KTH ROYAL INSTITUTE
OF TECHNOLOGY

Department of
Industrial Economics and Management
Electronic Working Paper Series

Paper no: 2016/13

The origin of outperformance for stock recommendations by sell-side analysts

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08-04-2016

The origin of outperformance for stock recommendations by sell-side analysts

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Abstract

We examine the structure of portfolios built on sell-side analysts' recommendations and show that those portfolios' abnormal returns are explained primarily by the analysts' stock picking ability and only partially by the effect of overweight in small-cap stocks, given that more than 80% of the studied portfolios are concentrated in the three smallest Size Deciles. We document the portfolios' abnormal returns by examining the number of stocks in the portfolios and the weights assigned to market-cap Size Deciles and Global Industry Classification Standard (GICS) sectors and perform an attribution analysis that allows us to identify the sources of overall value-added performance. We find that the average monthly added value of 0.46 (0.34) percent obtained on Strong Buy and Buy recommendations from Stars (Non-Stars) is primarily explained by the analysts' intra-sector stock-picking skills and that the monthly added value of 0.16 (0.18) percent obtained from Stars (Non-Stars) is related to the portfolios' allocation among size-specific deciles.

Keywords: Alpha, Sell-side analyst recommendations, Attribution analysis, StarMine, Institutional Investor, The Wall Street Journal

JEL Classification Numbers: G11, G23, G24

March 18th, 2016

Acknowledgement

This research was conducted as part of the EMJD Programme European Doctorate in Industrial Management (EDIM). Yury O. Kucheev thanks the Swedish Bank Research Foundation, which funded this part of his PhD project. All errors are the responsibility of the authors. We thank Per Thulin, Björn Hagströmer, Monia Lougui, Gregg Vanourek, Ed Saiedi and seminar participants at the KTH- Royal Institute of Technology for their valuable comments. This research was performed during Tomas Sorensson's time as a research fellow at the Swedish House of Finance, Stockholm School of Economics, which is gratefully acknowledged.

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1 Introduction

An investment portfolio's performance can be explained in terms of both selection and allocation effects. In this research, we measure whether the outperformance of portfolios constructed using sell-side analysts' recommendations previously reported in the academic literature is caused by the analysts' selection skills or their allocation skills. We focus on the structure of portfolios constructed using investment recommendations from sell-side analysts. There is limited discussion in the extant literature about the actual structure of the dynamic portfolios used in research and how the observed abnormal returns are explained by the portfolios' holdings, which is surprising considering the number of studies showing that a portfolio constructed by investing one dollar in each new Strong Buy and Buy recommendation generates significant abnormal returns. Additionally, it is important for investors to understand which type of portfolio output they can expect if they follow analysts' recommendations. Knowing a portfolio's content also helps in assessing which classes of stocks are recommended, their contribution to the portfolio's risk and return, and how the portfolio is positioned in relation to the market portfolio.

Our study fills a gap between earlier research showing high abnormal returns for dynamic portfolios constructed using sell-side analysts' recommendations and the lack of detailed knowledge about the actual content of these portfolios. We conduct a holdings-based analysis that allows us to compare the size and market sector weights in the dynamic portfolios for Star analysts and for Non-Star analysts within the overall market structure.

Literature on the investment value of recommendations from sell-side analysts documents the likelihood of generating excess returns by constructing a dynamic portfolio based on analysts' recommendations (Barber et al., 2006, 2007; Fang and Yasuda, 2014; Kucheev et al., 2015). These studies reported not only high abnormal returns found to be linked to overall firm-level or analyst-group characteristics but also the statistical features of the database used and recommendations (such as the frequency and the magnitude of recommendation levels and recommendation changes and the timing of recommendations). However, the actual portfolio holdings obtained by following the dynamic portfolio methodologies used by academics remain uninvestigated. Focusing on actual holdings enables an exploration of whether the overall portfolio's performance is driven by analysts' stock-picking skills (the selection effect) or by an overweight in either sectors that are more profitable or size-specific market deciles (the allocation effect).

Although most researchers attempt to measure stock-picking skill, the sector rotation (market timing) in constructed portfolios is not a conscious decision by analysts but instead an artifact of the methodology and/or nature of the market explained by analysts' attention to a particular sector or size-specific market decile. Analysts do have a choice of stocks within the market size

in which they recommend stocks to invest in; however, the portfolio sector weights that we investigate are driven by the number of analysts who follow the sector and the frequency of recommendation changes for the sector. Thus, it is important to clarify the extent to which outperformance is explained by the selection and allocation effects to discuss whether analysts possess any significant stock-picking skills that allow them to beat industry- and size-specific benchmarks.

Our study investigates the source of the abnormal returns reported in a large number of studies performed on the investment value of analysts' stock recommendations by focusing on the actual stock holdings in the constructed portfolios used in these studies. Our primary methodological approach is that of an attribution analysis based on holdings that reveals how value-added performance is attributed to analysts' stock selection and market-timing skills.

We expect this study to be of interest to both academics and practitioners. From an academic perspective, our study contributes to a deeper understanding of how the abnormal returns of portfolios constructed based on analysts' recommendations are obtained. From an investor's perspective, our research strengthens our knowledge about analysts' ratings, the investment value of their recommendations and the portfolio characteristics that will result from their advice. Finally, for sell-side analysts, our research provides decision support for making better recommendations in terms of understanding the importance of choice of industry and size of recommended firms.

Our study uses investment recommendations from The Thomson Financials Institutional Brokers' Estimate System (I/B/E/S) *Detail Recommendations File* and manually collected lists of star analysts from *Institutional Investor* magazine (October 2003-October 2013), *The Wall Street Journal* (May 2003-April 2013), and *StarMine* (October 2003-August 2013). We follow the methodology of Barber et al. (2006) and construct portfolios based on the recommendations of Star and Non-Star analysts by investing one dollar into each new recommendation (excluding reiterations) and then holding the stocks either for one year or until the recommendation changes, whichever comes first.

First, we investigate how recommendation-based portfolio holdings differ from the market capitalization-weighted portfolio (the benchmark). We find that portfolios constructed on sell-side analysts' recommendations have significantly different market sector weights than that of a capitalization-weighted benchmark portfolio. Our attribution analysis reveals that these differences in investment weights partially explain the observed outperformance. This finding emphasizes the importance of both a holdings-based analysis and a returns-based analysis.

Second, we apply a returns-based analysis and compare the performance of constructed portfolios with the Center for Research in Security Prices' (CRSP) market-capitalization-weighted portfolio (a portfolio of all assets traded on NYSE, AMEX and NASDAQ and whose returns' time-series are included in the CRSP database). In doing so, we also compare portfolios constructed based on the recommendations of Star analysts with portfolios constructed based on the recommendations of Non-Star analysts. Analysis of market-adjusted returns and risk-adjusted returns (alphas) shows that Long portfolios (that include Strong Buy and Buy recommendations) based on both Stars' and Non-Stars' recommendations outperformed the market during the study period. Stars had a monthly alpha of 0.34 percent for their Long portfolio, thus outperforming the alpha of 0.20 for the Non-Stars Long portfolio (all of the values and the difference between Long portfolios are statistically significant). Returns for Short (including Sell and Strong Sell recommendations) portfolios were significant for Non-Stars and insignificant for Stars, whereas the difference between the Short portfolios of Stars and Non-Stars was insignificant. The total and idiosyncratic risk for Stars' portfolios was lower than for Non-Star's portfolios.

Third, we implement a holdings-based analysis for ten GICS Sectors (Global Industry Classification Standards). We find that sector-specific returns for Long portfolios of Stars and Non-Stars were higher in all CRSP sectors (significantly higher in seven (five) sectors for Stars (Non-Stars)). An attribution analysis shows that the outperformance comes from the selection effect, explaining how well analysts select stocks within GICS Sectors, whereas the allocation effect was trivial for Non-Stars and was significant (but small) for Stars.

Fourth, we also implement a holdings-based analysis for CRSP market-cap Size Deciles, finding that constructed portfolios are heavily loaded with small stocks, having approximately 40 percent invested in the smallest decile and approximately 80 percent invested in the three smallest deciles. Stars performed significantly better than Non-Stars for the smallest decile, whereas Non-Stars achieved higher returns in the largest decile (for the largest stocks, the differences from the market and among groups were insignificant). The excess returns were primarily attributed to allocation skills because a significant portion of the excess returns (approximately 0.17 percentage points for both Long and Short portfolios of Stars and Non-Stars) was caused by the allocation effect and may be explained by the fact that the constructed portfolios had more weight in small stocks, thus leading to overall above-market performance.

In summary, our results show that abnormal returns in the investigated portfolios are primarily driven by the analysts' choice of small-cap stocks and by their ability to outperform sector-specific benchmarks. These results confirm that analysts possess substantial stock-picking skills. We show that the constructed portfolios for Star versus Non-Star analysts'

recommendations differ substantially in regard to weights and returns in different sectors and Size Deciles, thus explaining the difference in alphas. Finally, our paper provides a link between alphas documented in several studies of recommendations issued by analysts and the content of the constructed portfolios. To our knowledge, this is the first study to conduct such an in-depth investigation of the portfolios used in academic research showing high abnormal returns given that we have shown the content of constructed portfolios. We conclude that it is possible for investors to obtain returns close to these high abnormal returns by following the recommendations of sell-side analysts. However, large institutional investors may find it difficult to follow closely such portfolios because of the liquidity and supply of the small stocks that dominate our recommendation-based portfolios.

The remainder of this paper is organized as follows. Section 1 continues with a literature review. In section 2, data and descriptive statistics are given. Section 3 contains the results, and section 4 summarizes our findings and discusses their implications.

1.1 Related literature

In this section, we first discuss two main methodologies applied for measuring investment value in the academic literature and the findings obtained using these methods. Second, we identify the gap in the existing literature and propose how to fill this gap.

To test the profitability of sell-side analysts' recommendations, the literature has adopted two methodological approaches. The first method employs the event-study approach and discusses the cumulative abnormal returns obtained by individual recommendations (Booth et al., 2014; Desai et al., 2000; Jegadeesh et al., 2004; Loh, 2010; Womack, 1996). In the second method, dynamic portfolios are built according to either individual or consensus recommendations from various groups of analysts; next, the returns on such portfolios are compared both among one another and with overall market performance (Barber et al., 2001, 2006; Fang and Yasuda, 2014; Kucheev et al., 2015).

1.1.1 Event-study methodology – cumulative abnormal returns

The first method either measures the impact of individual recommendations on future returns or tests how future returns depend on the previous characteristics of a recommended firm or analyst. This method requires multiple benchmarks for comparing individual returns to obtain cumulative abnormal returns for overall statistics. The primary drawback of an event-study with respect to measuring the performance of recommendations is the absence of a uniform post-event period for all recommendations. This non-uniform time period is caused by the nature of the recommendation issuance because the recommendations are provided throughout the year at

various frequencies for firms of various sizes and sector groups. A new event, i.e., either a recommendation change or a new recommendation at the same level as the previous one, can occur within a short period of time and interfere when testing the effects of recommendations.

The research shows that analyst recommendations are followed by a significant price reaction and that the documented price reaction gives an opportunity for excess returns that are generated by following the recommendations (Desai et al., 2000; Jegadeesh et al., 2004; Loh, 2010; Womack, 1996). At the same time, it is important to understand which recommendations generate higher returns in the post-announcement period. Jegadeesh et al. (2004) find that analysts prefer high momentum stocks and growth stocks when issuing recommendations. The stocks that receive more favorable recommendations by analysts typically have higher trading volume, more positive price momentum, higher past and projected growth, more positive accounting accruals and more aggressive capital expenditures. Using the study findings for investment purposes (Jegadeesh et al., 2004), the results suggest that analyst recommendations play a dual role in the price-formation process. On the one hand, analysts overweight growth and glamour stocks in their recommendations. On the other hand, analyst recommendations can be incrementally useful in return predictions because the change in the consensus recommendation has a significant ability to forecast near-term (three to 12 months) cross-sectional returns.

Desai et al. (2000) have investigated the investment value of recommendations published following a pull-out survey of *The Wall Street Journal*'s star analysts. The authors measured the cumulative abnormal returns over various holding periods and found that star analysts' recommendations outperform industry- and size-specific benchmarks, not only for small-cap stocks, but also for large-cap stocks. The median recommendation in their sample was issued for a large company with higher-than-average beta, high P/E, and high M/B ratios, which implies that *The Wall Street Journal* star analysts followed a momentum/growth strategy in the period studied (1993-1996).

1.1.2 Portfolio methodology — returns on constructed portfolios

In the second method (constructed portfolios), the overall group performance is attributed to the group's characteristics and the estimated returns of a group's portfolio are matched against a particular benchmark (usually against the overall market performance). In contrast to the event study, using this constructed portfolio approach avoids all problems related to the timing of subsequent recommendations and enables the use of testing strategies that are closer to the strategies used by investors. Simultaneously, it is difficult to disentangle the individual analyst effects in this type of portfolio construction. In our study, we follow this approach and construct portfolios based on the recommendations of two groups of analysts: Stars and Non-Stars.

Barber et al. (2001, 2003, 2006, 2007) have primarily constructed portfolios based on a buy-and-hold strategy. In their early papers, those authors separated firms into portfolios based on the estimated consensus recommendation for each firm (Barber et al., 2001, 2003). In their later papers, they designed a method for measuring the investment value of recommendations; the stock was included in the portfolio at the end of the announcement day or at the next trading day for recommendations that were issued on a non-trading days, and was kept for either (approximately) one year or until the recommendation was changed (Barber et al., 2006, 2007, 2010). Barber et al. (2006) have found that the buy recommendations of brokers who are less inclined to issue buys significantly outperformed those of brokers with the greatest percentage of buy recommendations. Conversely, downgrades to hold or sell made by the brokers who issue the fewest buy recommendations significantly underperform downgrades made by the brokers who issue the most buy recommendations.

Barber et al. (2007) compare the performance of recommendations issued by analysts at investment banks with those prepared by analysts employed by independent research firms. The buy recommendations of independent research firms outperformed those of investment banks by an average of 3.1 basis points per day. In contrast, hold/sell recommendations by investment banks outperformed those of independent research firms by an average of 1.8 basis points per day. The study covers the time period from February 1996-June 2003.

Barber et al. (2010) have shown that documented abnormal returns of analysts' recommendations are derived from both rating levels and ratings changes. Conditional on ratings levels, upgrades earn the highest returns and downgrades earn the lowest returns. When conditioned on the magnitude and sign of the ratings change, the more favorable the recommendation level, the higher the return. The findings imply that an investment strategy based on both recommendation levels and changes has the potential to outperform a strategy based exclusively on one or the other. A long-short portfolio would have yielded an average daily abnormal return of 5.2 basis points.

Fang and Yasuda (2014) have investigated the investment value of sell-side analysts' stock recommendations and whether analysts rated as stars by *Institutional Investor* magazine have better stock-picking skills than their Non-Star peers. They have found that stars' recommendations are worth significantly more than non-stars' recommendations; for investors with no advance information, top-ranking Stars' buy recommendations significantly outperformed others by approximately 0.3 percent on a monthly risk-adjusted basis.

Kucheev et al., (2015) have compared the performance of four different star rankings from the previous year with the post-election period. They have concluded that the group of star analysts rated by StarMine's "Top Earnings Estimators" in the period from 2003 to 2013 had the highest

average monthly abnormal return (0.97 percent) for their long-short portfolio. The results of the study indicated that the choice of analysts ranking is economically important in making investment decisions.

In summary, the previous literature extensively investigated the investment value of recommendations and the likelihood of generating excess returns on recommendations was predicted by the post-announcement price drift. Various sources of the excess returns were studied, including firm-specific characteristics (e.g., firm size, stock price, and volume traded), analysts' attributes (available resources, work load, industry and firm-specific experience), and features of the recommendation sample (recommendation changes and levels). The characteristics of the constructed portfolios and a detailed analysis of the holdings remain uninvestigated, which is surprising because the analysis of size- and industry-specific portfolio holdings may reveal whether the excess returns are obtained from selection skills or because of allocation effects. Our study fills this gap by conducting a detailed analysis of holdings with a size- and sector-specific attribution analysis for recommendations issued by Star and Non-Star analysts.

2 Data and descriptive statistics

We used five data sources. The Thomson Financials Institutional Brokers' Estimate System (I/B/E/S) *Detail Recommendations File* provides standardized stock recommendations for all of the various brokers' scales by mapping all of the recommendations on a final scale from 1 to 5, where 1 corresponds to "Strong Buy", 2 to "Buy", 3 to "Hold", 4 to "Sell" and 5 to "Strong Sell". The CRSP *Daily Stock File* provides daily holding period stock returns, which include dividends, price and cash adjustments. The GICS Sector classification (Global Industry Classification Standard) is taken from the Compustat Database and merged with the CRSP by company identification (CUSIP number). The *Fama-French Factors – Daily Frequency* database provides daily returns for the factors of value-weighted market index, size, and book-to-market and momentum. We manually collected lists of star analysts from *Institutional Investor* magazine (October 2003-October 2013), *The Wall Street Journal* (May 2003-April 2013), and *StarMine* (October 2003-August 2013). The lists of stars are matched with I/B/E/S by analysts' names and broker affiliations and double-checked for any possible inconsistencies (e.g., typos in names, analyst changes of broker in a given year). Our sample does not include analysts from some brokerage houses, notably Lehman Brothers and Merrill Lynch, because their recommendations are no longer available from I/B/E/S.

We apply the following filters to the dataset. We retain only recommendations for stocks classified as either ordinary shares or American Depository Receipts (CRSP Share Codes 10, 11,

12, 30, 31, and 32). To avoid the influence of "penny stocks" on our conclusions, we exclude recommendations for stocks with a price of less than one dollar. We also exclude recommendations from anonymous analysts or if the brokerage firm's name or code is missing.

Our final database contains 153,423 recommendations for 6,121 companies listed on the NYSE, AMEX and NASDAQ markets that were announced between May 2003 and November 2014.

The entire sample of analysts is divided into groups of Stars and Non-Stars. The group of Stars consists of 1,924 unique (non-repeating) names of analysts listed by the *Institutional Investor* magazine, *The Wall Street Journal*, and *StarMine* between May 2003 and November 2013. When a particular analyst is rated as a Star in two different rankings or industries, the analyst is included only once in the group of Stars. The group of Non-Stars includes 7,658 unique names of analysts who were not listed as Stars in a given year.

Our study includes 33,200 (22 percent) recommendations for Stars and 120,221 (78 percent) for Non-Stars between May 2003-November 2014. Thirty-six percent of those recommendations are Strong Buy and Buy, forming Long portfolios; 51 percent are Hold, forming Hold portfolios; and 13 percent are Sell and Strong Sell, which form Short portfolios.

For Long portfolios, Stars issue 5,148 Strong Buy and 6,754 Buy recommendations, comprising 43 and 57 percent of the total number of recommendations in Long portfolios, respectively. The Long portfolios of Non-Stars have almost the same proportion of Strong Buy and Buy recommendations (44 and 56 percent, respectively). The Short portfolio for Stars is composed of 65 percent Sell and 35 percent Strong Sell recommendations. For Non-Stars, the Short portfolio consists of 70 percent Sell and 30 percent Strong Sell.

Insert Table I here.

3 Methods

To measure the profitability of the recommendations, we apply a well-established construction of buy-and-hold "Long", "Hold" and "Short" portfolios for each group of analysts in the year subsequent to the year in which the rankings were assigned (Barber et al., 2006; Fang and Yasuda, 2014). For each new Strong Buy or Buy recommendation, one dollar is invested at the end of the recommendation announcement day (or at the close of the next trading day if the recommendation is issued after the close of trading or on a non-trading day) into the "Long" portfolio. The stock is held in the portfolio for the following year if there are no recommendation changes by the same analyst. If, during the following year, the analyst changes his or her recommendation level from Strong Buy or Buy to Hold or Sell or Strong Sell, then the stock is

withdrawn from the "Long" portfolio and placed in the "Hold" or "Short" portfolio by the end of the trading day on which the new recommendation is issued (or at the close of the next trading day if the recommendation is issued after the closing of trading or on a non-trading day). If there is a recommendation revision but the new recommendation is on the same level (that is, Buy or Strong Buy), then this recommendation revision is omitted in our analysis and the stock is kept in the same portfolio until the next recommendation change (similar to Fang and Yasuda, 2014). Thus, re-iterations of recommendations are not included in the portfolio simulation. The same procedures are applied to "Hold" (includes Hold recommendations) and "Short" (includes Sell and Strong Sell recommendations) portfolios. As a result of this strategy, the calendar day τ gross return on a portfolio ρ includes from $n=1$ to $N_{\rho\tau}$ recommendations and could be defined as follows:

$$R_{\rho\tau} = \frac{\sum_{n=1}^{N_{\rho\tau}} X_{n,\tau-1} R_{i_n,\tau}}{\sum_{n=1}^{N_{p\tau}} X_{n,\tau-1}}, \quad (1)$$

where $X_{n,\,\tau-1}$ is the cumulative total gross return of stock i_n from the next trading day after a recommendation was added to the portfolio to day $\tau-1$, which is the previous trading day before τ, that is,

$$X_{n,\tau-1} = R_{i_n,recdat_n+1} R_{i_n,recdat_n+2} * \ldots * R_{i_n,recdat_n\tau-1} \quad (2)$$

Market-adjusted return is calculated as the raw daily returns of the portfolio minus the daily market returns, where market daily return is a market-capitalization-weighted CRSP portfolio.

The daily, risk-adjusted returns for each group's "Long", "Hold" and "Short" portfolios are estimated as an intercept (alpha) that is calculated according to the four-factor model proposed by (Carhart, 1997) as follows:

$$R_{\rho\tau} - Rf_\tau = \alpha_\rho + \beta_\rho (Rm_\tau - Rf_\tau) + s_\rho SMB_\tau + h_\rho HML_\tau + m_\rho UMD_\tau + \varepsilon_{\rho\tau}, \quad (3)$$

where

Rm_τ is the daily market return,

Rf_τ is the risk-free rate of return,

SMB_τ is a size factor, that is, the difference between the value-weighted portfolio returns of small and large stocks,

HML_τ is a book-to-market factor, that is, the difference between the value-weighted portfolio returns of high book-to-market and low book-to-market stocks,

UMD_τ is a momentum factor, that is, the difference in the returns of stocks with a positive return momentum and those with a negative return momentum over months τ-*12* and τ-*2*, and

$\varepsilon_{\rho\tau}$ is the random error term.

We report figures in monthly values by multiplying daily values by 21 trading days.

We measure two types of risk: Total Risk and Idiosyncratic Risk. A portfolio's Total Risk is the standard deviation of raw daily returns on constructed portfolios. A portfolio's Idiosyncratic Risk is the standard deviation of the return residuals ($\varepsilon_{\rho\tau}$) from Equation 3.

We evaluate the sources of portfolios' excess returns[2] using performance attribution analysis for two dimensions following Brinson and Fachler (1985)—economic sectors (GICS Sectors), and for market-capitalization-weighted Size Deciles (CRSP Size Deciles)—according to the following equations:

$$\text{Allocation} = \frac{1}{T}\sum_{j}\sum_{\tau=1}^{T}\left[\left(w_{\rho j,\tau} - w_{mj,\tau}\right)\times\left(R_{mj,\tau} - R_{m,\tau}\right)\right] = \text{Static} + \text{Dynamic}, \quad (4)$$

$$\text{Static Added Value} = \sum_{j}\left[\frac{1}{T}\sum_{\tau=1}^{T}\left[w_{\rho j,\tau} - w_{mj,\tau}\right]\right]\times\left[\frac{1}{T}\sum_{\tau=1}^{T}\left[R_{mj,\tau} - R_{m,\tau}\right]\right], \quad (5)$$

$$\text{Dynamic Added Value} = \text{Allocation Effect} - \text{Static Added Value}, \quad (6)$$

$$\text{Selection} = \frac{1}{T}\sum_{j}\sum_{\tau=1}^{T}\left[\left(w_{mj,\tau}\right)\times\left(R_{\rho j,\tau} - R_{mj,\tau}\right)\right], \quad (7)$$

$$\text{Interactio n} = \frac{1}{T}\sum_{j}\sum_{\tau=1}^{T}\left[\left(w_{\rho j,\tau} - w_{mj,\tau}\right)\times\left(R_{\rho j,\tau} - R_{mj,\tau}\right)\right], \quad (8)$$

where $w_{\rho j}$ and w_{mj} are the investment average daily proportions given to the *j*th market segment (GICS Sector or CRSP Size Decile) for day τ in the constructed portfolio and the market portfolio, respectively,

$R_{\rho j}$ and R_{mj} are the investment daily returns of the *j*th market segment in the constructed portfolio and the market portfolio, respectively,

$R_{m,\tau}$ is the total return of the market portfolio at day τ, and

T is the number of days.

[2] Throughout this paper, we use the following terminology for returns. Market-adjusted returns refer to the entire portfolio returns minus the returns of the CRSP market, whereas excess returns are those segment-specific returns related to relevant segment benchmarks. The alphas obtained from Equation 3 are denoted as risk-adjusted or abnormal returns.

The reported figures for the Allocation and Selection Effects are the average monthly values for each group's portfolio. The Allocation Effect evaluates the decision to over- or underweight a particular market segment in view of that segment's return relative to the overall return of the benchmark (i.e., $R_{mj} - R_m$). Good timing skills lead to allocating more money to segments that produce above-average returns. The Selection Effect measures the ability to construct specific market segment portfolios that beat the corresponding market segment benchmarks (i.e., $R_{pj} - R_{mj}$), weighted by the benchmark portfolio weights (w_{mj}). In addition to traditional Brinson attribution analysis (Brinson and Fachler, 1985), we follow Hsu et al. (2010) and split the Allocation Effect into static and dynamic components. The static component measures the performance attributed to the persistent sector profile of the actual portfolio. The dynamic component measures the performance attributed to the timing ability. Distinguishing between static and dynamic effects in our analysis helps us disentangle whether the observed Allocation Effects are caused by constant portfolio weights or the dynamic timing of market segments.

For the market segmentation by sector classification, we use 10 sectors from the GICS: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Telecommunication Services and Utilities. The GICS Sector Codes for each company are taken from Compustat and merged with CRSP based on company identification (i.e., a CUSIP number). Companies in CRSP that were not found in the Compustat database were given a GICS code of "00", and the sector was named "Unknown".

For market segmentation by Size Deciles, all of the companies in the CRSP are assigned to 10 size-specific cap-weighted portfolios based on their total company market capitalization calculated in a manner similar to that of the CRSP Cap-Based Indexes (CRSP, 2015). For each trading day (τ), all of the companies are sorted from largest to smallest based on market capitalization, calculated as the total number of shares outstanding multiplied by the share's price. Next, each company (i) is assigned a cumulative market capitalization score, $MS_{i,\tau}$, which is equal to the cumulative capitalization of all companies with greater capitalization plus half of its own capitalization. $MS_{i,\tau}$ is expressed as a percentage of the total CRSP market capitalization and is based on the midpoint of a company's market capitalization, thus assigning the company into the Size Decile portfolio in which the majority of its market capitalization lies. To allocate companies into the Size Deciles portfolios, capitalization-based breakpoints are set to 10 percent (e.g., 10, 20, 30). Finally, each company is assigned a size-specific capitalization-weighted portfolio (cap-weighted) number from 1 (largest) to 10 (smallest), which is later used in the performance attribution analysis.

4 Results: portfolio returns and attribution analysis

4.1 Number of stocks and returns-based analysis

Table II reports the number of stocks held in the constructed portfolios that were built using the I/B/E/S recommendation sample according to the trading strategy described in the methodology section.[3] For the Long portfolio, the average number of stocks is 585.81 for Stars and 1572.41 for Non-Stars. In the Hold portfolio, Stars have an average of 747.83 stocks, whereas Non-Stars have 1,835.34 stocks. For the Short portfolio, the average number of stocks is 195.25 for Stars and 588.99 for Non-Stars. An analysis of the average number of stocks in the constructed portfolios shows that Non-Stars' portfolios have approximately 2.7 times more stocks than Stars' portfolios. This difference is expected, considering the difference in the number of recommendations by Stars and Non-Stars (see Table I) because the group of Non-Stars is larger than the group of Stars.

Insert Table II here.

Our returns-based analysis of portfolios composed of recommendations from Stars and Non-Stars is conducted for the period from November 1, 2003, to May 30, 2014. The results are presented in Table III. For reference purposes, the first line in Table III reports the corresponding figures for the capitalization-weighted market returns (CRSP cap-weighted). The first part of Table III reports figures for the Long portfolios by Stars and Non-Stars. The second part of the table compares the Hold portfolios and the third part is for the Short portfolios of Stars and Non-Stars. The differences between mean values for Stars and Non-Stars are presented in the third column of the table.

Insert Table III here.

For Long portfolios, monthly alphas are 0.34 percent for recommendations by Stars (significantly different from zero at the one percent level) and 0.20 percent for recommendations by Non-Stars (not significantly different from zero), and their difference of 0.14 percent is statistically significant at the ten percent significance level. Market-adjusted returns for Long portfolios are 0.46 percent for Stars and 0.34 percent for Non-Stars (both figures are statistically significant, whereas their difference is not significantly different from zero).

The Hold portfolios of the Stars and Non-Stars had market- and risk-adjusted returns and the difference between those returns among groups is not significantly different from zero. Thus, as expected, the Hold portfolio performs at the same level as the market.

[3] In the appendix, we report the number of stocks for the segment-specific portfolios used in the attribution analysis (by Size Decile and Industry Sector).

Studying the results for Short portfolios, we can observe that the monthly alpha is -0.20 percent for Stars (insignificant) and -0.28 percent for Non-Stars (significantly different from zero at the five percent level). Market-adjusted returns are -0.05 percent for Stars and -0.13 percent for Non-Stars. However, the differences between market- and risk-adjusted returns for Stars and Non-Stars are insignificantly different from zero.

The Long portfolio formed by recommendations from Stars has lower idiosyncratic and total risk than the portfolios formed by recommendations from Non-Stars. However, the Short portfolio by Stars has higher idiosyncratic risk than the portfolio of Non-Stars.

An analysis of market-adjusted and excess returns shows that only the Long portfolios for both Stars and Non-Stars outperform the market. Among the Short portfolios, only Non-Stars have beaten the market because their portfolio has a negative and statistically significant alpha. Additionally, Stars outperform Non-Stars for Long portfolios because their returns are higher with lower total and idiosyncratic risk.

4.2 Attribution analysis for GICS Sectors and CRSP Size Deciles

Table IV reports the results for the attribution analysis of the GICS Sectors (Panel A) and CRSP Size Deciles (Panel B). The attribution analysis allows us to investigate the extent to which the excess returns are related to the analysts' selection or allocation skills. Each panel includes three parts for Long, Hold, and Short portfolios. Within each part, we report the results for Stars, Non-Stars and the difference between these groups. The results of the *t*-test show whether Allocation, Selection or Interaction Effects are significantly different from zero.

Insert Table IV here

For Long portfolios, the Allocation Effects for GICS Sectors are small for both Stars and Non-Stars at 0.08 (significantly different from zero) and 0.04 percent (insignificant), respectively. The Dynamic and Static components in the Allocation Effects for both groups have equal contribution to the total Allocation Effect, with 0.05 percent for Dynamic for Stars and 0.02 for Non-Stars and 0.03 percent for Static of Stars and 0.02 for Non-Stars. The selection effect is 0.33 percent for Stars and 0.30 percent for Non-Stars, with both figures being statistically significant. The Interaction term has the only statistically significant difference between groups, whereas none of the other effects are different for Stars and Non-Stars.

For Hold portfolios, GICS attribution analysis shows relatively low and insignificant values (as expected) because the added value for Hold portfolios is statistically insignificant (see Table III).

For Short portfolios, the Allocation Effect for the GICS sector for Non-Stars is only 0.05 (insignificant) compared with 0.12 percent (significant) for Stars, with the difference between groups being 0.07 percent (significant). The Allocation Effect for Short portfolios for both groups is explained primarily by the Dynamic component. The Selection Effect is low for both groups, -0.21 for Stars and -0.18 percent for Non-Stars (both values are insignificant).

For CRSP Size Deciles on Panel B of Table IV, the Allocation Effect for all three portfolio types is very similar, at 0.16, 0.18, and 0.14 for the Long, Hold, and Short portfolios of Stars and 0.18, 0.18, and 0.17 for Non-Stars (all values are statistically significant). These Allocation Effects are explained by the Static component with a dynamic allocation close to zero. For the Selection Effects, only the Long portfolio of Stars has a statistically significant Selection Effect of 0.17 percent. Thus, the outperformance of the Long portfolios of Non-Stars is explained primarily by the Allocation Effects, whereas Stars have both allocation and selection skills.

To summarize the results of the attribution analysis, the Allocation Effect is relatively small for GICS Sectors and not as important as the Selection Effect, which is large for both Long and Short portfolios. The difference in the Selection and Allocation Effects explains the outperformance of Stars compared with Non-Stars. We conclude that the overall excess returns are mostly explained by how well Star analysts select individual stocks within particular GICS Sectors along with how those sectors are over- or underweighted in portfolios constructed from recommendations. Another explanation for the significant Allocation Effect for Stars and the insignificant Allocation Effect for Non-Stars is that Long and Short portfolios of Stars have substantially smaller numbers of stocks than Non-Stars. Thus, high coverage by Non-Stars brings their Long and Short portfolios close to the market weights, whereas fewer stocks in the Stars' portfolios causes deviation from the market weights. Observed high deviation from the market weights in Stars' portfolios leads also to the larger size of the dynamic component relative to the static one, while in the Non-Stars' portfolios the dynamic component is almost equal to the static one.

Based on the CRSP Size attribution analysis, we conclude that the Allocation Effect within Size Deciles is substantial and leads to the outperformance of both groups of analysts above the market, although there is no difference in Allocation Effects among Stars and Non-Stars. At the same time, the Selection Effects for Size Deciles are only significant for Stars' Long portfolio. Such significant CRSP Size Allocation Effects for both groups reveal that analysts' portfolios gain sizable excess returns by overweighting particular size segments. Furthermore, our analysis does not provide any information about whether such a decision to allocate more wealth in profitable size segments is a conscious choice made by analysts or a methodological artifact that

can be explained by the effect of overweighing (underweighting) small (large) stocks because of investing the equal amount of one dollar into each new recommendation.

4.3 Holdings-based analysis for GICS sectors

The results of a holdings-based analysis for GICS Sectors are reported in Table V, where Panel A is for Long, Panel B is for Hold, and Panel C is for Short portfolios. To illustrate further, we show in Figure 1 the columns with the excess weights and excess returns for a Long portfolio. This analysis enables us to investigate the differences in weights and returns with the CRSP cap-weighted portfolio. The actual weights and returns are those assigned and obtained for a particular sector in the portfolio constructed based on the analysts' recommendations, whereas the market values are those obtained based on the CRSP cap-weighted portfolio calculations. The excess weights and returns are calculated as the difference in the actual and market values. Companies in I/B/E/S that were not matched with the GICS Sector classification in Compustat database but with returns time-series in CRSP are marked as "Unknown Sector" and represent 3.0 percent of the constructed (actual) portfolios.

Insert Table V here.

The upper bar charts on Figure 1 present the difference in portfolio weights for GICS Sectors for Long portfolios with the CRSP cap-weighted portfolio. These charts are built on data from columns with excess weights (columns 3 and 8) and excess returns (columns 6 and 10) from Table V. We illustrate only the Long portfolio because the patterns of over- and underweighting for Long, Hold and Short portfolios are similar, except for the Industrials and Telecommunication Services sectors for Non-Stars: where the Non-Stars' Short portfolio is underweighted in Industrials and overweighted in Telecommunication Services, whereas in the Non-Stars' Long and Hold portfolios, these Sectors are overweighted and underweighted, respectively (see Panels B and C in Table V).

Insert Figure 1 here.

In the Stars' Long, Hold and Short portfolios, the highest overweight is for Consumer Discretionary, Industrials and Materials, whereas for Non-Stars the main overweight is in Information Technology, Consumer Discretionary and Materials. The most underweighted sectors for Stars and Non-Stars are Financials and Consumer Staples. The biggest difference in weights between Stars and Non-Stars is for the Information Technology sector, which is highly overweighted by Non-Stars, whereas it has almost the market weight for the Stars. Another difference between Stars and Non-Stars is that the Utilities and Health Care sectors have opposite under- and overweight patterns for Stars and Non-Stars (Utilities is overweighted by

Stars and underweighted by Non-Stars, Health Care is conversely underweighted by Stars and overweighted by Non-Stars). According to Table V, all Excess Weights (columns 3 and 8) and the difference in weights between Stars and Non-Stars (column 11) are statistically significant at the one percent level.

The bottom bar charts in Figure 1 show excess returns for the Long portfolios over the sectors' returns for the CRSP cap-weighted portfolios. The portfolios of Stars and Non-Stars outperform in all market sectors, although not all excess returns are significantly different from zero (see columns 6 and 10 in Panel A in Table V). Both Stars and Non-Stars perform insignificantly different from the market in the Financials, Information Technology and Telecommunication Services sectors. Additionally, Non-Stars show insignificant outperformance (market performance) in the Energy and Consumer Discretionary sectors. Thus, Stars significantly outperform the market in more sectors (numerically) than do Non-Stars. The only significant difference in returns between Stars and Non-Stars is observed for the Consumer Discretionary sector (see column 12 in Panel A in Table V).

In the Hold portfolios (Panel B in Table V), Stars outperform the market only in the Health Care sector, whereas Non-Stars underperform in Consumer Discretionary. In all other sectors, the excess returns are insignificantly different from the market sector-specific returns. With respect to the differences in returns between groups, Stars significantly outperform Non-Stars (have higher returns) only in the Consumer Discretionary and Consumer Staples sectors.

The Short portfolio returns are presented in Panel C of Table V. The excess returns are interpreted in the reverse manner: negative excess returns of portfolios show outperformance, and positive excess returns correspond to underperformance. The reported excess returns for sector-specific Short portfolios are not as high as for Long portfolios. The sector-specific Short portfolios of Stars outperform the market in Information Technology and underperform in Health Care. The Short portfolios of Non-Stars outperform the market in Financials. The only sector in which Stars and Non-Stars have statistically significant differences in returns is Health Care, where Non-Stars outperform Stars by 0.67 percentage points.

4.4 Holdings-based analysis for CRSP Size Deciles

The results of a holdings-based analysis for CRSP Size Deciles are reported in Table VI, where Panel A is for Long, Panel B is for Hold, and Panel C is for Short portfolios. The actual weights and returns are those assigned and estimated for a particular Size Decile in a portfolio constructed based on analysts' recommendations, whereas the market values are those obtained based on CRSP market-capitalization-weighted portfolio calculations. Because we use the cap-

weighted deciles, the market weights for each Size Decile are roughly equal to 10 percent. The Excess Weights and Excess Returns are calculated as the difference in actual and market values. For illustration, we show in Figure 2 the Excess Weights (columns 3 and 6 from Panel A, Table VI) and Excess Returns (columns 6 and 10 from Panel A, Table VI). We illustrate only results for the Long size-specific portfolios because the patterns for over- and underweights for Hold and Short portfolios are similar to that for the Long portfolio (see corresponding columns in Panels B and C of Table VI).

Insert Table VI here.

The upper bar charts in Panel A in Figure 2 present the difference in portfolio weights for CRSP Size Deciles for Long size-specific portfolios. For Long, Hold and Short portfolios, Stars and Non-Stars significantly overweight small stocks and underweight the largest stocks, with the lowest three deciles being overweighed (excess weights are positive). The largest difference in weights is for small stocks in the first Size Decile, where the portfolio of Stars has 34.6 percent of their value and Non-Stars have 42.8 percent. The Size Decile with the largest stocks has only 0.6 percent in the Stars and Non-Stars' portfolios.

Insert Figure 2 here.

The bottom bar charts in Panel A of Figure 2 show the excess returns for the portfolios with the market-capitalization-weighted returns for Size Deciles. For Long portfolios, Stars' size-specific portfolios outperform in almost all market deciles, except for the Size Decile with the largest stocks, in which the Stars portfolio underperforms. These excess returns for the largest size-specific portfolio of the group of Stars are statistically insignificant from the market returns. Considering that the size-specific portfolios for the largest Size Decile constructed on recommendations from Stars and Non-Stars have an average as low as 2.93 and 6.01 stocks (see Appendix A, Panel B), it is not expected to observe any significant excess returns. As seen in column 6 in Table VI, Stars outperform the market in the smallest two Size Deciles and in the seventh Size Decile (with an actual weight close to the weight of the market portfolio). However, Non-Stars outperform the market only in the smallest Size Decile (see column 10). With respect to the difference in returns between groups of Stars and Non-Stars, we find that Stars significantly outperform Non-Stars in the smallest, seventh and second (next to largest) Size Deciles.

For the Hold size-specific portfolios, both groups have insignificant excess returns (see Panel B in Table VI). The difference in returns between Stars and Non-Stars is significant only for the smallest Size Decile, where the Hold size-specific portfolio of Stars outperform that of Non-Stars by 0.17 percentage points.

In the Short size-specific portfolios (Panel C in Table VI), both groups outperform the market in the smallest Size Decile. In other Size Deciles, Non-Stars perform insignificantly different from the market, whereas Stars underperform the market in the third Size Decile.

To summarize the results of the holdings-based analysis, we found that the portfolios for both groups of analysts have significantly different weights than the market capitalization-weighted portfolio. Stars and Non-Stars show persistently better performance in some market sectors. Stars outperform Non-Stars in all Long, Hold and Short portfolios, with significant differences between Long portfolios only. At the same time, their outperformance against the market is primarily explained by holdings in the smallest market deciles. Considering that both groups significantly overweight in the smallest three Size Deciles, we can see how the Allocation Effects reported in Panel B of Table IV contribute to overall portfolio performance. Additionally, we question whether such portfolios based on recommendations are attainable for large institutional investors because of the lack of liquidity and volume of the small stocks that represented the major portion of these portfolios. This question merits further investigation.

5 Conclusion

In this study, we investigated the extent to which an analysis of portfolio holdings can explain outperformance by portfolios constructed using investment recommendations from sell-side analysts issued from 2003 to 2014. We conduct a detailed study of market sectors and size-specific capitalization-weighted holdings of portfolios that are generated according to recommendations from Star and Non-Star sell-side analysts. In line with previous studies (see e.g., Barber et al., 2006, 2007; Fang and Yasuda, 2014 among others), we found that Star and Non-Star analysts' recommendations generally had raw and risk-adjusted returns (alphas) that outperformed the overall market and that Buy and Strong Buy recommendations from Star analysts outperformed those of Non-Stars. Stars had higher raw returns and less total and idiosyncratic risk than Non-Stars for their Long portfolios. Hold recommendations by both groups performed at the market level. Although Non-Stars' Short portfolio outperformed the market, we did not find a statistically significant difference between the returns of the Short portfolios of Stars and Non-Stars.

We used a holdings-based analysis accompanied by attribution analysis to clarify whether this outperformance spans all market sectors and is driven by selection skills or whether it is caused by the Allocation Effect. Our analysis shows that the investment weights in constructed recommendation-based portfolios are significantly different from those in the market-capitalization-weighted portfolios.

A holdings-based analysis of ten GICS Sectors confirmed that the returns for sector holdings in Stars' Long portfolios beat seven out of ten sectors of CRSP cap-weighted sector holdings, whereas Non-Stars outperformed in only five sectors. Hold sector-specific portfolios mainly performed on the market level. For the sector-specific Short portfolios, Stars outperformed in Information Technology but underperformed in Health Care sectors; meanwhile, Non-Stars outperformed in only Financials. Our findings confirm that outperformance is due not only to Allocation Effects but also to analysts' superior stock selection skills, which allow them to beat their respective market-segment benchmarks. The Allocation Effect for market attribution analysis was negligible for Non-Stars and significant for Stars' Long and Short portfolios.

A holdings-based analysis of cap-weighted Size Deciles revealed that Stars and Non-Stars' portfolios are heavily loaded with small stocks (approximately 40% of investment value is located in the smallest Size Decile). Stars perform significantly better than Non-Stars in small stocks, whereas Non-Stars perform better for the largest stocks, although the difference for large stocks is insignificant. The excess returns are mostly explained by the analysts' stock-allocation skills, and some portion of the outperformance for Long portfolio is explained by the analysts' selection skills.

One important implication for potential investors is related to the results for Short portfolios. Although the observed alphas were statistically significant and confirmed the view that analysts outperformed the market, the raw returns for Short portfolios were positive. Thus, if short positions had been created based on our investigated strategy, they would have caused losses in value.

References

Barber, B., Lehavy, R., McNichols, M., Trueman, B., 2001. Can investors profit from the prophets? Security analyst recommendations and stock returns. J. Finance 56, 531–563.

Barber, B., Lehavy, R., McNichols, M., Trueman, B., 2003. Reassessing the returns to analysts' stock recommendations. Finan. Anal. J. 59, 88–96.

Barber, B.M., Lehavy, R., McNichols, M., Trueman, B., 2006. Buys, holds, and sells: the distribution of investment banks' stock ratings and the implications for the profitability of analysts' recommendations. J. Acc. Econ. 41, 87–117.

Barber, B.M., Lehavy, R., Trueman, B., 2007. Comparing the stock recommendation performance of investment banks and independent research firms. J. Finan. Econ. 85, 490–517.

Barber, B.M., Lehavy, R., Trueman, B., 2010. Ratings changes, ratings levels, and the predictive value of analysts' recommendations. Finan. Manag. 39, 533–553.

Booth, L., Chang, B., Zhou, J., 2014. Which analysts lead the herd in stock recommendations? J. Acc. Auditing Finance 29, 464–491.

Brinson, G.P., Fachler, N., 1985. Measuring non-US. Equity portfolio performance. J. Portfol. Manag. 11, 73–76.

Carhart, M.M., 1997. On persistence in mutual fund performance. J. Finance 52, 57–82.

Center for Research in Security Prices (CRSP), 2015. CRSP U.S. Equity Indexes Methodology Guide. CRSP, Chicago, IL.

Desai, H., Liang, B., Singh, A.K., 2000. Do all-stars shine? Evaluation of analyst recommendations. Finan. Anal. J. 56 , 20–29.

Fang, L.H., Yasuda, A., 2014. Are stars' opinions worth more? The relation between analyst reputation and recommendation values. J. Finan. Serv. Res. 46, 235–269.

Hsu, J.C., Kalesnik, V., Myers, B.W., 2010. Performance attribution: measuring dynamic allocation skill. Finan. Anal. J. 66, 17–26.

Jegadeesh, N., Kim, J., Krische, S.D., Lee, C.M.C., 2004. Analyzing the analysts: when do recommendations add value? J. Finance 59, 1083–1124.

Kucheev, Y.O., Ruiz, F., Sorensson, T., 2015. Do stars shine? Comparing the performance persistence of star sell-side analysts listed by Institutional Investor, the Wall Street Journal, and Starmine. Working Paper. Available at SSRN 275987.

Loh, R.K., 2010. Investor inattention and the underreaction to stock recommendations. Finan. Manag. 39, 1223–1252.

Womack, K.L., 1996. Do brokerage analysts' recommendations have investment value? J. Finance 51, 137–167. doi:

Tables and Figures

Table I. Number of recommendations and percentage of recommendation levels in each portfolio. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from May 12, 2003 to November 07, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations; the Hold portfolio includes only Hold recommendations. For each figure, the percentage from the overall group's portfolio (Long plus Hold plus Short) is reported in parentheses. Columns may not sum to one hundred because of rounding.

	Stars		**Non-Stars**	
Portfolio	**Number of Recommendations**	**% from Total Long or Short Portfolio**	**Number of Recommendations**	**% from Total Long or Short Portfolio**
Long Portfolio (Strong Buy, Buy)				
Strong Buy	5148 (16%)	43%	19333 (16%)	44%
Buy	6754 (20%)	57%	24772 (21%)	56%
Total Long:	11902 (36%)		44105 (37%)	
Hold Portfolio (Hold)				
Total Hold:	16818 (51%)		61434 (51%)	
Short Portfolio (Sell, Strong Sell)				
Sell	2924 (9%)	65%	10241 (9%)	70%
Strong Sell	1556 (5%)	35%	4443 (4%)	30%
Total Short:	4480 (13%)		14684 (12%)	
Overall (Long + Hold + Short):	33200 (100%)		120223 (100%)	

Table II. Descriptive statistics for the daily number of stocks in constructed portfolios. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in a group of Non-Stars are those not listed in any of mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 31, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations; the Hold portfolios include only Hold recommendations.

	Mean	Std.Dev.	Min	Max
Long Portfolios (Strong Buy, Buy)				
Stars	585.81	81.09	200	742
Non-Stars	1572.41	104.33	1312	1820
Hold Portfolios (Hold)				
Stars	747.83	91.45	331	927
Non-Stars	1835.34	97.32	1606	2094
Short Portfolios (Sell, Strong Sell)				
Stars	195.25	55.23	111	367
Non-Stars	588.99	87.95	393	907

Table III. Returns-based analysis of portfolios for recommendations from Stars and Non-Stars (monthly values). Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Hold" portfolio includes only Hold recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations. Market-adjusted returns are calculated by subtracting monthly CRSP cap-weighted returns from monthly returns of Long or Hold or Short portfolios. Abnormal returns (alphas) are obtained from the Carhart four-factor model. Idiosyncratic Risk is calculated as a standard deviation of residuals from the regression analysis for the Carhart four-factor model.

	Stars				**Non-Stars**				**Difference Stars – Non-Stars**	
	Mean	**Std.Dev.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Min**	**Max**	**Mean**	***t*-stat**
CRSP Market Return, %	0.86	25.86	-179.7	223.3	-	-	-	-	-	-
Long Portfolio (Strong Buy, Buy)										
Raw Return, %	1.32	30.96	-206.34	237.66	1.20	31.79	-217.47	256.71	0.12	1.56
Market-adjusted Return, %	0.46***	7.51	-38.97	44.98	0.34*	8.31	-44.11	54.51		
Alpha, %	0.34***				0.20*				0.14*	1.85
Total Risk (Std.Dev. Raw Return)	30.96				31.79					
Idiosyncratic Risk	4.17				5.28				3.85	
Hold Portfolio (Hold)										
Raw Return, %	1.02	31.36	-228.60	216.17	0.94	31.60	-224.41	220.05	0.07	1.19
Market-adjusted Return, %	0.16	8.43	-53.09	54.18	0.08	8.66	-59.89	56.66		
Alpha, %	0.05				-0.04				0.09	1.41
Total Risk (Std.Dev. Raw Return)	31.36				31.60					
Idiosyncratic Risk	3.86				4.52				3.17	
Short Portfolio (Sell, Strong Sell)										
Raw Return, %	0.81	33.74	-238.55	197.53	0.73	33.01	-248.27	222.31	0.08	0.64
Market-adjusted Return, %	-0.05	11.97	-62.05	90.32	-0.13	10.40	-71.77	73.40		
Alpha, %	-0.20				-0.28**				0.07	0.61
Total Risk (Std.Dev. Raw Return)	33.74				33.01					
Idiosyncratic Risk	6.61				6.11				6.16	

*** p<0.01, ** p<0.05, * p<0.1

Table IV. Average monthly raw and market-adjusted returns for Long and Short portfolios of Stars and Non-Stars. Attribution analysis for GICS Sectors and CRSP Size Segments. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003, to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Hold" portfolio includes only Hold recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations. Market-adjusted returns are calculated by subtracting monthly CRSP cap-weighted returns from monthly returns of Long or Short portfolios. Ten main GICS Sectors were used for sector classification. Attribution analysis for CRSP Size was performed on market-capitalization deciles. Market-adjusted (MKT-adjusted) return is calculated as the raw portfolio's return minus the market return. This MKT-adjusted return is equal to the Allocation plus Selection plus Interaction Effects. The differences in MKT-adjusted returns and Allocation plus Selection plus Interaction Effects are caused by rounding in the calculations.

Panel A. Attribution analysis for GICS Sectors

	Allocation Effect	Dynamic Allocation	Static Allocation	Selection Effect	Interaction
Long Portfolios (Strong Buy, Buy)					
Stars	0.08**	0.05	0.03	0.33***	0.02
Non-Stars	0.04	0.02	0.02	0.30**	-0.05**
Stars – Non-Stars	0.04	0.03	0.01	0.03	0.07**
Hold Portfolios (Hold)					
Stars	0.05	0.03	0.02	0.08	-0.02
Non-Stars	0.04	0.03	0.01	0.00	-0.01
Stars – Non-Stars	0.01	-0.01	0.01	0.09	-0.01
Short Portfolios (Sell, Strong Sell)					
Stars	0.12**	0.09	0.03	-0.21	0.02
Non-Stars	0.05	0.04	0.01	-0.18	-0.01
Stars – Non-Stars	0.07*	0.05	0.02	-0.03	0.03

*** p<0.01, ** p<0.05, * p<0.1

Panel B. Attribution analysis for CRSP Size Deciles

	Allocation Effect	Dynamic Allocation	Static Allocation	Selection Effect	Interaction
Long Portfolios (Strong Buy, Buy)					
Stars	0.16**	-0.01	0.17	0.17**	0.14**
Non-Stars	0.18**	0.01	0.17	0.07	0.10**
Stars – Non-Stars	-0.02	-0.01	0.00	0.09	0.04
Hold Portfolios (Hold)					
Stars	0.18**	0.00	0.18	-0.04	0.02
Non-Stars	0.18*	0.01	0.18	-0.03	-0.07
Stars – Non-Stars	-0.01	0.00	0.00	-0.01	0.10*
Short Portfolios (Sell, Strong Sell)					
Stars	0.14*	-0.05	0.19	0.06	-0.28**
Non-Stars	0.17*	-0.02	0.19	-0.11	-0.20**
Stars – Non-Stars	-0.03	-0.04	0.01	0.17	-0.08

*** p<0.01, ** p<0.05, * p<0.1

Table V. Holdings-based analysis of monthly excess returns for GICS Sectors. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Hold" portfolio includes only Hold recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations. Ten main GICS Sectors were used for a sector classification. Actual Returns and Weights are those for the constructed Long, Hold and Short portfolios. Excess Returns and Weights are the differences of the Actual and the corresponding market returns or weights, respectively.

Panel A. Long portfolios

GICS Sector	Stars						Non-Stars				Stars – Non-Stars	
	Investment Weights, %			Returns,%			Investment Weights, %		Returns, %		Difference Investment Weights, %	Excess Returns, %
	Actual (1)	Market (2)	Excess (3)=(1)-(2)	Actual (4)	Market (5)	Excess (6)=(4)-(5)	Actual (7)	Excess (8)=(7)-(2)	Actual (9)	Excess (10)=(9)-(5)	(11)=(1)-(7)	(12)=(4)-(9)
Energy	8.0	11.2	-3.3***	2.02	1.49	0.54**	10.2	-1.0***	1.88	0.40	-2.2***	0.14
Materials	8.4	4.9	3.5***	1.84	1.18	0.66***	7.1	2.2***	1.61	0.43*	1.3***	0.23
Industrials	15.0	9.5	5.5***	1.40	1.04	0.36*	10.5	1.1***	1.50	0.46***	4.5***	-0.10
Consum. Discr.	17.9	10.2	7.7***	1.40	1.03	0.37**	14.6	4.5***	1.08	0.04	3.3***	0.32***
Consum. Stap.	5.4	8.6	-3.2***	1.25	0.93	0.32*	2.9	-5.7***	1.40	0.47**	2.5***	-0.15
Health Care	10.0	10.7	-0.7***	1.41	0.96	0.46**	11.9	1.2***	1.38	0.43**	-1.9***	0.03
Financials	10.1	18.3	-8.2***	0.85	0.67	0.17	11.2	-7.1***	0.92	0.25	-1.1***	-0.07
Info.Tech.	16.4	15.3	1.1***	1.01	0.82	0.18	24.8	9.5***	0.95	0.13	-8.3***	0.05
Telecom. Serv.	2.0	3.1	-1.1***	1.47	1.03	0.45	2.1	-1.0***	1.42	0.40	-0.1***	0.05
Utilities	3.7	2.7	1.0***	1.29	0.92	0.37***	2.0	-0.7***	1.24	0.32***	1.7***	0.05
Unknown	3.0	5.6	-2.5***	0.74	0.65	0.09	2.7	-2.8***	0.87	0.22	0.3***	-0.13

Panel B. Hold portfolios

GICS Sector	Stars				Non-Stars				Stars – Non-Stars	
	Investment Weights, %		Returns,%		Investment Weights, %		Returns, %		Difference Investment Weights, %	Excess Returns, %
	Actual	Excess	Actual	Excess	Actual	Excess	Actual	Excess		
Energy	6.9	-4.3***	1.65	0.17	9.1	-2.1***	1.66	0.18	-2.2***	-0.01
Materials	8.2	3.3***	1.22	0.04	6.2	1.3***	1.40	0.22	2.0***	-0.17
Industrials	14.0	4.5***	1.09	0.05	9.8	0.3***	1.17	0.13	4.2***	-0.08
Consum. Discr.	18.4	8.2***	0.99	-0.04	15.3	5.1***	0.74	-0.29*	3.1***	0.25**
Consum. Stap.	5.9	-2.7***	1.22	0.29	2.9	-5.7***	0.95	0.02	3.0***	0.27*
Health Care	9.7	-1.0***	1.39	0.43*	12.1	1.4***	1.25	0.29	-2.4***	0.14
Financials	11.6	-6.7***	0.53	-0.14	13.7	-4.6***	0.60	-0.07	-2.1***	-0.07
Info.Tech.	15.6	0.3***	0.82	-0.01	23.6	8.3***	0.73	-0.09	-8.0***	0.09
Telecom. Serv.	2.4	-0.8***	0.97	-0.06	2.2	-1.0***	1.01	-0.02	0.2***	-0.04
Utilities	3.9	1.2***	0.94	0.02	2.3	-0.4***	0.79	-0.13	1.6***	0.15
Unknown	3.4	-2.2***	0.77	0.12	2.8	-2.7***	0.29	-0.36	0.5***	0.48

Panel C. Short portfolios

GICS Sector	Stars				Non-Stars				Stars – Non-Stars	
	Investment Weights, %		Returns,%		Investment Weights, %		Returns, %		Difference Investment Weights, %	Excess Returns, %
	Actual	Excess	Actual	Excess	Actual	Excess	Actual	Excess		
Energy	7.8	-3.5***	1.10	-0.38	8.9	-2.4***	1.50	0.02	-1.1***	-0.40
Materials	8.5	3.7***	1.30	0.11	7.6	2.7***	1.08	-0.11	0.9***	0.22
Industrials	12.4	3.0***	0.87	-0.17	8.0	-1.4***	1.08	0.03	4.4***	-0.20
Consum. Discr.	19.8	9.6***	0.70	-0.33	14.8	4.6***	0.84	-0.19	5.0***	-0.15
Consum. Stap.	6.0	-2.6***	0.89	-0.04	3.3	-5.2***	1.22	0.29	2.6***	-0.34
Health Care	9.8	-0.9***	1.70	0.74**	11.4	0.7***	1.03	0.07	-1.6***	0.67**
Financials	12.1	-6.2***	0.38	-0.29	13.8	-4.5***	0.15	-0.53***	-1.7***	0.24
Info.Tech.	15.3	0.05	0.24	-0.59*	23.4	8.1***	0.55	-0.27	-8.0***	-0.32
Telecom. Serv.	2.6	-0.6***	1.70	0.68	3.2	0.1***	0.44	-0.58	-0.6***	1.26
Utilities	2.8	0.1	1.08	0.16	2.5	-0.2***	1.09	0.16	0.3***	-0.01
Unknown	3.2	-2.4***	-0.83	-1.48	3.1	-2.4***	-0.28	-0.92	0.1***	-0.55

Table VI. Holdings-based analysis of monthly excess returns for CRSP Size Deciles. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations; the "Hold" portfolio includes only Hold recommendations; the "Short" portfolio includes Sell and Strong Sell recommendations. CRSP Size classification was based on market-capitalization deciles. Actual Returns and Weights are those for the constructed Long, Hold and Short portfolios. Excess Returns and Weights are the differences of the Actual Returns and the corresponding market returns or weights, respectively.

Panel A. Long portfolios

	Stars						Non-Stars				Stars – Non-Stars	
	Investment Weights, %			Returns,%			Investment Weights, %		Returns, %		Difference Investment	
Size Decile	Actual	Market	Excess	Actual	Market	Excess	Actual	Excess	Actual	Excess	Weights, %	Excess Returns, %
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)=(4)-(5)	(7)	(8)=(7)-(2)	(9)	(10)=(9)-(5)	(11)=(1)-(7)	(12)=(4)-(9)
Largest	0.6	9.9	-9.4***	0.29	0.48	-0.19	0.6	-9.4***	0.73	0.25	0.0	-0.44
2	1.5	9.6	-8.1***	0.56	0.44	0.11	1.0	-8.6***	0.16	-0.28	0.4***	0.39*
3	2.1	10.0	-7.9***	0.85	0.81	0.04	1.8	-8.2***	0.97	0.16	0.3***	-0.12
4	3.5	9.8	-6.3***	0.70	0.68	0.02	2.6	-7.2***	0.58	-0.09	0.9***	0.11
5	5.2	9.6	-4.4***	0.95	0.88	0.07	4.2	-5.4***	1.04	0.16	1.0***	-0.08
6	7.5	9.9	-2.4***	1.12	0.97	0.16	5.8	-4.1***	0.91	-0.06	1.7***	0.22
7	9.8	9.7	0.04*	1.41	1.12	0.29**	8.4	-1.36*	1.17	0.05	1.4***	0.24*
8	13.5	9.6	3.8***	1.15	1.02	0.13	12.7	3.0***	1.06	0.04	0.8***	0.09
9	21.8	9.7	12.1***	1.29	1.08	0.21*	20.0	10.4***	1.16	0.08	1.7***	0.12
Smallest	34.6	12.0	22.6***	1.64	1.06	0.57***	42.8	30.8***	1.40	0.34***	-8.2***	0.23**

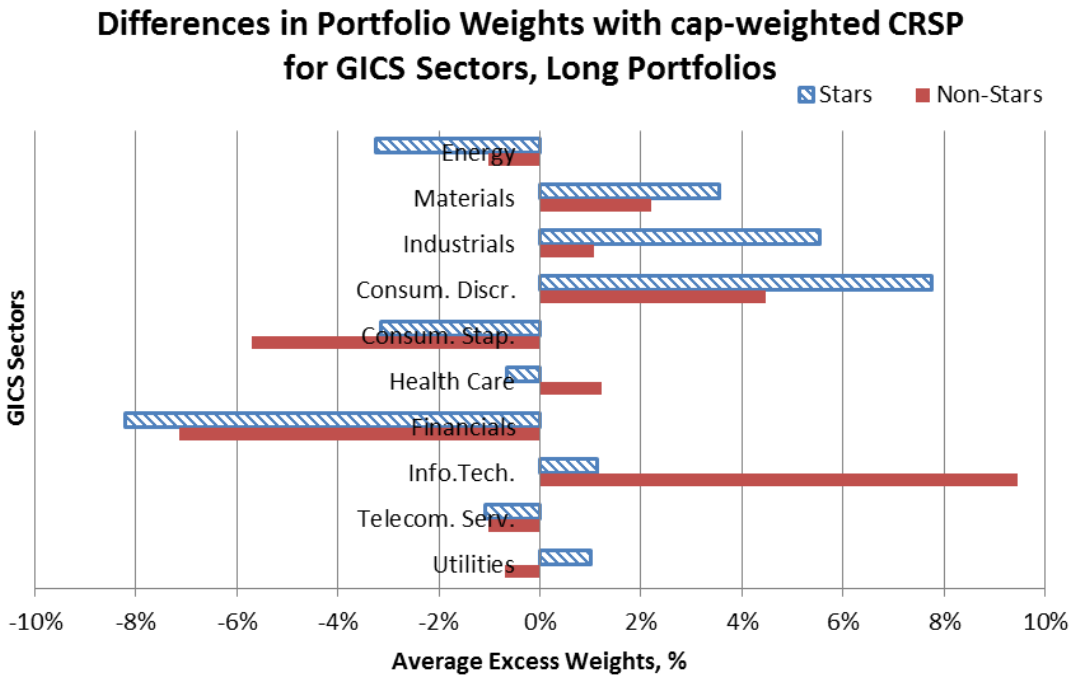
Panel B. Hold portfolios

Size Decile	Stars				Non-Stars				Stars – Non-Stars	
	Investment Weights, %		Returns,%		Investment Weights, %		Returns, %		Difference Investment Weights, %	Excess Returns, %
	Actual	Excess	Actual	Excess	Actual	Excess	Actual	Excess		
Largest	0.6	-9.3***	0.14	-0.34	0.5	-9.5***	0.41	-0.07	0.2***	-0.26
2	0.9	-8.7***	0.37	-0.08	0.8	-8.9***	0.53	0.09	0.2***	-0.16
3	1.2	-8.8***	1.05	0.24	1.2	-8.8***	1.09	0.28	0.0***	-0.05
4	2.5	-7.3***	0.66	-0.02	2.1	-7.8***	0.57	-0.10	0.4***	0.09
5	4.0	-5.6***	0.80	-0.08	3.5	-6.1***	0.78	-0.10	0.5***	0.02
6	5.9	-4.0***	0.84	-0.12	4.9	-5.0***	0.91	-0.06	1.0***	-0.07
7	8.9	-0.8***	0.97	-0.16	7.5	-2.3***	1.01	-0.11	1.5***	-0.05
8	14.1	4.5***	1.08	0.06	12.1	2.5***	1.00	-0.02	2.0***	0.08
9	21.8	12.1***	1.09	0.01	19.4	9.7***	1.08	0.00	2.4***	0.01
Smallest	40.0	28.0***	1.04	-0.02	48.2	36.2***	0.88	-0.19	-8.2***	0.17*

Panel C. Short portfolios

Size Decile	Stars				Non-Stars				Stars – Non-Stars	
	Investment Weights, %		Returns,%		Investment Weights, %		Returns, %		Difference Investment Weights, %	Excess Returns, %
	Actual	Excess	Actual	Excess	Actual	Excess	Actual	Excess		
Largest	0.6	-9.3***	0.64	0.16	0.4	-9.6***	0.27	-0.21	0.3***	0.37
2	1.0	-8.7***	0.85	0.40	0.6	-9.1***	0.30	-0.14	0.4***	0.55
3	1.1	-8.9***	2.36	1.55**	1.0	-9.1***	1.16	0.35	0.2***	1.20*
4	1.8	-8.0***	0.51	-0.17	1.7	-8.2***	0.50	-0.18	0.2***	0.01
5	3.1	-6.6***	0.82	-0.06	3.2	-6.4***	0.79	-0.08	-0.1***	0.02
6	4.6	-5.4***	1.09	0.13	4.5	-5.4***	0.82	-0.14	0.1**	0.27
7	9.0	-0.7***	1.03	-0.09	7.6	-2.2***	1.00	-0.12	1.5***	0.03
8	14.6	5.0***	1.09	0.07	12.0	2.4***	0.99	-0.03	2.6***	0.10
9	22.2	12.5***	1.08	0.00	20.1	10.4***	1.02	-0.06	2.1***	0.06
Smallest	43.0	31.0***	0.52	-0.55**	49.2	37.1***	0.51	-0.55***	-6.1***	0.00

Figure 1. Holdings-based analysis of monthly excess returns for GICS Sectors. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations. The "Hold" and "Short" portfolios are not presented. Ten main GICS Sectors are used for sector classification.



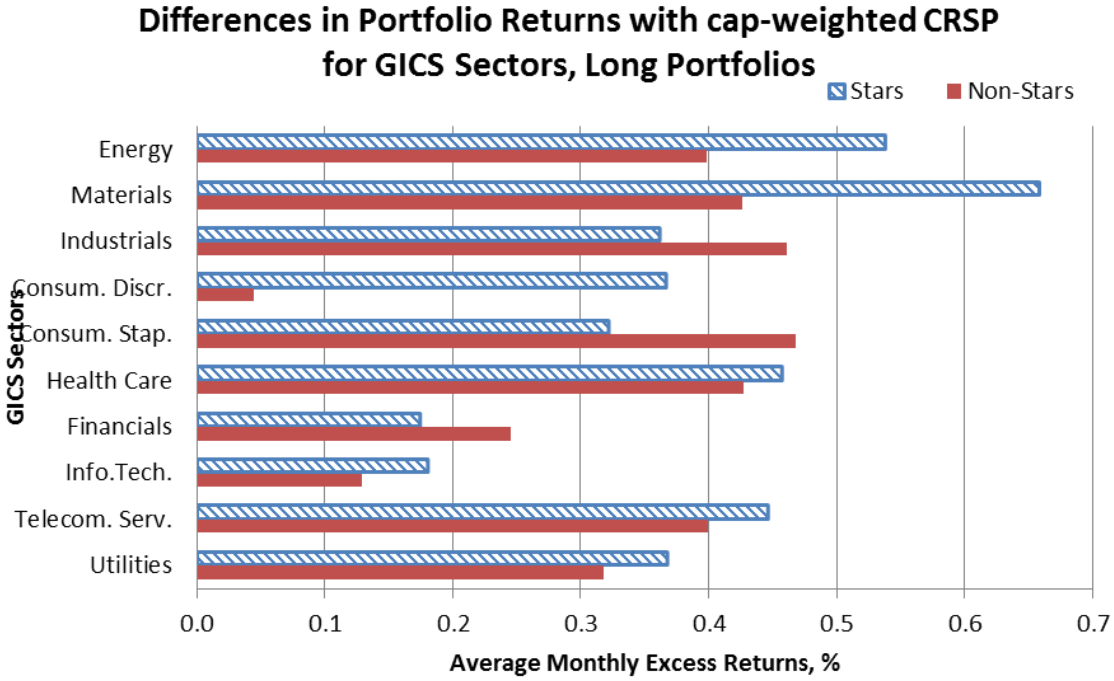
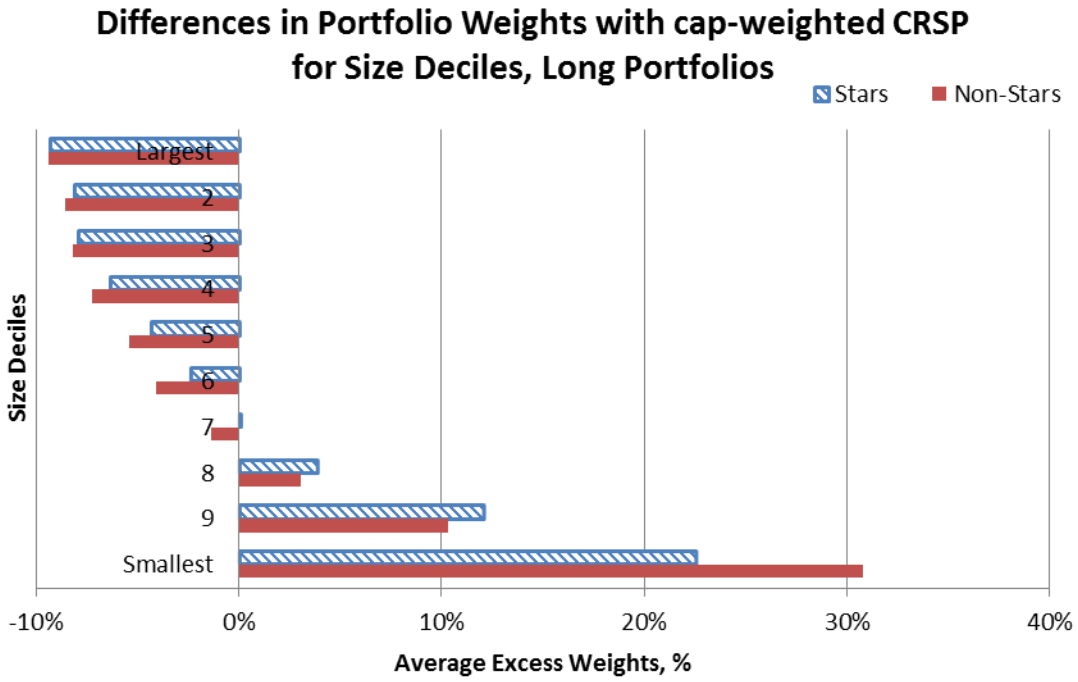
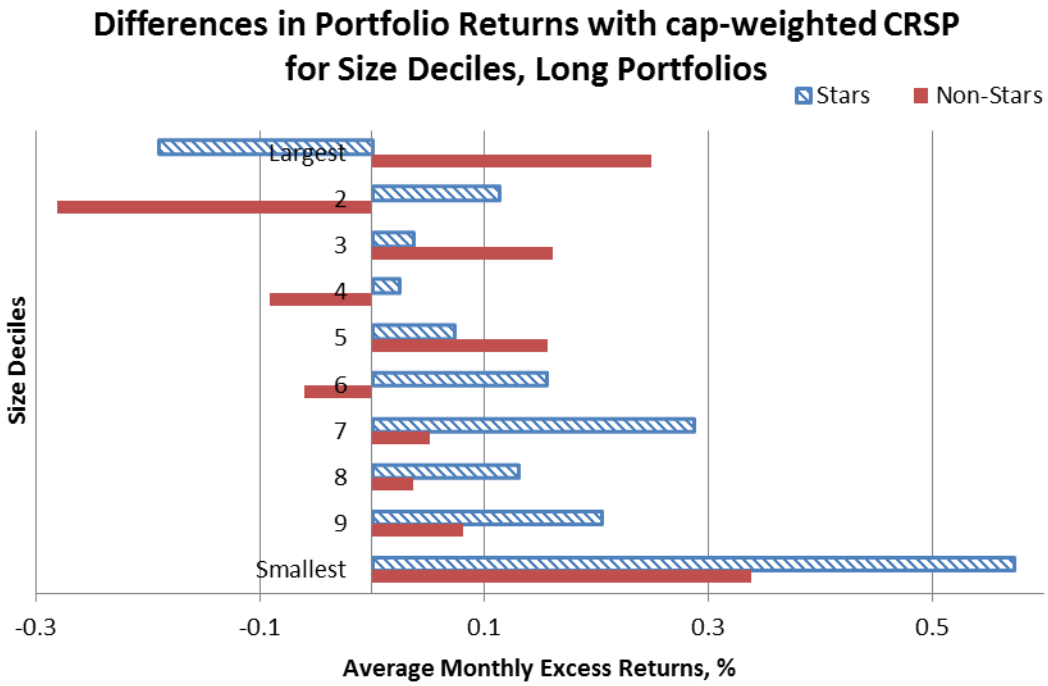


Figure 2. Holdings-based analysis of monthly excess returns for CRSP Size Deciles. Star analysts are those listed in *The Wall Street Journal*, *Institutional Investor*, and Thomson Reuters' *StarMine* "Top Stock Pickers" and "Top Earnings Estimators". Analysts in the group of Non-Stars are those who are not listed in any of the mentioned Star rankings during a particular evaluation year. Time period: from November 1, 2003 to May 30, 2014. The "Long" portfolio includes Strong Buy and Buy recommendations. The "Hold" and "Short" portfolios are not presented. CRSP Size classification was based on market-capitalization deciles.





Appendix A. Descriptive statistics for the daily number of stocks in the constructed sub-portfolios.

Panel A. GICS Sector sub-portfolios

	Stars				Non-Stars			
	Mean	**Std.Dev.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Min**	**Max**
Long Portfolios (Strong Buy, Buy)								
Energy	42.97	7.74	9	58	125.49	22.18	81	168
Materials	45.54	9.13	12	75	105.67	13.96	75	138
Industrials	86.21	21.20	23	133	195.08	31.60	139	275
Consumer Discretionary	102.41	18.63	44	139	231.26	19.89	175	275
Consumer Staples	30.14	5.04	10	41	54.57	5.12	41	66
Health Care	61.49	8.67	22	78	199.51	17.89	159	243
Financials	62.81	11.65	27	97	201.87	17.53	156	253
Information Technology	102.93	18.11	39	138	341.96	41.18	259	434
Telecommunication Services	10.84	2.71	3	17	32.43	6.23	20	50
Utilities	22.19	9.22	2	38	39.24	7.65	21	57
Hold Portfolios (Hold)								
Energy	50.46	8.91	26	69	134.15	21.65	94	176
Materials	56.82	9.52	22	76	116.46	14.91	87	149
Industrials	104.95	21.57	36	147	215.95	28.23	159	277
Consumer Discretionary	133.34	21.85	55	172	277.09	20.03	228	333
Consumer Staples	38.07	5.86	17	49	62.52	6.31	49	80
Health Care	77.63	12.82	28	107	233.14	17.98	197	280
Financials	91.91	17.89	47	134	272.93	34.86	207	346
Information Technology	124.70	22.12	63	177	377.61	40.12	302	463
Telecommunication Services	15.19	4.50	6	27	40.77	7.80	27	62
Utilities	28.62	9.67	6	47	50.22	8.30	30	69
Short Portfolios (Sell, Strong Sell)								
Energy	14.63	6.06	4	33	46.47	9.66	25	70
Materials	16.93	8.76	5	51	42.49	10.40	21	67
Industrials	24.39	9.10	7	53	49.27	12.81	20	77
Consumer Discretionary	37.75	9.84	20	63	89.48	15.52	54	120
Consumer Staples	10.81	3.51	4	20	20.63	3.81	12	30
Health Care	18.93	5.60	9	35	71.05	9.82	42	102
Financials	24.46	10.62	6	56	86.26	25.11	42	158
Information Technology	31.06	9.61	14	66	132.23	26.07	82	221
Telecommunication Services	4.40	2.11	1	10	17.26	5.60	5	30
Utilities	5.87	3.88	1	18	15.27	4.91	7	31

Panel B. CRSP Size Deciles sub-portfolios

	Stars				Non-Stars			
	Mean	**Std.Dev.**	**Min**	**Max**	**Mean**	**Std.Dev.**	**Min**	**Max**
Long Portfolios (Strong Buy, Buy)								
Largest	2.93	1.34	1	7	6.01	1.11	3	8
2	6.69	1.64	2	12	9.85	1.35	5	14
3	9.62	3.08	2	17	16.47	2.72	9	22
4	15.81	3.14	6	25	26.74	3.01	17	34
5	24.01	4.15	7	36	41.58	4.26	28	51
6	36.19	6.67	16	52	61.38	6.06	41	74
7	49.11	7.35	13	73	91.48	10.46	58	116
8	74.15	10.30	31	98	158.01	10.05	128	187
9	127.08	17.88	46	164	289.38	21.23	232	343
Smallest	240.32	47.04	73	353	871.49	78.75	704	1062
Hold Portfolios (Hold)								
Largest	3.82	1.53	1	7	6.04	1.36	2	9
2	5.77	1.80	1	10	9.87	1.69	5	14
3	8.23	2.48	1	14	16.16	3.02	9	23
4	15.62	2.99	4	23	26.37	3.42	15	36
5	23.85	4.10	9	34	43.05	4.22	30	53
6	37.58	6.76	13	55	63.15	6.20	43	79
7	57.11	8.14	20	76	94.52	9.43	69	112
8	91.25	13.86	40	128	169.34	14.80	126	203
9	155.38	17.52	79	196	318.00	26.49	257	402
Smallest	349.24	61.15	155	520	1088.81	92.92	900	1295
Short Portfolios (Sell, Strong Sell)								
Largest	1.43	0.50	1	2	2.27	1.15	1	6
2	1.88	1.00	1	6	3.34	1.56	1	8
3	2.24	1.06	1	6	5.09	2.13	1	12
4	3.37	1.96	1	9	8.65	2.45	3	15
5	5.45	2.81	1	16	15.91	3.00	9	25
6	8.47	4.39	1	21	22.96	5.17	10	40
7	16.04	4.97	6	28	38.88	6.80	17	57
8	26.93	8.88	11	57	63.89	9.26	42	103
9	42.42	15.11	14	91	112.88	18.22	69	182
Smallest	89.24	25.69	48	171	315.49	62.14	203	494