.79)	(2.80)	(2.78)
Observations	36,569	36,569	36,569	36,569	36,569	36,569

Table VIII. *RTI* persistence, regression analysis.

This table shows the relationship between this-quarter and past-quarter values of *RTI*. The other variables are defined as follows. *Alpha* is the fund's net return in excess of the return predicted by the four-factor model (MKT, SMB, HML, and MOM) in which the factor loadings are estimated over the 36 months preceding the observation period. *Illiq* is the weighted average of the stock-level illiquidity percentile rank computed across all the equity holdings of the fund's portfolio at the end of the observation period, *LogTNA* is the natural logarithm of the fund TNA measured in millions USD, *LogAge* is the natural logarithm of the age of the fund's oldest shareclass measured in years, *ExpRatio* is the TNA-weighted average of the annual expense ratios of the fund's shareclasses, *Turnover* is the fund's equity turnover ratio as reported by Morningstar, *Flow* is the ratio of the fund's excess TNA (computed as the difference between the fund's actual TNA and the TNA that would result if all the capital earned by the fund over the period were reinvested in the fund) in the observation period to the fund's actual TNA in the previous period. The coefficients for *Alpha*, *Return*, *Illiq*, *LogTNA*, *LogAge*, *ExpRatio*, *Turnover*, and *Flow* are scaled by 10^3. T-statistics are reported in parentheses. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

	(1) $RTI_{K,t}^{TG}$	(2) $RTI_{K,t}^{ATG}$	(3) $RTI_{CW,t}^{TG}$	(4) $RTI_{CW,t}^{ATG}$	(5) $RTI_{MT,t}^{TG}$	(6) $RTI_{MT,t}^{ATG}$	(7) $RTI_{K,t}^{TG}$	(8) $RTI_{K,t}^{ATG}$	(9) $RTI_{CW,t}^{TG}$	(10) $RTI_{CW,t}^{ATG}$	(11) $RTI_{MT,t}^{TG}$	(12) $RTI_{MT,t}^{ATG}$
$RTI_{K,t-1}^{TG}$	0.0910***						0.0889***					
	(10.56)						(18.33)					
$RTI_{K,t-1}^{ATG}$		0.0797***						0.0780***				
		(9.16)						(16.69)				
$RTI_{CW,t-1}^{TG}$			0.0960***						0.0945***			
			(11.24)						(19.95)			
$RTI_{CW,t-1}^{ATG}$				0.0902***						0.0891***		
				(12.14)						(19.08)		
$RTI_{MT,t-1}^{TG}$					0.0812***						0.0798***	
					(9.88)						(16.15)	
$RTI_{MT,t-1}^{ATG}$						0.0717***						0.0703***
						(10.29)						(14.89)
$Alpha_{t-1}$	-0.0683	-0.0353	0.110	0.138	0.0172	0.109	-0.0799	-0.0491	0.0890	0.127	0.00292	0.0937
	(-0.51)	(-0.26)	(0.89)	(1.17)	(0.12)	(0.74)	(-0.67)	(-0.43)	(0.85)	(1.26)	(0.02)	(0.81)
$Return_{t-1}$	0.0726	0.0981	0.0167	-0.0282	0.0283	0.0592	0.0816	0.105	0.0254	-0.0228	0.0341	0.0650
	(0.81)	(1.11)	(0.21)	(-0.37)	(0.32)	(0.67)	(1.01)	(1.36)	(0.36)	(-0.33)	(0.42)	(0.83)
$Illiq_{t-1}$	1.131***	1.133***	1.164***	1.142***	1.113***	1.044***	1.168***	1.163***	1.307***	1.169***	1.187***	1.118***
	(14.72)	(14.82)	(14.45)	(14.89)	(13.70)	(14.27)	(14.22)	(14.80)	(18.18)	(16.68)	(14.46)	(14.06)
$LogTNA_{t-1}$	-1.042***	-1.015***	-1.422***	-1.593***	-1.396***	-1.446***	-1.027***	-1.006***	-1.412***	-1.590***	-1.389***	-1.440***
	(-4.14)	(-4.01)	(-5.83)	(-6.74)	(-5.53)	(-5.68)	(-5.22)	(-5.34)	(-8.21)	(-9.48)	(-7.06)	(-7.55)
$LogAge_{t-1}$	1.013*	0.445	1.285**	1.510**	1.637**	1.949**	0.998*	0.445	1.239**	1.535***	1.618**	1.933***
	(1.65)	(0.74)	(2.22)	(2.61)	(2.64)	(3.07)	(1.95)	(0.91)	(2.78)	(3.53)	(3.17)	(3.91)
$ExpRatio_{t-1}$	0.749***	0.791***	0.713***	0.662***	0.796***	0.822***	0.681***	0.720***	0.646***	0.605***	0.731***	0.750***
	(7.58)	(7.87)	(7.69)	(7.34)	(7.80)	(8.00)	(8.39)	(9.28)	(9.12)	(8.77)	(9.02)	(9.55)
$Turnover_{t-1}$	-0.928**	-0.931**	-0.904**	-1.436**	-1.087**	-1.143**	-1.022**	-1.047**	-1.001**	-1.525***	-1.183**	-1.249**
	(-2.69)	(-2.72)	(-2.15)	(-2.83)	(-2.99)	(-2.90)	(-2.02)	(-2.16)	(-2.27)	(-3.54)	(-2.34)	(-2.55)
$Flow_{t-1}$	0.194	-0.175	2.308*	1.324	0.615	0.300	0.103	-0.256	2.193**	1.260	0.517	0.197
	(0.27)	(-0.30)	(1.78)	(1.60)	(0.81)	(0.43)	(0.11)	(-0.27)	(2.56)	(1.51)	(0.53)	(0.21)
Style FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No	No
Observations	34,131	34,131	34,131	34,131	34,131	34,131	34,131	34,131	34,131	34,131	34,131	34,131
Adjusted R^2	0.044	0.045	0.052	0.052	0.041	0.042	0.046	0.046	0.053	0.053	0.042	0.043

Table IV. *RTI* persistence, transition frequencies.

This table examines transition frequencies between the past and the present *RTI*. Funds are split into quintiles by *RTI* in the current and the future period. Panel A (Panel B) shows the results for the quarterly (annual) horizon. The first figure at the intersection of row *r* and column *c* shows how many funds moved from quintile *r* to quintile *c* in the indicated period. The second figure in the cell shows the probability that a fund from quintile *r* would move to quintile *c*.

Panel A: Transition matrices for *RTI* quintiles (1 quarter)

$RTI_{K,t-1}^{TG}$	$RTI_{K,t}^{TG}$					
	1	2	3	4	5	Total
1	5,081	4,286	3,400	2,518	1,382	16,667
	30.50%	25.70%	20.40%	15.10%	8.30%	100.00%
2	4,344	4,005	3,486	2,540	1,530	15,905
	27.30%	25.20%	21.90%	16.00%	9.60%	100.00%
3	3,372	3,425	3,285	3,060	1,934	15,076
	22.40%	22.70%	21.80%	20.30%	12.80%	100.00%
4	2,504	2,611	2,970	2,988	2,352	13,425
	18.70%	19.40%	22.10%	22.30%	17.50%	100.00%
5	1,342	1,495	1,941	2,376	3,184	10,338
	13.00%	14.50%	18.80%	23.00%	30.80%	100.00%
Total	16,643	15,822	15,082	13,482	10,382	71,411
	23.30%	22.20%	21.10%	18.90%	14.50%	100.00%

$RTI_{K,t-1}^{ATG}$	$RTI_{K,t}^{ATG}$					
	1	2	3	4	5	Total
1	5,066	4,302	3,389	2,499	1,441	16,697
	30.30%	25.80%	20.30%	15.00%	8.60%	100.00%
2	4,374	4,080	3,381	2,635	1,611	16,081
	27.20%	25.40%	21.00%	16.40%	10.00%	100.00%
3	3,327	3,345	3,399	2,982	1,840	14,893
	22.30%	22.50%	22.80%	20.00%	12.40%	100.00%
4	2,663	2,670	2,900	2,923	2,276	13,432
	19.80%	19.90%	21.60%	21.80%	16.90%	100.00%
5	1,375	1,546	1,890	2,371	3,126	10,308
	13.30%	15.00%	18.30%	23.00%	30.30%	100.00%
Total	16,805	15,943	14,959	13,410	10,294	71,411
	23.50%	22.30%	20.90%	18.80%	14.40%	100.00%

$RTI_{CW,t-1}^{TG}$	$RTI_{CW,t}^{TG}$					
	1	2	3	4	5	Total
1	5,714	4,374	3,243	2,326	1,309	16,966
	33.70%	25.80%	19.10%	13.70%	7.70%	100.00%
2	4,440	3,911	3,413	2,743	1,526	16,033
	27.70%	24.40%	21.30%	17.10%	9.50%	100.00%
3	3,134	3,437	3,414	2,958	1,828	14,771
	21.20%	23.30%	23.10%	20.00%	12.40%	100.00%
4	2,366	2,663	3,003	3,043	2,348	13,423
	17.60%	19.80%	22.40%	22.70%	17.50%	100.00%
5	1,317	1,539	1,835	2,374	3,153	10,218
	12.90%	15.10%	18.00%	23.20%	30.90%	100.00%
Total	16,971	15,924	14,908	13,444	10,164	71,411
	23.80%	22.30%	20.90%	18.80%	14.20%	100.00%

$RTI_{CW,t-1}^{ATG}$	$RTI_{CW,t}^{ATG}$					
	1	2	3	4	5	Total
1	5,535	4,372	3,344	2,363	1,276	16,890
	32.80%	25.90%	19.80%	14.00%	7.60%	100.00%
2	4,403	4,047	3,352	2,642	1,549	15,993
	27.50%	25.30%	21.00%	16.50%	9.70%	100.00%
3	3,333	3,363	3,375	2,990	1,843	14,904
	22.40%	22.60%	22.60%	20.10%	12.40%	100.00%
4	2,394	2,720	2,958	2,991	2,297	13,360
	17.90%	20.40%	22.10%	22.40%	17.20%	100.00%
5	1,319	1,574	1,924	2,297	3,150	10,264
	12.90%	15.30%	18.70%	22.40%	30.70%	100.00%
Total	16,984	16,076	14,953	13,283	10,115	71,411
	23.80%	22.50%	20.90%	18.60%	14.20%	100.00%

$RTI_{MT,t-1}^{TG}$	$RTI_{MT,t-1}^{TG}$					
	1	2	3	4	5	Total
1	5,007	4,281	3,470	2,528	1,386	16,672
	30.00%	25.70%	20.80%	15.20%	8.30%	100.00%
2	4,288	4,047	3,415	2,733	1,597	16,080
	26.70%	25.20%	21.20%	17.00%	9.90%	100.00%
3	3,411	3,405	3,368	3,013	1,967	15,164
	22.50%	22.50%	22.20%	19.90%	13.00%	100.00%
4	2,588	2,685	2,910	2,880	2,232	13,295
	19.50%	20.20%	21.90%	21.70%	16.80%	100.00%
5	1,346	1,622	1,944	2,242	3,046	10,200
	13.20%	15.90%	19.10%	22.00%	29.90%	100.00%
Total	16,640	16,040	15,107	13,396	10,228	71,411
	23.30%	22.50%	21.20%	18.80%	14.30%	100.00%

$RTI_{MT,t-1}^{ATG}$	$RTI_{MT,t}^{ATG}$					
	1	2	3	4	5	Total
1	4,922	4,298	3,371	2,564	1,478	16,633
	29.60%	25.80%	20.30%	15.40%	8.90%	100.00%
2	4,220	3,860	3,537	2,757	1,580	15,954
	26.50%	24.20%	22.20%	17.30%	9.90%	100.00%
3	3,475	3,473	3,391	2,969	1,826	15,134
	23.00%	22.90%	22.40%	19.60%	12.10%	100.00%
4	2,639	2,748	2,950	2,867	2,268	13,472
	19.60%	20.40%	21.90%	21.30%	16.80%	100.00%
5	1,405	1,566	1,915	2,348	2,984	10,218
	13.80%	15.30%	18.70%	23.00%	29.20%	100.00%
Total	16,661	15,945	15,164	13,505	10,136	71,411
	23.30%	22.30%	21.20%	18.90%	14.20%	100.00%

Panel B: Transition matrices for *RTI* quintiles (1 year)

$RTI_{K,t-4}^{TG}$	$RTI_{K,t}^{TG}$					
	1	2	3	4	5	Total
1	4,624	3,746	3,076	2,350	1,263	15,059
	30.70%	24.90%	20.40%	15.60%	8.40%	100.00%
2	3,787	3,538	3,069	2,434	1,411	14,239
	26.60%	24.80%	21.60%	17.10%	9.90%	100.00%
3	2,941	3,139	3,143	2,679	1,726	13,628
	21.60%	23.00%	23.10%	19.70%	12.70%	100.00%
4	2,167	2,423	2,657	2,597	2,080	11,924
	18.20%	20.30%	22.30%	21.80%	17.40%	100.00%
5	1,235	1,386	1,685	2,068	2,745	9,119
	13.50%	15.20%	18.50%	22.70%	30.10%	100.00%
Total	14,754	14,232	13,630	12,128	9,225	63,969
	23.10%	22.20%	21.30%	19.00%	14.40%	100.00%

$RTI_{K,t-4}^{ATG}$	$RTI_{K,t}^{ATG}$					
	1	2	3	4	5	Total
1	4,424	3,878	3,207	2,308	1,233	15,050
	29.40%	25.80%	21.30%	15.30%	8.20%	100.00%
2	3,844	3,514	3,117	2,513	1,486	14,474
	26.60%	24.30%	21.50%	17.40%	10.30%	100.00%
3	3,076	3,007	3,034	2,586	1,687	13,390
	23.00%	22.50%	22.70%	19.30%	12.60%	100.00%
4	2,245	2,470	2,546	2,612	2,073	11,946
	18.80%	20.70%	21.30%	21.90%	17.40%	100.00%
5	1,296	1,441	1,595	2,131	2,646	9,109
	14.20%	15.80%	17.50%	23.40%	29.00%	100.00%
Total	14,885	14,310	13,499	12,150	9,125	63,969
	23.30%	22.40%	21.10%	19.00%	14.30%	100.00%

$RTI_{CW,t-4}^{TG}$	$RTI_{CW,t}^{TG}$					
	1	2	3	4	5	Total
1	5,059	3,859	2,865	2,243	1,193	15,219
	33.20%	25.40%	18.80%	14.70%	7.80%	100.00%
2	3,854	3,494	3,215	2,498	1,365	14,426
	26.70%	24.20%	22.30%	17.30%	9.50%	100.00%
3	2,848	3,087	3,003	2,712	1,610	13,260
	21.50%	23.30%	22.60%	20.50%	12.10%	100.00%
4	2,202	2,402	2,590	2,679	2,072	11,945
	18.40%	20.10%	21.70%	22.40%	17.30%	100.00%
5	1,176	1,406	1,674	2,084	2,779	9,119
	12.90%	15.40%	18.40%	22.90%	30.50%	100.00%
Total	15,139	14,248	13,347	12,216	9,019	63,969
	23.70%	22.30%	20.90%	19.10%	14.10%	100.00%

$RTI_{CW,t-4}^{ATG}$	$RTI_{CW,t}^{ATG}$					
	1	2	3	4	5	Total
1	5,007	3,938	2,907	2,119	1,180	15,151
	33.00%	26.00%	19.20%	14.00%	7.80%	100.00%
2	3,864	3,554	3,131	2,486	1,390	14,425
	26.80%	24.60%	21.70%	17.20%	9.60%	100.00%
3	2,940	2,982	3,080	2,661	1,696	13,359
	22.00%	22.30%	23.10%	19.90%	12.70%	100.00%
4	2,167	2,456	2,625	2,683	2,022	11,953
	18.10%	20.50%	22.00%	22.40%	16.90%	100.00%
5	1,237	1,399	1,736	2,000	2,709	9,081
	13.60%	15.40%	19.10%	22.00%	29.80%	100.00%
Total	15,215	14,329	13,479	11,949	8,997	63,969
	23.80%	22.40%	21.10%	18.70%	14.10%	100.00%

$RTI_{MT,t-4}^{TG}$	$RTI_{MT,t-1}^{TG}$					
	1	2	3	4	5	Total
1	4,456	3,864	3,035	2,447	1,302	15,104
	29.50%	25.60%	20.10%	16.20%	8.60%	100.00%
2	3,769	3,447	3,192	2,509	1,464	14,381
	26.20%	24.00%	22.20%	17.40%	10.20%	100.00%
3	3,044	3,045	3,063	2,680	1,765	13,597
	22.40%	22.40%	22.50%	19.70%	13.00%	100.00%
4	2,262	2,436	2,658	2,581	1,955	11,892
	19.00%	20.50%	22.40%	21.70%	16.40%	100.00%
5	1,269	1,458	1,657	1,970	2,641	8,995
	14.10%	16.20%	18.40%	21.90%	29.40%	100.00%
Total	14,800	14,250	13,605	12,187	9,127	63,969
	23.10%	22.30%	21.30%	19.10%	14.30%	100.00%

$RTI_{MT,t-4}^{ATG}$	$RTI_{MT,t}^{ATG}$					
	1	2	3	4	5	Total
1	4,366	3,765	3,147	2,378	1,319	14,975
	29.20%	25.10%	21.00%	15.90%	8.80%	100.00%
2	3,686	3,498	3,185	2,545	1,432	14,346
	25.70%	24.40%	22.20%	17.70%	10.00%	100.00%
3	3,100	3,029	3,032	2,634	1,697	13,492
	23.00%	22.50%	22.50%	19.50%	12.60%	100.00%
4	2,299	2,466	2,626	2,712	2,012	12,115
	19.00%	20.40%	21.70%	22.40%	16.60%	100.00%
5	1,367	1,440	1,699	2,003	2,532	9,041
	15.10%	15.90%	18.80%	22.20%	28.00%	100.00%
Total	14,818	14,198	13,689	12,272	8,992	63,969
	23.20%	22.20%	21.40%	19.20%	14.10%	100.00%

Table X. Relationship between *RTI* and fund management characteristics.

This table shows the results of the regressions of various *RTI* measures on the fund management characteristics and a set of control variables (shown only in Panel A, defined as in Table III). The fund management characteristics are constructed as follows. *Tenure* is calculated as the number of years that the current fund manager has spent with the fund, *FundAffiliation* is calculated as the total number of funds linked to the manager in the observation quarter in Morningstar, *NrManagers* is calculated as the total number of managers linked to the fund in the observation quarter, and *ManagerStyles* calculated as the number of distinct Morningstar styles that the fund manager manages funds in. The coefficients for *Tenure*, *FundAffiliation*, *NrManagers*, *ManagerStyles*, *Illiq*, *LogTNA*, *LogAge*, *ExpRatio*, *Turnover*, and *Flow* are scaled by 10^3. T-statistics are reported in parentheses. * (**, ***) indicates the significance of the correlation coefficient at the 10% (5%, 1%) level.

Panel A: Dependent variable is RTI_K^{TG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.562***				0.393**	0.592***				0.423***
	(3.61)				(2.33)	(5.57)				(3.60)
$FundAffiliation_{t-1}$		-0.680***			-0.399*		-0.666***			-0.388*
		(-5.40)			(-1.67)		(-6.23)			(-1.93)
$NrManagers_{t-1}$			-0.742***		-0.601***			-0.719***		-0.609***
			(-6.77)		(-4.39)			(-6.97)		(-4.57)
$ManagerStyles_{t-1}$				-2.092***	-1.014**				-2.096***	-1.019**
				(-5.75)	(-2.11)				(-7.44)	(-2.59)
$Illiq_{t-1}$	1.352***	1.365***	1.370***	1.429***	1.400***	1.251***	1.286***	1.294***	1.314***	1.281***
	(16.72)	(17.17)	(17.16)	(16.91)	(16.44)	(15.43)	(15.91)	(16.01)	(14.95)	(14.54)
$LogTNA_{t-1}$	-1.061***	-1.048***	-1.045***	-1.058***	-0.935**	-1.072***	-1.061***	-1.058***	-1.070***	-0.939***
	(-3.85)	(-3.80)	(-3.81)	(-3.54)	(-3.12)	(-5.40)	(-5.35)	(-5.33)	(-4.90)	(-4.28)
$LogAge_{t-1}$	1.029	1.338*	1.365**	0.892	0.370	1.095**	1.426**	1.452**	0.976*	0.422
	(1.50)	(1.95)	(2.01)	(1.18)	(0.49)	(2.06)	(2.73)	(2.78)	(1.68)	(0.71)
$ExpRatio_{t-1}$	8.537***	8.093***	8.407***	7.171***	7.274***	8.043***	7.608***	7.961***	6.907***	7.032***
	(7.72)	(7.39)	(7.66)	(6.04)	(6.16)	(9.68)	(9.15)	(9.59)	(7.50)	(7.61)
$Turnover_{t-1}$	-0.0389**	-0.0460***	-0.0464***	-0.0423**	-0.0360**	-0.0438***	-0.0509***	-0.0507***	-0.0445**	-0.0379**
	(-2.84)	(-3.30)	(-3.33)	(-2.81)	(-2.43)	(-3.36)	(-3.93)	(-3.91)	(-3.13)	(-2.65)
$Flow_{t-1}$	0.0679	0.0808	0.0639	0.0753	0.0738	0.0634	0.0759*	0.0603	0.0733	0.0727
	(1.33)	(1.58)	(1.25)	(1.33)	(1.30)	(1.55)	(1.86)	(1.48)	(1.62)	(1.60)
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.037	0.037	0.037	0.036	0.038	0.039	0.039	0.039	0.038	0.039

Panel B: Dependent variable is RTI_K^{ATG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.584***				0.503**	0.608***				0.520***
	(3.78)				(2.92)	(5.90)				(4.54)
$FundAffiliation_{t-1}$		-0.642***			-0.318		-0.625***			-0.301
		(-5.06)			(-1.32)		(-6.03)			(-1.54)
$NrManagers_{t-1}$			-0.694***		-0.559***			-0.662***		-0.555***
			(-7.53)		(-4.42)			(-6.62)		(-4.27)
$ManagerStyles_{t-1}$				-1.735***	-0.772				-1.700***	-0.759**
				(-4.93)	(-1.64)				(-6.18)	(-1.98)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.044	0.045	0.045	0.042	0.044	0.046	0.046	0.046	0.044	0.045

Panel C: Dependent variable is RTI_{CW}^{TG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.520***				0.362**	0.528***				0.364***
	(3.66)				(2.33)	(5.71)				(3.55)
$FundAffiliation_{t-1}$		-0.658***			-0.272		-0.641***			-0.272
		(-5.51)			(-1.23)		(-6.90)			(-1.55)
$NrManagers_{t-1}$			-0.815***		-0.706***			-0.788***		-0.716***
			(-8.28)		(-5.76)			(-8.79)		(-6.14)
$ManagerStyles_{t-1}$				-2.196***	-1.169**				-2.120***	-1.085**
				(-6.62)	(-2.74)				(-8.59)	(-3.15)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.041	0.042	0.043	0.042	0.043	0.043	0.044	0.045	0.043	0.045

Panel D: Dependent variable is RTI_{CW}^{ATG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.511***				0.414**	0.528***				0.424***
	(3.62)				(2.58)	(5.86)				(4.20)
$FundAffiliation_{t-1}$		-0.643***			-0.398*		-0.624***			-0.399**
		(-5.35)			(-1.76)		(-6.89)			(-2.31)
$NrManagers_{t-1}$			-0.704***		-0.549***			-0.674***		-0.549***
			(-7.35)		(-4.47)			(-7.72)		(-4.78)
$ManagerStyles_{t-1}$				-1.928***	-0.894**				-1.851***	-0.817**
				(-5.86)	(-1.96)				(-7.63)	(-2.41)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.043	0.044	0.044	0.044	0.045	0.046	0.046	0.046	0.045	0.047

Panel E: Dependent variable is RTI_{MT}^{TG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.495***				0.386**	0.510***				0.400***
	(3.38)				(2.39)	(4.86)				(3.46)
$FundAffiliation_{t-1}$		-0.651***			-0.383		-0.634***			-0.366*
		(-5.08)			(-1.62)		(-6.01)			(-1.85)
$NrManagers_{t-1}$			-0.816***		-0.654***			-0.785***		-0.645***
			(-7.91)		(-4.86)			(-7.70)		(-4.92)
$ManagerStyles_{t-1}$				-2.222***	-1.112**				-2.188***	-1.106**
				(-6.13)	(-2.37)				(-7.88)	(-2.86)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.035	0.036	0.036	0.036	0.037	0.037	0.037	0.038	0.037	0.038

Panel F: Dependent variable is RTI_{MT}^{ATG}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$Tenure_{t-1}$	0.575***				0.543**	0.597***				0.560***
	(3.68)				(3.18)	(5.78)				(4.91)
$FundAffiliation_{t-1}$		-0.646***			-0.426*		-0.625***			-0.414**
		(-5.13)			(-1.82)		(-6.02)			(-2.12)
$NrManagers_{t-1}$			-0.665***		-0.509***			-0.618***		-0.487***
			(-6.41)		(-3.57)			(-6.18)		(-3.76)
$ManagerStyles_{t-1}$				-1.876***	-0.828*				-1.796***	-0.782**
				(-5.23)	(-1.70)				(-6.55)	(-2.05)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Style FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Fund	Fund	Fund	Fund	Fund	No	No	No	No	No
Observations	35,268	35,268	35,268	29,450	29,450	35,268	35,268	35,268	29,450	29,450
Adjusted R^2	0.039	0.040	0.040	0.038	0.039	0.041	0.041	0.041	0.039	0.040

Appendix 1. Examples of articles with distinct tangibility ratios.

Following are the examples of three articles about the General Motors Corporation of about equal size appearing in the same month (January 1999) and the same source (Reuters Newswires) that fall in the top, middle, and bottom tercile, respectively, by news tangibility.

Article 1

Time and date: 12:06, 01/06/1999
Source: Reuters News
Title: GM U.S. December sales post 3.1% gain.

"*General Motors Corp. on Wednesday reported a 3.1 percent increase in total U.S. sales to 407,487 for December, better than analysts expected, but still closed out the year down 3.3 percent.*

GM, Detroit's No. 1 automaker, said monthly car sales, including those of its Saab affiliate, were up 1.9 percent to 216,318. Total truck sales, including medium-duty trucks, were up a surprisingly strong 4.5 percent to 191,169. Analysts had forecast a total decline of as much as 5 percent for December.

GM said its December truck sales, and the 2,150,076 trucks it sold in all of 1998, were both record numbers. Trucks include pickup trucks, sport utilities and minivans. Car sales for the whole year fell 8.6 percent to 2,458,688, in part reflecting two labour strikes in the summer.

Earlier, Toyota Motor Corp., Japan's largest automaker, said its December U.S. vehicle sales jumped 19 percent to 138,720. Sales for all of 1998 hit a record 1,361,025, an increase of 10.6 percent. Toyota's Camry sedan had total 1998 sales of 429,575, making it the best-selling car in the U.S. for the second year in a row.

Honda Motor Co. Ltd. reported a December U.S. vehicle sales gain of 6.3 percent to 83,936. Sales for the year rose 7.4 percent to 1,009,600 units.

On Tuesday, Ford Motor Co. reported light vehicle sales increased 6.8 percent to 320,290. DaimlerChrysler AG said sales for all brands except Mercedes-Benz rose 6.9 percent to 203,325."

This article has a tangibility ratio of 9.37% (112 / 1195)

Article 2

Time and date: 10:35, 01/19/1999
Source: Reuters News
Title: Russian AvtoVAZ carmaker still in talks with GM.

"*Russia's largest carmaker AvtoVAZ said Tuesday that revised plans for joint production with General Motors Corp. were still being hammered out since Russia's severe economic crisis took hold last August.*

AvtoVAZ's chief engineer Vladimir Presipkinsky told journalists that negotiations were under way on a proposal to organise joint production of the Opel-Astra T3000 in Russia. He said GM subsidiary Adam Opel had proposed that the vehicles be produced using equipment that is to be eliminated from U.S. and European assembly lines by 2005.

Presipkinsky said initial plans called for production of about 150,000 vehicles with output gradually changing over to a Russian model. He said such a joint venture would require equal investments from GM and AvtoVAZ but that a decision on the deal could not be made until a business plan had been completed. "The financial viability of producing such a vehicle in Russia will be the deciding factor," Presipkinsky said.

AvtoVAZ and GM had previously planned kit assembly of Opel vehicles but the start of the crisis last August prompted both parties to rethink the deal, AvtoVAZ officials said. AvtoVAZ is Russia's largest carmaker, but last year saw company output fall from a planned 747,000 units to just 598,000 with 90,000 cars unsold by year's end. Company officials said that in 1999 AvtoVAZ had set its production target at 657,400 cars, including 118,000 for export. Its main marques are the Niva four-wheel drive and the Samara saloon car. "

This article has a tangibility ratio of 3.75% (47 / 1253)

Article 3

Time and date: 18:16, 01/22/1999
Source: Reuters News
Title: GM will introduce parking technology on 2000 DeVille.

"*General Motors Corp. said on Friday that it will offer a new type of parking technology on its 2000 model-year Cadillac DeVille cars to help drivers avoid stray shopping carts or other parking hazards.*

The ultrasonic rear park assist technology is designed to help drivers park their vehicles while in reverse, using both audio and visual cues that convey the closeness of objects behind the vehicle, GM said in a press release. The visual display uses three light-emitting diodes, working in concert with an audio chime system to alert the driver to potential hazards. It is the second new technology GM will offer on its next-generation full-size Cadillac sedan, following a thermal-imaging night-vision system. "Whereas Night Vision will help drivers see farther ahead than they ever could see with just their headlights, our new Ultrasonic Rear Parking Assist will allow them to 'see' potential obstacles behind them during parking manoeuvres, such as a sign post or a shopping cart," Cadillac general manager John F. Smith said. The parking technology, developed by German electrical engineering group Robert Bosch GmbH , uses four sensors on the car's rear fascia that send out ultrasonic waves when the car is in reverse. The sensors pick up the echo of a signal when it bounces off an object and determines distance to the object. The system only operates at up to three miles an hour."

This article has a tangibility ratio of 0.35% (4 / 1147)