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Can Investors Profit from the Prophets? Security Analyst Recommendations and Stock Returns

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ABSTRACT

We document that purchasing (selling short) stocks with the most (least) favorable consensus recommendations, in conjunction with daily portfolio rebalancing and a timely response to recommendation changes, yield annual abnormal gross returns greater than four percent. Less frequent portfolio rebalancing or a delay in reacting to recommendation changes diminishes these returns; however, they remain significant for the least favorably rated stocks. We also show that high trading levels are required to capture the excess returns generated by the strategies analyzed, entailing substantial transactions costs and leading to abnormal net returns for these strategies that are not reliably greater than zero.

THIS STUDY EXAMINES WHETHER INVESTORS can profit from the publicly available recommendations of security analysts. Academic theory and Wall Street practice are clearly at odds regarding this issue. On the one hand, the semistrong form of market efficiency posits that investors should not be able to trade profitably on the basis of publicly available information, such as analyst recommendations. On the other hand, research departments of brokerage houses spend large sums of money on security analysis, presumably because these firms and their clients believe its use can generate superior returns.

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These observations provide a compelling empirical motivation for our inquiry and distinguish our analysis from many recent studies of stock return anomalies.[1] In contrast to many of these studies, which focus on corporate events, such as stock splits, or firm characteristics, such as recent return performance, that are not directly tied to how people invest their money, we analyze an activity—security analysis—that is undertaken by investment professionals at hundreds of major brokerage houses with the express purpose of improving the return performance of their clients.

The possibility that there could exist profitable investment strategies based on the publicly available recommendations of security analysts is suggested by the findings of Stickel (1995) and Womack (1996), who show that favorable (unfavorable) changes in individual analyst recommendations are accompanied by positive (negative) returns at the time of their announcement.[2] Additionally, they document a post-recommendation stock price drift, which Womack finds to last up to one month for upgrades and six months for downgrades.

Our paper's perspective, however, is different from that of Stickel and Womack. Their primary goal is to measure the average price reaction to changes in individual analysts' recommendations; therefore, they take an analyst and event-time perspective. This approach can only provide evidence as to whether, absent transactions costs, profitable investment strategies could potentially be designed around those recommendations. In contrast, we take a more investor-oriented, calendar-time perspective. This permits us to directly measure the abnormal gross returns to a number of investment strategies and to estimate portfolio turnover and the associated transactions costs incurred in implementing them. Consequently, we are able to determine whether investors can earn positive abnormal profits on these strategies after accounting for transactions costs.

By measuring turnover and assessing whether investors can generate abnormal returns net of trading costs on the various stock market investment strategies we examine, our analysis contributes to the market efficiency debate. Our methodology could easily be extended to the study of other strategies, such as those based on price momentum or the post-earnings announcement drift.

We focus on the profitability of investment strategies involving consensus (average) analyst recommendations. The consensus is a natural choice, as it takes into account the information implicit in the recommendations of *all* the analysts following a particular stock. It is arguably the analyst statistic that is most easily accessed by investors, as it appears on many Internet

[1] See Fama (1998) for a review and critique of this body of work.

[2] Other papers examining the investment performance of security analysts' stock recommendations are Diefenbach (1972), Bidwell (1977), Groth et al. (1979), Dimson and Marsh (1984), and Barber and Loeffler (1993). Copeland and Mayers (1982) study the investment performance of the *Value Line Investment Survey* and Desai and Jain (1995) analyze the return from following *Barron's* annual roundtable recommendations.

financial Web sites (such as CBS.MarketWatch.com and Yahoo!Finance) and is incorporated into the databases of several financial information providers (such as *Dow Jones Interactive*).

The data used in this paper come from the Zacks database for the period 1985 to 1996, which includes over 360,000 recommendations from 269 brokerage houses and 4,340 analysts. As such, our study uses a much larger sample of analyst recommendations than has been employed in past research. Stickel, by comparison, studies the price impact of 16,957 changes in analyst recommendations over the 1988 to 1991 period, and Womack analyzes the impact of 1,573 changes in analyst recommendations for the top 14 U.S. brokerage research departments during the 1989 to 1991 period.

With the Zacks database, we track in calendar time the investment performance of firms grouped into portfolios according to their consensus analyst recommendations. Every time an analyst is reported as initiating coverage, changing his or her rating of a firm, or dropping coverage, the consensus recommendation of the firm is recalculated and the firm moves between portfolios, if necessary. Any required portfolio rebalancing occurs at the end of the trading day. This means that investors are assumed to react to a change in consensus recommendation at the close of trading on the day that the change took place. Consequently, any return that investors might have earned from advance knowledge of the recommendations (or from trading in the recommended stocks at the start of the trading day) is excluded from the return calculations.

For our sample period we find that buying the stocks with the most favorable consensus recommendations earns an annualized geometric mean return of 18.8 percent, whereas buying those with the least favorable consensus recommendations earns only 5.78 percent (see Figure 1). As a benchmark, during the same period an investment in a value-weighted market portfolio earns an annualized geometric mean return of 14.5 percent. Alternatively stated, the most highly recommended stocks outperform the least favorably recommended ones by 102 basis points *per month*.

After controlling for market risk, size, book-to-market, and price momentum effects, a portfolio comprised of the most highly recommended stocks provides an average annual abnormal gross return of 4.13 percent whereas a portfolio of the least favorably recommended ones yields an average annual abnormal gross return of −4.91 percent. Consequently, purchasing the securities in the top portfolio and selling short those in the lowest portfolio yields an average abnormal gross return of 75 basis points per month.[3] By comparison, over the same period, high book-to-market stocks outperform low book-to-market stocks by a mere 17 basis points, and large firms out-

[3] If large institutional clients were to gain access to, and trade on, analysts' recommendations before they were made public, their investment value would be even greater. This is due to the strong market reaction that immediately follows the announcement of a recommendation. (The magnitude of this reaction for our sample of analyst recommendations is documented in Table III.)

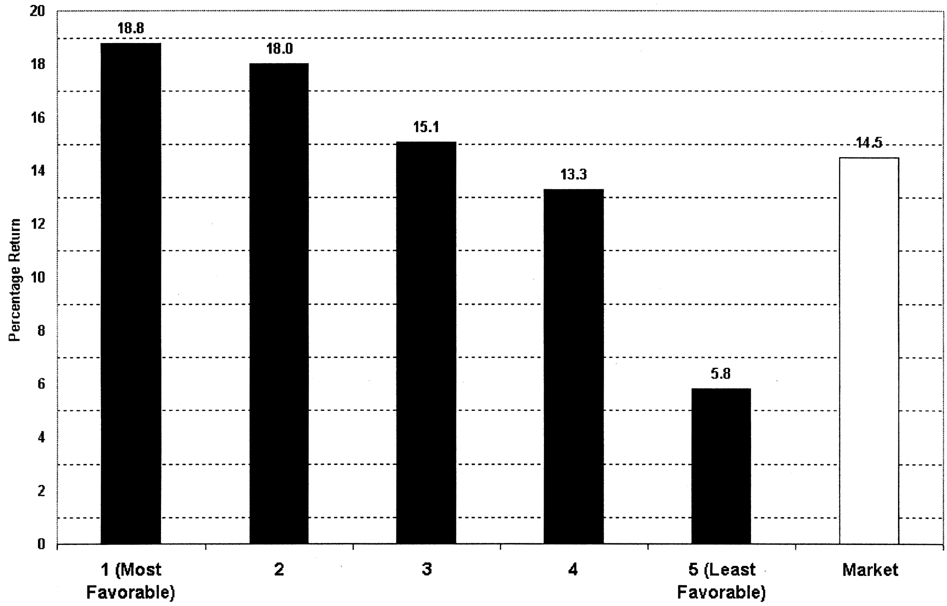

Figure 1. Annualized geometric mean percentage gross return earned by portfolios formed on the basis of consensus analyst recommendations, 1986 to 1996.

perform small firms by 16 basis points per month. Our results are most pronounced for small firms; among the few hundred largest firms we find no reliable differences between the returns of those most highly rated and those least favorably recommended.

Underlying the calculation of these abnormal returns is the assumption that investors react in a timely manner to changes in analysts' consensus recommendations. It is expected, though, that many smaller investors will take some time to react, either because they only gain access to consensus recommendation changes after one or more days, or because it is impractical for them to engage in the daily portfolio rebalancing that is needed to respond to the changes. To understand the impact of these delays on the returns investors can earn, we examine two additional sets of investment strategies. The first entails less frequent portfolio rebalancing—weekly, semimonthly, or monthly—instead of daily. For this set of strategies the average annual abnormal gross return to the portfolio of the highest rated stocks declines to between 2 and $2\frac{1}{2}$ percent, numbers that are, for the most part, not reliably greater than zero. In contrast, the average annual abnormal gross return on the portfolio of the least favorably recommended stocks remains significantly less than zero, although the magnitude decreases somewhat, to between -4 and $-4\frac{1}{2}$ percent. Apparently, very frequent rebalancing is crucial to capturing the gross returns on the most highly recommended stocks, but is not as important in garnering the gross returns on those that are least favorably rated.

The second set of alternative strategies retains daily portfolio rebalancing but assumes a delayed reaction by investors to all changes in analysts' consensus recommendations—of either one week, a half-month, or a full month. We show that a delay of either one week or a half month decreases the average annual abnormal gross return on the portfolio of the most highly recommended stocks to around two percent, whereas a month's delay reduced it to less than one percent. None of these returns is reliably greater than zero. In contrast, the average annual abnormal gross return on the portfolio of the least favorably rated stocks remains significantly negative for all delay periods examined, standing at over -4 percent for a one-week delay and about $-2\frac{1}{2}$ percent for either a half month's or a full month's delay. These results highlight the importance to investors of acting quickly to capture the gross returns on the highest rated stocks.

None of the returns documented thus far take into account transactions costs, such as the bid-ask spread, brokerage commissions, and the market impact of trading. As we show, under the assumption of daily rebalancing, purchasing the most highly recommended securities or shorting the least favorably recommended ones requires a great deal of trading, with turnover rates at times in excess of 400 percent annually. After accounting for transactions costs, these active trading strategies do not reliably beat a market index. Restricting these trading strategies to the smallest firms (whose abnormal gross returns are shown to be the highest) does not alter this conclusion; transactions costs remain very large, and abnormal net returns are not significantly greater than zero. Rebalancing less frequently does reduce turnover significantly (falling below 300 percent for monthly rebalancing). But, because the abnormal gross returns fall as well, abnormal net returns are still not reliably greater than zero, in general. Despite the lack of positive net returns to the strategies we examine, analyst recommendations do remain valuable to investors who are otherwise considering buying or selling. *Ceteris paribus*, an investor would be better off purchasing shares in firms with more favorable consensus recommendations and selling shares in those with less favorable consensus ratings.

Although a large number of trading strategies are investigated and none are found to yield positive abnormal net returns, our analysis by no means rules out the possibility that profitable trading strategies exist. It remains an open question whether other strategies based on analysts' recommendations (or based on a subset of analysts' recommendations, such as those of the top-ranked analysts or the largest brokerage houses), or even whether the strategies studied here, but applied to different time periods or different stock recommendation data, will be able to generate positive abnormal net returns.

The plan of this paper is as follows. In Section I, we describe the data and our sample selection criteria. A discussion of our research design follows in Section II. In Section III, we form portfolios according to consensus analyst recommendations and analyze their returns. The impact of investment delays on the returns available to investors is considered in Section IV. In

Section V we estimate the transactions costs of following the strategies of buying the most highly rated stocks and selling short those that are least favorably rated and discuss the profitability of these strategies. We partition our sample by firm size and reexamine the returns to our strategies in Section VI. A summary and conclusions section ends the paper.

I. The Data, Sample Selection Criteria, and Descriptive Statistics

The analyst recommendations used in this study were provided by Zacks Investment Research, which obtains its data from the written and electronic reports of brokerage houses. The recommendations encompass the period from 1985 (the year that Zacks began collecting this data) through 1996. Each database record includes, among other items, the recommendation date, identifiers for the brokerage house issuing the recommendation and the analyst writing the report (if the analyst's identity is known), and a rating between 1 and 5. A rating of 1 reflects a strong buy recommendation, 2 a buy, 3 a hold, 4 a sell, and 5 a strong sell. This five-point scale is commonly used by analysts. If an analyst uses a different scale, Zacks converts the analyst's rating to its five-point scale. Ratings of 6 also appear in the Zacks database and signify termination of coverage.

Another characteristic of the database, one that has not been explicitly acknowledged in any prior study as far as we are aware, is that the data made available to academics does not constitute Zacks' complete set of recommendations. According to an official at Zacks, some individual brokerage houses have entered into agreements that preclude their recommendations from being distributed by Zacks to anyone other than the brokerage houses' clients. Consequently, although the recommendations of most large and well-known brokers are included, the recommendations of several large brokerage houses are not part of this academic database (although they are represented in Zacks' consensus statistics).[4,5]

The Zacks database contains 378,326 observations for the years 1985 through 1996. Dropping those for the 1,286 firms not appearing on the CRSP file leaves a final sample of 361,620 recommendations. Table I provides descriptive statistics for these recommendations. As shown in column 3, the number of firms covered by Zacks has increased steadily over the years. For the year

[4] For the first year in which we compute recommendation returns, 1986, the Zacks database includes the recommendations of 12 of the 20 largest brokerage houses, in terms of capital employed. (Capital levels are taken from the *Securities Industry Yearbook* (1987, 1997).) The capital of these 12 brokerage houses comprises 54 percent of the total capital of these largest houses. For the last year of recommendation returns, 1996, the Zacks database includes the recommendations of 12 of the 19 largest brokerage houses (the 20th does not prepare analyst recommendations), whose capital comprises 49 percent of the total capital of these largest houses.

[5] Supplementary tests performed using the *First Call* database (which includes these large brokerage house recommendations) suggest that these omissions do not have a significant effect on our results. See footnote 20.

Table I

Descriptive Statistics on Analyst Recommendations from the Zacks Database, 1985 to 1996

The number of listed firms includes all firms listed on the CRSP NYSE/AMEX/Nasdaq stock return file, by year. The number of covered firms is the number of firms with at least one valid recommendation in the Zacks database, by year. The number of covered firms is also expressed as the percent of the number of listed firms. The market capitalization of covered firms as a percent of the total market capitalization is the average daily ratio between the sum of the market capitalizations of all covered firms and the market value of all securities used in the CRSP daily value-weighted indices. The mean and median number of analysts issuing recommendations for each covered firm is shown, as is the mean and median number of firms covered by each analyst in the database, by year. This is followed by the number of brokerage houses and number of analysts with at least one recommendation during the year. The last column is the average of all analyst recommendations in the database for the year.

			Covered Firms		Analysts per Covered Firm		Covered Firms per Analyst				
Year (1)	No. of Listed Firms (2)	No. of Covered Firms (3)	As a % of Listed Firms (4)	Market Cap. As % of Market (5)	Mean (6)	Median (7)	Mean (8)	Median (9)	No. of Brokers (10)	No. of Analysts (11)	Average Rating (12)
1985	6,826	1,841	27.0	68.8	2.66	2	10	7	26	492	2.52
1986	7,281	2,989	41.1	85.3	4.25	3	13	10	61	960	2.37
1987	7,575	3,163	41.8	89.0	4.53	3	13	10	74	1,080	2.28
1988	7,573	3,226	42.6	90.5	4.75	3	13	10	96	1,171	2.32
1989	7,304	3,066	42.0	91.2	4.15	3	12	9	95	1,032	2.35
1990	7,138	3,105	43.5	92.3	4.50	3	13	10	98	1,082	2.34
1991	7,171	3,201	44.6	93.0	5.18	3	13	11	120	1,270	2.36
1992	7,459	3,546	47.5	93.8	5.09	3	12	10	131	1,452	2.23
1993	7,964	4,097	51.4	93.5	5.50	3	13	11	151	1,700	2.22
1994	8,494	4,611	54.3	93.9	5.61	3	13	11	169	2,007	2.09
1995	8,857	5,129	57.9	94.6	5.37	3	13	11	188	2,144	2.11
1996	9,408	5,628	59.8	95.6	5.27	3	13	11	195	2,367	2.04
Average All Years	7,754	3,634	46.1	90.1	4.74	3	13	10	117	1,396	2.27

1996, 59.8 percent of all firms on the NYSE, AMEX, or Nasdaq have at least one recommendation in the database (column 4). The market capitalization of these firms constitute 95.6 percent of the capitalization of all firms in the market (column 5). This is consistent with the conventional wisdom that analysts tend to cover larger firms, because they offer more liquidity and allow the analysts' clients to more easily take large positions in the firms' shares (which, in turn, generates larger commissions revenues for the brokerage houses).

From 1986 onward, the mean number of analysts per covered firm has generally been increasing (column 6), whereas the median number has remained constant (column 7). The mean and median number of covered firms per analyst has also been stable (columns 8 and 9). Additionally, the number of brokerage houses contributing recommendations to Zacks and the number of analysts providing forecasts has steadily increased over time (columns 10 and 11). The last column of the table reports the average of all of the analyst ratings, by year. It shows a rather steady decrease over time, indicating that analysts' recommendations have become more favorable.[6]

A 6×6 transition matrix of the analysts' recommendations appears in Table II. Each cell $\{i, j\}$ of the matrix contains two numbers. The top one is the number of observations in the database in which an analyst moved from a recommendation of i to one of j; the bottom number is the median number of calendar days between the announcement of a recommendation of i and a revised recommendation of j. The diagonal elements of the matrix reflect reiterations of analyst recommendations. Most of the entries in this matrix are concentrated in the upper 3×3 cells. This is to be expected, given the conventional wisdom that analysts are reluctant to issue sell recommendations. Within this region, the bulk of the observations represent reiterations. The mean time between a recommendation and its reiteration is a little less than 300 days. This is much longer than the mean time between a recommendation and a revision by the analyst to a new rating, which is generally in the low 100-day range. To the extent that the Zacks database does not record all reiterations, such a difference is not surprising.

The line entitled "First Zacks Recommendation" records the first recommendation in the database for a given analyst–company pair. Consistent with McNichols and O'Brien (1998), the first recommendation is usually a buy (1 or 2), less often a hold, and rarely a sell (4 or 5). This again reflects the reluctance of analysts to issue sell recommendations. This observation is also consistent with the numbers in the last two lines of the table. Of all the recommendations in the database, 47.1 percent are buys whereas only 5.7 percent are sells. Excluding observations with a rating of 6, buys constitute 54.1 percent of the total, whereas sells make up only 6.5 percent.

[6] The year 1985 has, by far, the smallest number of covered firms, brokerage houses, and analysts, likely because it is the first year that Zacks began tracking recommendations. Because the 1985 data is so sparse, we do not include the investment returns from that year in our analysis.

Table II

Transition Matrix of Analyst Recommendations (Number, Median Calendar Days), 1985 to 1996

This table shows the number and the median calendar days between changes in or reiterations of recommendations. The first row reports all changes from a recommendation of 1 ("strong buy") to 1, 2 ("buy"), 3 ("hold"), 4 ("sell"), 5 ("strong sell") or discontinuation of coverage, and the total across the columns. The sixth and seventh rows identify recommendations for firms that were previously dropped from coverage and for firms for which coverage was initiated in the database. Fractional recommendations are rounded to the nearest whole value.

From	To Recommendation of:						
Recommendation of:	1	2	3	4	5	Dropped	Total
1	34,939	15,269	16,887	538	805	9,802	78,240
	293	109	128	140	135	121	
2	14,010	21,936	17,581	1,349	468	8,177	63,521
	95	299	115	106	111	121	
3	12,945	14,492	52,813	3,971	2,958	15,332	102,511
	113	112	291	114	116	123	
4	480	1,180	3,913	2,936	668	1,097	10,274
	132	103	98	245	98	135	
5	396	316	2,739	439	1,409	1,143	6,442
	95	105	94	90	301	99	
Dropped	4,951	3,507	5,999	546	400	5,013	20,416
	73	65	92	102	110	59	
First Zacks recommendation	26,053	19,817	24,458	2,392	1,531	5,965	80,216
Total	93,774	76,517	124,390	12,171	8,239	46,529	361,620
% of total	25.9	21.2	34.4	3.4	2.3	12.9	
% of non-drops	29.8	24.3	39.5	3.9	2.6		

We also compute the average three-day announcement period return for changes in or initiations of analyst recommendations. These returns are presented in Table III. Similar to the results of Stickel (1995) and Womack (1996), we find that the compound (size-adjusted) return for the three-day period centered on the day a rating change is announced is, in general, significantly positive for upgrades and significantly negative for downgrades.[7]

[7] Using the *First Call* database, Womack (1996) reports three-day returns that are much higher in magnitude than those documented here. This is consistent with his assertion that there are occasional delays in the recording of some of the recommendations in the Zacks database. (The difference may also be because Womack's sample consists only of large brokerage house recommendations. If these recommendations are accorded more publicity, this could lead to the market reaction being larger in the few days around their announcement.) As we report in footnote 20, though, supplementary tests using *First Call* data suggest that any timing issues surrounding Zacks do not have a significant effect on our main results.

Table III

Three-day Percentage Market-adjusted Returns Associated with Announcements of Changes in and Reiterations of Analyst Recommendations, 1985 to 1996

This table shows the percentage market-adjusted returns measured for the day before, the day of, and the day following changes in and reiterations of analyst recommendations. For example, the first row reports the returns associated with all changes from a recommendation of 1 (strong buy) to 1, 2 (buy), 3 (hold), 4 (sell), 5 (strong sell), or discontinuation of coverage. Returns are measured as the three-day buy and hold return less the return on a value-weighted NYSE/AMEX/Nasdaq index. The sixth and seventh rows show the returns associated with recommendations for firms that were previously dropped from coverage, and for firms for which coverage was initiated, respectively. Fractional recommendations are rounded to the nearest whole value. t-statistics, estimated using cross-sectional standard errors, are shown below the returns. Each t-statistic pertains to the hypothesis that the mean size-adjusted abnormal return is zero. (The number of observations in each cell is shown in Table II.)

From	To Recommendation of:					
Recommendation of:	1	2	3	4	5	Dropped
1	0.177	−0.889	−2.192	−1.305	−3.021	−0.020
	7.525	−17.448	−32.841	−4.129	−6.792	−0.364
2	1.059	0.114	−1.415	−0.638	−0.999	0.115
	21.565	3.809	−25.876	−3.154	−2.187	2.135
3	1.488	1.066	0.015	−1.054	−0.976	0.112
	27.895	22.877	0.788	−10.195	−5.926	2.630
4	0.723	0.610	0.610	−0.130	−0.336	0.393
	3.388	4.105	6.908	−1.399	−1.226	2.347
5	0.607	1.296	0.400	−0.283	−0.005	0.207
	2.113	4.384	3.487	−0.964	−0.032	0.999
Dropped	0.637	0.301	0.051	−1.168	−0.474	
	8.586	3.533	−0.810	−4.728	−1.463	
First Zacks recommendation	1.093	0.479	−0.149	−0.209	−0.650	
	29.445	13.150	−4.736	−2.135	−4.384	

Furthermore, for the set of initial analyst–company recommendations in the database, a buy rating (1 or 2) is accompanied by a significantly positive return, as expected, whereas a hold or sell rating (3, 4, or 5) is associated with a significantly negative return.

II. Research Design

A. Portfolio Construction

To determine whether investors can profit from analysts' consensus recommendations, we construct calendar-time portfolios based on the consensus rating of each covered firm. The average analyst rating, $\bar{A}_{i\tau-1}$, for firm i on date $\tau - 1$ is found by summing the individual ratings, $A_{ij\tau-1}$, of the

$j = 1$ to $n_{i\tau-1}$ analysts who have outstanding recommendations for the firm on that day and dividing by $n_{i\tau-1}$. Formally,

$$\bar{A}_{i\tau-1} = \frac{1}{n_{i\tau-1}} \sum_{j=1}^{n_{i\tau-1}} A_{ij\tau-1}. \quad (1)$$

Using these average ratings, each covered firm is placed into one of five portfolios as of the close of trading on date $\tau - 1$. The first portfolio consists of the most highly recommended stocks, those for which $1 \leq \bar{A}_{i\tau-1} \leq 1.5$; the second is comprised of firms for which $1.5 < \bar{A}_{i\tau-1} \leq 2$; the third contains firms for which $2 < \bar{A}_{i\tau-1} \leq 2.5$; the fourth is comprised of firms for which $2.5 < \bar{A}_{i\tau-1} \leq 3$; and the fifth portfolio consists of the least favorably recommended stocks, those for which $\bar{A}_{i\tau-1} > 3$.[8]

After determining the composition of each portfolio p as of the close of trading on date $\tau - 1$, the value-weighted return for date τ is calculated. Denoted by $R_{p\tau}$ for portfolio p, this return is given by:

$$R_{p\tau} = \sum_{,i=1}^{n_{p\tau-1}} x_{i\tau-1} R_{i\tau}, \quad (2)$$

where

$x_{i\tau-1}$ = the market value of equity for firm i as of the close of trading on date $\tau - 1$ divided by the aggregate market capitalization of all firms in portfolio p as of the close of trading on that date,
$R_{i\tau}$ = the return on the common stock of firm i on date τ, and
$n_{p\tau-1}$ = the number of firms in portfolio p at the close of trading on date $\tau - 1$.

There are two reasons we value weight rather than equally weight the securities in each portfolio. First, an equal weighting of daily returns (and the implicit assumption of daily rebalancing) leads to portfolio returns that are severely overstated.[9] Second, a value weighting allows us to better capture the economic significance of our results, as the individual returns of the

[8] Five portfolios are chosen so as to achieve a high degree of separation across firms in the sample while retaining sufficient power for our tests. The cutoffs, although somewhat arbitrary, are set so that only the bottom portfolio contains firms whose consensus ratings corresponded to hold or sell recommendations, due to the relative infrequency of such ratings. Qualitatively similar results are obtained for our main analysis when (1) the cutoffs for portfolios 1, 2, 3, and 4 each year are set equal to the 20th, 40th, 60th, and 80th percentiles, respectively, of the prior year's distribution of consensus recommendations, and (2) the first portfolio includes only firms with an average rating of one.

[9] This problem arises due to the cycling over time of a firm's closing price between its bid and ask (commonly referred to as the bid-ask bounce). For a more detailed discussion, see Blume and Stambaugh (1983), Barber and Lyon (1997), Canina et al. (1998), and Lyon, Barber, and Tsai (1999).

larger and more important firms will be more heavily represented in the aggregate return than will those of the smaller firms. This may, however, bias against finding evidence of abnormal returns, as markets are likely to be most efficient for the largest securities.

For each month in our sample period, the daily returns for each portfolio p, $R_{p\tau}$, are compounded over the n trading days of the month to yield a monthly return, R_{pt}:

$$R_{pt} = \prod_{\tau=1}^{n} (1 + R_{p\tau}) - 1. \tag{3}$$

In addition to these five portfolios, we construct two other portfolios. The first additional portfolio consists of all covered firms on each date τ (those that have an outstanding rating from at least one analyst in the Zacks database on that day) and the second portfolio consists of neglected firms on that date (those firms on the CRSP daily returns file that do not have any outstanding analyst ratings on that day).[10] The composition of each of these two portfolios is recalculated every day, because firms gain or lose analyst coverage over time.

B. Performance Evaluation

To determine whether profitable investment strategies exist with respect to analysts' consensus recommendations, we begin with a simple calculation of market-adjusted returns for each of our constructed portfolios. It is given by $R_{pt} - R_{mt}$ for portfolio p in month t, where R_{mt} is the month t return on the CRSP NYSE/AMEX/Nasdaq value-weighted market index. We next calculate three measures of abnormal performance for each portfolio. First, we employ the theoretical framework of the Capital Asset Pricing Model (CAPM) and estimate the following monthly time-series regression:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + \epsilon_{pt}, \tag{4}$$

where

R_{ft} = the month t return on treasury bills having one month until maturity,[11]
α_p = the estimated CAPM intercept (Jensen's alpha),
β_p = the estimated market beta, and
ϵ_{pt} = the regression error term.

This test yields parameter estimates of α_p and β_p.

[10] Because the academic version of the Zacks database does not include the recommendations of all brokerage houses, it is possible that some of the "neglected" firms are actually covered by one or more analysts. To the extent this is true, our test for differences in returns between neglected and covered firms is less powerful.

[11] This return is taken from *Stocks, Bonds, Bills, and Inflation, 1997 Yearbook*.

Second, we employ an intercept test using the three-factor model developed by Fama and French (1993). To evaluate the performance of each portfolio, we estimate the following monthly time-series regression:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \epsilon_{pt}, \quad (5)$$

where

SMB_t = the difference between the month t returns of a value-weighted portfolio of small stocks and one of large stocks, and

HML_t = the difference between the month t returns of a value-weighted portfolio of high book-to-market stocks and one of low book-to-market stocks.[12]

The regression yields parameter estimates of α_p, β_p, s_p, and h_p.

A third test includes a zero investment portfolio related to price momentum, as follows:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + m_p PMOM_t + \epsilon_{pt}. \quad (6)$$

$PMOM_t$ is the equally weighted month t average return of the firms with the highest 30 percent return over the 11 months through month $t-2$, less the equally weighted month t average return of the firms with the lowest 30 percent return over the 11 months through month $t-2$.[13] In addition to estimates of α_p, β_p, s_p, and h_p, this regression yields a parameter estimate of m_p. This specification will be referred to as the four-characteristic model.

In the analysis below we use these coefficient estimates to provide insights into the nature of the firms in each of the portfolios. A value of β_p greater (less) than one indicates that the firms in portfolio p are, on average, riskier (less risky) than the market. A value of s_p greater (less) than zero signifies a portfolio tilted toward smaller (larger) firms. A value of h_p greater (less) than zero indicates a tilt toward stocks with a high (low) book-to-market ratio. Finally, a value of m_p greater (less) than zero signifies a portfolio with stocks that have, on average, performed well (poorly) in the recent past.[14]

[12] The construction of these portfolios is discussed in detail in Fama and French (1993). We thank Ken French for providing us with this data.

[13] The rationale for using price momentum as a factor stems from the work of Jegadeesh and Titman (1993), who show that the strategy of buying stocks that have performed well in the recent past and selling those that have performed poorly generates significant positive returns over 3- to 12-month holding periods. This measure of price momentum has been used by Carhart (1997). We thank Mark Carhart for providing us with the price momentum data.

[14] Our use of the Fama-French and four-characteristic models does not imply a belief that the small firm, book-to-market, and price momentum effects represent risk factors. Rather, we use these models to assess whether any superior returns that are documented are due to analysts' stock-picking ability or to their choosing stocks with characteristics known to produce positive returns.

C. Turnover

Both the raw and risk-adjusted returns that are calculated are gross of any trading costs arising from the bid-ask spread, brokerage commissions, and the market impact of trading. To assess the size of these costs we calculate a measure of daily turnover for each portfolio. Turnover for portfolio p during trading day τ is defined as the percentage of the portfolio's holdings as of the close of trading on date $\tau - 1$ that has been sold off as of the close of trading on date τ. That is, it is the percent of the portfolio that has been "turned over" into some other set of stocks during date τ.

Turnover is calculated by following a three-step procedure. First, for each stock i in portfolio p as of the close of trading on date $\tau - 1$, we calculate the fraction it would have comprised of the portfolio at the end of trading on date τ *if there were no portfolio rebalancing*. Denoting this fraction by $G_{i\tau}$, it is given by

$$G_{i\tau} = \frac{x_{i\tau-1} \cdot (1 + R_{i\tau})}{\sum_{i=1}^{n_{p\tau-1}} x_{i\tau-1} \cdot (1 + R_{i\tau})}, \tag{7}$$

where, as before, $x_{i\tau-1}$ is the market value of equity for firm i as of the close of trading on date $\tau - 1$ divided by the aggregate market capitalization of all firms in portfolio p as of the close of trading on that date. Next, $G_{i\tau}$ is compared to the actual fraction firm i makes up of portfolio p at the end of trading on date τ, denoted by $F_{i\tau}$, taking into account any portfolio rebalancing required as a result of changes in analyst recommendations. Finally, the decrease (if any) in the percentage holding of each of the date $\tau - 1$ securities is summed, yielding the day's portfolio turnover. Denoted by $U_{i\tau}$, it is formally given by

$$U_{i\tau} = \sum_{i=1}^{n_{p\tau}} \max\{G_{i\tau} - F_{i\tau}, 0\}. \tag{8}$$

Annual turnover is then calculated by multiplying $U_{i\tau}$ by the number of trading days in the year.

III. Portfolio Characteristics and Returns

Table IV provides descriptive statistics for portfolios formed on the basis of analysts' consensus recommendations. Note first that the average number of firms in the portfolio of the least favorably ranked stocks, portfolio 5 (comprised of stocks with a consensus rating greater than 3 and less than or equal to 5), is less than one-third that of any of the other four portfolios (column 2). This is not surprising, because analysts are reluctant to issue sell recommendations. Given the consensus rating cutoffs we have chosen for portfolios 1 through 4, the average numbers of firms in these portfolios turn out to be roughly similar. There is considerable variation across portfolios in the average number of analysts per firm, though, ranging from a low of 2.35 for portfolio 1 to a high of 4.93 for portfolio 3 (column 3). The low number of analysts for firms in portfolio 1 may well reflect the difficulty a firm has in attaining an average rating of between 1 and 1.5 if there are many analysts covering it, and leads one to suspect that these firms are relatively small. This is confirmed by the data in column 5, which shows the market capitalization of these firms to be considerably smaller than that of the firms in portfolios 2, 3, and 4. The market capitalization of the firms in portfolio 5 is also small. This is consistent with the conventional wisdom that analysts are more reluctant to issue sell recommendations for the larger firms, as they are more likely to generate future investment banking business.

The annual turnover of each portfolio is given in column 6. It is remarkably stable across the five portfolios, varying from a low of 433 percent for portfolio 2 to a high of 478 percent for portfolio 4. These numbers are relatively high, especially when compared to an annual turnover figure of 12 percent for the portfolio of all covered firms, 70 percent for the neglected firm portfolio, and only 7 percent for a portfolio comprised of all the firms on CRSP. These high turnover numbers are driven by the fact that, conditional on receiving coverage, a firm changes portfolios 3.81 times per year, on average.

Table IV also presents the estimated coefficients for the four-characteristic model. The significant coefficients on market risk premium, *SMB*, and *HML* (columns 7–9) for portfolio 1 are indicative of small growth stocks with higher than average market risk. The significant coefficients on *SMB*, *HML*, and *PMOM* (column 10) for portfolio 5 reflect small-value firms that have performed poorly in the past. The coefficient on the market risk premium generally decreases as we move from portfolio 1 to portfolio 5, whereas the coefficient on *HML* increases, indicating that less favorable analyst ratings are associated with firms of lower market risk and higher book-to-market ratios. Compared to covered firms as a whole, neglected stocks are smaller, on average, with lower market risk and higher book-to-market ratios.

Table V, columns 2–6, documents the differential gross returns to the various portfolios and suggests the possibility that investment strategies based on publicly available consensus recommendations could be profitable. As shown in columns 2 and 3, there is a monotonic decrease in both raw and market-adjusted returns as we move from more highly to less highly recommended stocks. Portfolio 1's average monthly market-adjusted return of 0.351 percent translates into a cumulative return of close to 50 percent over the entire 11-year period, whereas portfolio 5's average monthly market-adjusted return of −0.667 is equivalent to a cumulative return of nearly −90 percent, a 140 percentage point spread.

One might conjecture that the patterns in market-adjusted returns can be explained by the market risk, size, book-to-market, and price momentum characteristics of the recommended stocks. The intercept tests from the CAPM, the Fama-French three-factor model, and the four-characteristic model pro-

Table IV

Descriptive Characteristics for Portfolios Formed on the Basis of Analyst Recommendations, 1986 to 1996

This table presents descriptive statistics for several portfolios. The first five portfolios are based on the daily average analyst recommendation. Portfolios 1–5 include stocks with average daily recommendations of (1–1.5], (1.5–2], (2–2.5], (2.5–3] and greater than 3, respectively. The difference between returns for portfolios 1 and 5 is shown next. The "All Covered" portfolio is the set of all stocks in portfolios 1–5, and the "Neglected" portfolio consists of all stocks on the daily CRSP returns file with no Zacks recommendations for a sample day. The final line shows the difference between returns for the All Covered and Neglected stocks. The average monthly number of firms in each portfolio, the mean number of analysts per firm per day in that portfolio, the average rating, and the percent of total market capitalization represented by the firms in the portfolio are shown. Annual turnover is calculated as the average percentage of the portfolio's holdings as of the close of one day's trading that has been sold as of the close of trading on the next trading day, multiplied by the number of trading days in the year. The coefficient estimates are those from a time-series regression of the portfolio returns $(R_p - R_f)$ on the market excess return $(R_m - R_f)$, a zero-investment size portfolio (SMB), a zero-investment book-to-market portfolio (HML), and a zero-investment price momentum portfolio (PMOM). t-statistics appear below the coefficient estimates. Each t-statistic pertains to the null hypothesis that the associated coefficient is zero, except for the t-statistics on the coefficient estimate of $(R_m - R_f)$ for portfolios 1–5, and the All Covered and Neglected portfolios, for which the null hypothesis is that the coefficient is one. The t-statistics for coefficients that are significant at a level of 10 percent or better are shown in bold.

Portfolio (1)	Monthly Avg. No. of Firms (min, max) (2)	No. of Analysts (3)	Average Rating (4)	% of Market Cap (5)	% Annual Turnover (6)	Coefficient Estimates for the Four-Characteristic Model				Adjusted R^2 (11)
						$R_m - R_f$ (7)	SMB (8)	HML (9)	PMOM (10)	
1 (most favorable)	760	2.35	1.24	8.5	458	1.055	0.214	−0.313	0.010	94.0
	(189, 1759)					**1.881**	**4.304**	**−5.408**	0.215	
2	810	3.61	1.85	29.7	433	1.030	−0.020	−0.155	0.025	98.2
	(391, 1396)					**2.064**	−0.794	**−5.377**	1.049	
3	646	4.93	2.29	34.2	459	0.988	−0.060	0.070	0.056	98.6
	(237, 948)					−1.055	**−3.110**	**3.118**	**3.023**	
4	804	3.21	2.80	17.6	478	0.958	0.017	0.232	−0.022	95.8
	(522, 1046)					**−2.267**	0.538	**6.221**	−0.737	
5 (least favorable)	211	3.58	3.52	3.0	465	0.960	0.260	0.279	−0.293	88.3
	(115, 317)					−1.204	**4.556**	**4.213**	**−5.407**	
P1–P5	971	NA	NA	NA	923	0.095	−0.046	−0.592	0.303	47.2
	(375, 1876)					**1.980**	−0.552	**−6.221**	**3.893**	
All covered	3231	3.22	2.21	92.1	12	0.994	0.001	−0.004	0.015	99.9
	(1554, 5146)					**−1.698**	0.119	−0.607	**2.682**	
Neglected	3932	NA	NA	9.7	70	0.934	0.402	0.276	−0.024	94.9
	(3537, 4705)					**−3.120**	**11.161**	**6.554**	−0.698	
All covered − neglected	7163	NA	NA	NA	82	0.060	−0.402	−0.280	0.039	60.9
	(6259, 8781)					**2.760**	**−10.744**	**−6.441**	1.095	

Table V

Percentage Monthly Returns Earned by Portfolios Formed on the Basis of Analyst Recommendations, 1986 to 1996

This table presents percentage monthly returns earned by portfolios formed according to average analyst recommendation. Raw returns are the mean percentage monthly returns earned by each portfolio. Market-adjusted returns are the mean raw returns less the return on a value weighted NYSE/AMEX/Nasdaq index. The CAPM intercept is the estimated intercept from a time-series regression of the portfolio return $(R_p - R_f)$ on the market excess return $(R_m - R_f)$. The intercept for the Fama-French three-factor model is the estimated intercept from a time-series regression of the portfolio return on the market excess return $(R_m - R_f)$, a zero-investment size portfolio (SMB), and a zero-investment book-to-market portfolio (HML). The four-characteristic intercept is estimated by adding a zero-investment price momentum portfolio (PMOM) as an independent variable. Annual turnover is calculated as the average percentage of the portfolio's holdings as of the close of one day's trading that has been sold as of the close of trading on the next trading day, multiplied by the number of trading days in the year. The net annual return assumes that portfolios 1 and 2 are purchased, and 3, 4, and 5 are sold short. It is found by multiplying the absolute value of the gross monthly return by 12 and subtracting the annual turnover multiplied by the round-trip cost of a trade. This cost is estimated at 1.31 percent for all portfolios except that of the neglected stocks, where the estimated cost is 4.12 percent. Each t-statistic pertains to the null hypothesis that the associated return is zero. The t-statistics for returns that are significant at a level of 10 percent or better are shown in bold.

Portfolio (1)	Mean Raw Return (2)	Mean Market-adjusted Return (3)	Intercept from: CAPM (4)	Intercept from: Fama-French (5)	Intercept from: Four-characteristic (6)	% Annual Turnover (7)	Net Annual Return from: CAPM (8)	Net Annual Return from: Fama-French (9)	Net Annual Return from: Four-characteristic (10)
1 (most favorable)	1.576	0.351	0.201	0.352	0.344	458	−3.586	−1.772	−1.867
		2.472	1.475	**3.167**	**2.930**				
2	1.495	0.270	0.184	0.229	0.210	433	−3.470	−2.919	−3.149
		3.999	**2.976**	**4.140**	**3.605**				
3	1.263	0.038	0.029	−0.006	−0.049	459	−5.663	−5.942	−5.422
		0.763	0.592	−0.132	−1.076				
4	1.121	−0.103	−0.053	−0.124	−0.107	478	−5.629	−4.773	−4.982
		−1.180	−0.640	**−1.729**	−1.409				
5 (least favorable)	0.558	−0.667	−0.599	−0.637	−0.409	465	1.099	1.552	−1.179
		−3.908	**−3.502**	**−4.513**	**−3.044**				
P1–P5	1.018	1.018	0.800	0.989	0.753	923	−2.491	−0.223	−3.055
	4.160	**4.160**	**3.495**	**5.113**	**3.900**				
All covered	1.306	0.081	0.053	0.055	0.043	12	0.479	0.502	0.363
		6.432	**3.994**	**4.102**	**3.150**				
Neglected	0.890	−0.334	−0.277	−0.273	−0.254	70	0.443	0.392	0.168
		−2.799	**−2.245**	**−3.371**	**−2.977**				
All covered − neglected	0.416	0.416	0.330	0.328	0.298	82	0.922	0.894	0.531
	3.200	**3.200**	**2.606**	**3.910**	**3.374**				

vide strong evidence that they cannot. In every case, the intercept tests (presented in columns 4, 5, and 6) indicate that more highly rated stocks have higher abnormal returns than less highly rated stocks.[15] The abnormal gross return on portfolio 1, for example, ranges from a low of 0.201 percent per month, under the CAPM, to a high of 0.352 percent per month, using the Fama-French three-factor model. In contrast, the abnormal gross return on portfolio 5 varies between a low of −0.637 and a high of −0.409 percent per month. The abnormal gross return that can be generated from a strategy of purchasing the most favorably ranked securities and selling short the least favorably ranked ones ranges from a low of 0.753 to a high of 0.989 percent per month.[16]

Table V also reveals that a portfolio of all covered stocks earns positive and significant abnormal gross returns, whereas the abnormal returns of neglected stocks are negative and significant. The abnormal gross return to purchasing the covered firms and selling short the neglected stocks ranges from a low of 0.298 percent per month, using the four-characteristic model, to a high of 0.330 percent, under the CAPM. The underperformance of neglected stocks is consistent with evidence in McNichols and O'Brien (1998) that analysts tend to drop coverage of firms that they expect to do poorly, rather than retain them and issue negative comments. In contrast to our empirical findings, Arbel, Carvell, and Strebel (1983) document that during the 1970s, neglected firms actually earn superior returns. There are a few possible explanations for these seemingly contradictory results. First, Arbel et al. restrict their attention to large firms (the S&P 500), whereas our ne-

[15] As an added control for price momentum, and as a control for earnings momentum, we perform two supplementary tests. The additional test relating to price momentum is run because our four-characteristic model (which does include a control for this factor) implicitly assumes that price momentum is *linearly* related to returns. We control for earnings momentum in order to determine whether the abnormal returns we find are driven by the well-documented post-earnings announcement drift. For each test, we divide our sample into low, medium, and high momentum stocks. In unreported results, we find that the abnormal return to a portfolio of the most favorably recommended stocks is significantly higher than that of a portfolio of the least favorably recommended ones in each price momentum partition. This provides additional evidence that the differential returns reported in Table V do not simply reflect the effect of price momentum. We also find a significant abnormal return difference for the sample of firms with medium earnings momentum and for those with high earnings momentum. For the firms with low earnings momentum, the difference is positive and significant for one of our return models, but is insignificantly positive for the other two. From these results, we conclude that the differential returns are not driven solely by the post-earnings announcement drift.

[16] To test our results for robustness, we partition our sample into two time periods, the first covering 1986 to 1990 and the second covering 1991 to 1996, estimating separate regressions for each. We find the estimated intercepts to be insignificantly different across periods, whereas the abnormal return on portfolio 1 remains significantly greater than that of portfolio 5. We also partition our sample period into bull and bear market months, where a bull (bear) month is defined as one in which the CRSP value-weighted market index return is positive (negative). The estimated intercepts are insignificantly different across markets, and the abnormal return on portfolio 1 remains significantly higher than that on portfolio 5.

glected firms are relatively small (as reflected by our finding that they comprise only 9.7 percent of total market capitalization). Second, some of their "neglected" firms actually have an analyst following them. Third, they do not control for possible book-to-market effects. (As we show, neglected firms have higher book-to-market ratios.) During their sample period from 1970 to 1979, high book-to-market firms outperform low book-to-market firms by 57 basis points per month.

IV. The Cost of Investment Delays

Evidence that portfolios 1 and 5 generate significant abnormal gross returns implies that prices do not immediately incorporate all of the information in analysts' consensus stock recommendation changes. This is consistent with the finding of Stickel (1995) and Womack (1996) that there exist stock price drifts subsequent to individual analyst recommendation changes. To gain additional insight into the magnitude of these drifts, we partition each of portfolios 1 and 5 into four subportfolios. The first subportfolio contains those stocks added to the overall portfolio within the previous 5 trading days, the second consists of those added within the prior 6 and 10 trading days, the third is comprised of those entering the portfolio between 11 and 21 trading days ago, and the fourth consists of those added more than 21 days previously. In untabulated results, we find that for the most favorably rated stocks, the subportfolio market-adjusted monthly returns are 1.412, 0.944, 0.602, and 0.338 percent, respectively; for the least favorably recommended ones, the subportfolio market-adjusted monthly returns are −2.403, −1.348, −0.874, and −0.534 percent, respectively. Consistent with the results of Stickel and Womack, the returns on these portfolios steadily erode, though the market-adjusted return for each subportfolio remains reliably different from zero. The returns of 0.338 and −0.534 percent for the stocks added to portfolios 1 and 5 more than 21 days previously compare to overall market-adjusted returns for these two portfolios of 0.351 and −0.667 percent, respectively. The similarity between these two sets of returns stems from the fact that the more recently added stocks comprise a small portion, on average, of all the outstanding recommendations in each of these portfolios. Consequently, the portfolio returns reported in Table V primarily reflect the securities that have been in a particular portfolio for more than 21 days.

To allow investors to take full advantage of these price drifts, we have assumed up to this point that investors react quickly (at the end of the trading day) to changes in analysts' consensus recommendations. It is expected, though, that many retail investors will take some time to react, either because they only gain access to consensus recommendation changes one or more days after they occur, or because they find it impractical to engage in the daily portfolio rebalancing that is needed to respond to the changes. To understand the impact of investment delays on the returns that can be earned by investors, we examine two additional sets of investment strategies. The first entails less frequent portfolio rebalancing—weekly, semimonthly, or monthly—instead of daily. It is expected that less frequent rebalancing will cause abnormal returns to diminish in magnitude, both because investors will be less likely to capture the higher price drift occurring in the early days after a stock enters a particular portfolio (as documented above), and because they will be holding the stock for some time after it has been dropped from the portfolio, when it will be reacting (presumably adversely) to the move.

Aside from a change in the rebalancing period, the methodology used to test for the profitability of this set of investment strategies is identical to that employed earlier. With weekly rebalancing, for example, the consensus recommendation of each covered stock is calculated as of the close of trading each Monday and the stock assigned to the appropriate portfolio at that time. Stock assignments then remain fixed until the following Monday, when the consensus recommendations are recalculated and stocks are moved between portfolios, as necessary. Portfolio turnover is again calculated as described in Section II.C. Portfolio composition and turnover are similarly calculated for the other rebalancing periods.

Table VI, columns 4–6, reports the abnormal gross returns to portfolios 1 and 5 under these alternative investment strategies. Compared to daily rebalancing, the abnormal gross returns for portfolio 1 are lower for all rebalancing periods, as expected. Under the CAPM, abnormal returns are near zero and insignificant, and under the Fama-French three-factor model and the four-characteristic model, the returns vary between 0.181 and 0.233 percent per month and are of mixed significance. Also as expected, turnover decreases significantly as the rebalancing period is lengthened, declining from 458 percent with daily rebalancing to 274 percent for monthly rebalancing (column 7). In contrast to the loss of significance for portfolio 1's returns, the abnormal gross return for portfolio 5 remains significant across all rebalancing periods, varying between −0.329 percent and −0.599 percent monthly. Again, turnover declines substantially, from 465 percent with daily rebalancing to 294 percent under monthly rebalancing.

The second set of alternative strategies assumes that investors react to analyst consensus recommendation changes with a delay (but retains the assumption of daily rebalancing). As with strategies involving less frequent portfolio rebalancing, it is expected that such delays will adversely affect investors' returns. Table VII documents the abnormal gross returns generated if investors' reaction is delayed by one week (panel A), a half month (panel B), or a full month (panel C). For each of these three delay intervals, the abnormal gross return for portfolio 1 is insignificantly different from zero, never exceeding 0.2 percent per month. In contrast, the abnormal gross return for portfolio 5 remains significantly negative for all delay windows. (This difference is consistent with Womack's (1996) finding of a longer lasting post-recommendation stock price drift for downgrades.) With a one-week delay, the abnormal gross return ranges from −0.335 to −0.518 percent monthly. With a month's delay, the abnormal gross return still remains sizeable, varying from −0.229 to −0.388 percent per month. Apparently, timely reaction to analyst recommendation changes is more important for capturing the gross returns to the most highly recommended stocks than for garnering the gross returns to those that are least favorably rated.

V. The Impact of Transactions Costs

All returns presented thus far have been gross of the transactions costs associated with the bid-ask spread, brokerage commissions, and the market impact of trading. Keim and Madhavan (1998) provide an estimate of the total round-trip transactions costs incurred by institutions in trading exchange-listed and Nasdaq stocks, broken down by firm size quintile. Using their numbers, we estimate round-trip transactions costs for the large, medium, and small stocks in our sample at 0.727, 1.94, and 4.12 percent of share value traded, respectively.[17] Weighting these percentages by the fraction that each firm size classification makes up of total market capitalization (large firms comprise 70 percent of the total, medium-sized firms 20 percent, and small firms 10 percent), we estimate average round-trip transactions costs for our portfolios at 1.31 percent of share value traded.[18] (To the extent that our portfolios are more heavily weighted toward small stocks, this estimate will be conservative.) In conjunction with the calculated turnover for each portfolio, these percentages can be used to provide an estimate of the impact of transactions costs on investment returns. (The method for computing turnover was described in Section II.C.) Most of the following discussion will focus on the returns generated by strategies which involve daily portfolio rebalancing and an immediate (end-of-day) investor reaction to analyst consensus recommendation changes.

A round-trip transactions cost of 1.31 percent implies, for each portfolio, total annual transactions costs equal to 1.31 percent of its annual turnover. Transactions costs, therefore, reduce the annual return from holding portfolio 1 by 6 percent, given its 458 percent annual turnover. As a consequence, an active strategy of buying the most highly recommended stocks yields a negative abnormal net annual return ranging between −3.59 and

[17] As discussed in Section V, our firm size classifications are defined in terms of deciles, rather than quintiles; therefore, we cannot directly use the cost numbers provided in Keim and Madhavan (1998). To estimate the cost for our largest firms, given our size definitions, we take a weighted average of the costs of the top two quintiles of Keim and Madhavan, with the top quintile receiving double the weight of the second quintile. The cost for our medium-sized firms is estimated as a weighted average of the costs of quintiles 2–4, with quintile 3 receiving twice the weight of the other two. For our small firms, the cost is estimated as a weighted average of the costs of quintiles 4 and 5, with quintile 5 receiving twice the weight of quintile 4. All of our calculations also assume an equal weighting of exchange-listed and Nasdaq firms. Keim and Madhavan find the costs for trading Nasdaq stocks to be higher than the costs for trading exchange-listed stocks (except in the top quintile). Because the majority of our sample are Nasdaq firms, our estimate of transactions costs is likely to be conservative.

[18] Other papers have estimated the round-trip cost of the bid-ask spread alone to be one percent for mutual funds (Carhart (1997)) as well as for individual investors (Barber and Odean (2000)).

Table VI

Percentage Monthly Returns Earned by Portfolios Formed on the Basis of Analyst Recommendations, by Rebalancing Frequency, 1986 to 1996

This table presents percentage monthly returns earned by portfolios composed of the most favorably and least favorably ranked stocks, for various rebalancing periods. Panel A presents the returns based on a strategy of rebalancing the portfolios weekly, at the close of trading each Monday. Panel B presents the returns to a strategy of rebalancing the portfolios semimonthly, at the close of trading on the 15th and last days of the month. Panel C presents the returns to a strategy of rebalancing the portfolios monthly, at the close of trading on the last day of the month. Raw returns are the mean percentage monthly returns earned by each portfolio. Market-adjusted returns are the mean raw returns less the return on a value weighted NYSE/AMEX/Nasdaq index. The CAPM intercept is the estimated intercept from a time-series regression of the portfolio return $(R_p - R_f)$ on the market excess return $(R_m - R_f)$. The intercept for the Fama-French three-factor model is the estimated intercept from a time-series regression of the portfolio return on the market excess return $(R_m - R_f)$, a zero-investment size portfolio (SMB), and a zero-investment book-to-market portfolio (HML). The four-characteristic intercept is estimated by adding a zero-investment price momentum portfolio (PMOM) as an independent variable. Annual turnover is calculated as the average percentage of the portfolio's holdings as of the close of one day's trading that has been sold as of the close of trading on the next trading day, multiplied by the number of trading days in the year. The net annual return assumes that portfolio 1 is purchased and 5 is sold short. It is found by multiplying the absolute value of the gross monthly return by 12 and subtracting the annual turnover multiplied by the round trip cost of a trade. This cost is estimated at 1.31 percent for all portfolios. Each t-statistic pertains to the null hypothesis that the associated return is zero. The t-statistics for returns that are significant at a level of 10 percent or better are shown in bold.

			Intercept from				Net Annual Return from		
Portfolio (1)	Mean Raw Return (2)	Mean Market-adjusted Return (3)	CAPM (4)	Fama-French (5)	Four-characteristic (6)	% Annual Turnover (7)	CAPM (8)	Fama-French (9)	Four-characteristic (10)

Panel A: Weekly Rebalancing									
P1 (most favorable)	1.483	0.258	0.079	0.233	0.182	395.2	−4.232	−2.386	−2.996
		1.699	0.560	**1.997**	1.487				
P5 (least favorable)	0.687	−0.538	−0.479	−0.526	−0.329	377.5	0.805	1.370	−0.995
		−3.168	**−2.794**	**−3.791**	**−2.427**				
P1–P5	0.796	0.796	0.558	0.759	0.511	772.7	−3.427	−1.016	−3.990
	3.072	**3.072**	**2.316**	**3.770**	**2.544**				
Panel B: Semimonthly Rebalancing									
P1 (most favorable)	1.479	0.255	0.082	0.234	0.212	346.4	−3.555	−1.727	−1.995
		1.708	0.591	**2.037**	**1.745**				
P5 (least favorable)	0.609	−0.615	−0.555	−0.599	−0.368	349.3	2.089	2.612	−0.157
		−3.606	**−3.233**	**−4.175**	**−2.692**				
P1–P5	0.870	0.870	0.637	0.833	0.580	695.7	−1.465	0.884	−2.152
	3.421	**3.421**	**2.694**	**4.227**	**2.966**				
Panel C: Monthly Rebalancing									
P1 (most favorable)	1.417	0.192	0.031	0.188	0.181	273.5	−3.205	−1.326	−1.412
		1.278	0.221	1.591	1.448				
P5 (least favorable)	0.627	−0.598	−0.535	−0.577	−0.378	293.5	2.570	3.080	0.692
		−3.621	**−3.223**	**−4.240**	**−2.857**				
P1–P5	0.790	0.790	0.566	0.765	0.559	567	−0.635	1.754	−0.720
	3.197	**3.197**	**2.457**	**4.020**	**2.904**				

Table VII

Percentage Monthly Returns Earned by Portfolios Formed on the Basis of Analyst Recommendations, by Delay in Investment, 1986 to 1996

This table presents percentage monthly returns earned by portfolios composed of the most favorable and least favorable ranked stocks, where investment is delayed beyond the close of trading on the date the average recommendation changes. Panel A presents the results for a one-week delay, Panel B for a half-month delay, and Panel C for a one-month delay. Raw returns are the mean percentage monthly returns earned by each portfolio. Market-adjusted returns are the mean raw returns less the return on a value weighted NYSE/AMEX/Nasdaq index. The CAPM intercept is the estimated intercept from a time-series regression of the portfolio return $(R_p - R_f)$ on the market excess return $(R_m - R_f)$. The intercept for the Fama-French three-factor model is the estimated intercept from a time-series regression of the portfolio return on the market excess return $(R_m - R_f)$, a zero-investment size portfolio (SMB), and a zero-investment book-to-market portfolio (HML). The four-characteristic intercept is estimated by adding a zero-investment momentum portfolio (PMOM) as an independent variable. Each t-statistic pertains to the null hypothesis that the associated return is zero. The t-statistics for returns that are significant at a level of 10 percent or better are shown in bold.

Portfolio (1)	Mean Raw Return (2)	Mean Market-adjusted Return (3)	Intercept from: CAPM (4)	Intercept from: Fama-French (5)	Intercept from: Four-characteristic (6)
Panel A: One-week Delay					
P1 (most favorable)	1.422	0.198	0.025	0.174	0.158
		1.267	0.170	1.394	1.198
P5 (least favorable)	0.699	−0.526	−0.467	−0.518	−0.335
		−3.118	**−2.750**	**−3.767**	**−2.468**
P1–P5	0.723	0.723	0.492	0.692	0.493
	2.838	**2.838**	**2.073**	**3.450**	**2.412**
Panel B: Semimonthly Delay					
P1 (most favorable)	1.408	0.181	0.034	0.177	0.181
		1.273	0.249	1.524	1.478
P5 (least favorable)	0.809	−0.418	−0.359	−0.403	−0.223
		−2.541	**−2.170**	**−3.008**	−1.693
P1–P5	0.599	0.599	0.393	0.580	0.404
	2.467	**2.467**	1.716	**3.015**	**2.054**
Panel C: One-month Delay					
P1 (most favorable)	1.283	0.056	−0.081	0.077	0.084
		0.386	−0.566	0.659	0.681
P5 (least favorable)	0.854	−0.373	−0.331	−0.388	−0.229
		−2.329	**−2.032**	**−3.234**	−1.940
P1–P5	0.429	0.429	0.251	0.465	0.313
	1.797	1.797	1.090	**2.539**	1.662

−1.77 percent (see columns 8, 9, and 10 of Table V). Transactions costs associated with a strategy of selling short the stocks in portfolio 5 reduces the annual return by 6.09 percent, given portfolio turnover of 465 percent.[19] This implies an abnormal net annual return that varies from a low of −1.18 percent to a high of 1.55 percent—returns that are, at best, insignificantly different from zero. In sum, neither of these strategies designed to take advantage of the consensus recommendations earns significant abnormal returns, after accounting for transactions costs.[20]

These results can be viewed another way, by calculating the "threshold" round-trip transactions costs below which the abnormal net returns become positive and significant. For the purposes of these calculations, we choose a confidence interval of 95 percent and assume that the standard deviation of each portfolio's abnormal net return is equal to that of its abnormal gross return.[21] We find that for portfolio 1, this threshold transactions cost is 0.35 percent for the Fama-French three-factor model and 0.30 percent for the four-characteristic model. (There is no level of transactions cost at which the abnormal net return will be positive under the CAPM.) For portfolio 5, the threshold ranges between 0.38 percent and 0.93 percent. Given the estimates of Keim and Madhavan, it is very unlikely that actual round-trip transactions costs fall below these threshold levels (especially given the fact that portfolios 1 and 5 are comprised of relatively small stocks, for which transactions costs tend to be higher).

Table V also provides insights into the profitability of trading strategies involving the portfolios of the all-covered and neglected stocks. A strategy of purchasing a portfolio of all the covered firms has an annual abnormal gross return of between 0.52 and 0.66 percent and costs 0.16 percent annually, given portfolio turnover of 12 percent. The abnormal net return, therefore,

[19] To the extent that there are additional transactions costs associated with short selling, the abnormal net return on portfolio 5 will be reduced even further.

[20] To test whether our results are significantly affected by the omission by Zacks of the recommendations of some of the large brokerage houses and by possible delays in the recording of some of the reported recommendations (Womack (1996)), we repeat our main tests using the *First Call* database. This database records the date and time that analyst recommendations are released to investors and includes the recommendations of most of the large brokerage houses that are omitted from Zacks. Using *First Call*, we again construct five portfolios of stock recommendations (allocating stocks to portfolios based on the stocks' consensus ratings) and calculate the average monthly abnormal returns to each portfolio, for the period from July 1995 to December 1998. (We choose to begin with July 1995 because the *First Call* database records very few real-time recommendations before then.) The most significant difference between these results and those of Zacks pertains to portfolio 5—the gross abnormal returns are approximately twice as great in magnitude for the *First Call* recommendations. Even so, none of the five portfolios generate positive and significant abnormal net returns.

[21] Given that there is variability in portfolio turnover, the standard deviation of a portfolio's abnormal net return should be greater than that of its abnormal gross return. Consequently, the threshold transactions cost levels we calculate here overstate the level of transactions cost at which the abnormal net returns become significantly positive.

is a maximum of 0.50 percent annually. Although this return is significantly greater than zero, it is economically small. Selling short the neglected stocks yields an annual abnormal gross return of between 3.05 and 3.32 percent. This strategy costs 2.88 percent, given turnover of 70 percent and using a transactions cost rate of 4.12 percent (given that these firms are mostly of small size). Consequently, the abnormal net return to this strategy is insignificantly different from zero.

One way to lower the high transactions costs associated with buying the stocks in portfolio 1 or selling short those in portfolio 5 is to rebalance less frequently. As columns 8–10 of Table VI make clear, though, the reduction in turnover for portfolio 1 is not enough to offset the decrease in abnormal gross returns that comes with less frequent rebalancing. For all rebalancing periods and all pricing models, portfolio 1's abnormal net return is negative. In contrast, the abnormal net return from short-selling portfolio 5 is, in most cases, positive, ranging as high as three percent annually. However, with the exception of marginal significance for monthly rebalancing and the Fama-French three-factor model, no abnormal net return is found to be reliably greater than zero. On the whole, then, our investment strategies do not provide significant profits to investors after a reasonable accounting for transactions costs, regardless of the frequency with which their portfolios are rebalanced.[22]

VI. Portfolios Partitioned According to Firm Size

In this section we investigate whether investment strategies based on consensus recommendations can generate significant abnormal net returns for either the small, medium, or large firm subset of our sample. There are several reasons to undertake this analysis. First, to the extent that there is less information publicly available about smaller firms, we would expect the investment performance of analysts' consensus recommendations to be greater for them.[23] Further, consistent with Shleifer and Vishny (1997) and Pontiff (1996), it is likely that investors' ability to arbitrage away any excess

[22] We also examine two other sets of strategies that are based on consensus recommendations. The first set involves purchasing the securities in portfolios 1 and 2 and selling short those in portfolios 4 and 5. These strategies result in somewhat reduced turnover (263 percent for the stocks in portfolios 1 and 2 and 365 percent for those in portfolios 4 and 5), because investors' holdings are unaffected by a stock that moves between portfolios 1 and 2 or between 4 and 5. However, the gross investment return is also reduced significantly, and the abnormal net return is not significantly greater than zero. The second set of strategies involves dropping recommendations that are more than 60 days old, so that the consensus is composed of only the most recent recommendations. Although abnormal gross returns are not significantly affected by the imposition of this requirement, turnover rates jump to more than 1,500 percent, making this set of strategies prohibitively expensive.

[23] Womack (1996) shows that the price reaction to individual analyst upgrades and downgrades, as well as the post-recommendation price drift, are more pronounced for small stocks.

returns will be lowest for these firms.[24] Finally, it is important to understand the extent to which analysts' consensus recommendations can generate excess returns for the larger firms, as they represent a greater share of the investment opportunities available in the market.

Table VIII presents the returns for our size partition, again assuming daily portfolio rebalancing and no delay in investors' reaction to analysts' consensus recommendation changes. For parsimony, we show only the findings from the four-characteristic model (the other models yield similar results). Following the criteria used by Fama and French (1993), size deciles are formed on the basis of NYSE firm-size cutoffs and are adjusted annually, in December. Each AMEX and Nasdaq firm is placed in the appropriate NYSE size decile based on the market value of its equity as of the end of December. Big firms (B) are defined as those in the top three deciles, small firms (S) are those in the bottom three deciles, and medium firms (M) are those in the middle four. Of all covered stocks, the number of small firms in our sample averages 1,957 per month, the number of medium firms averages 827, and the number of big firms averages 339.

For all firm sizes, the most highly recommended stocks earn positive abnormal gross returns, and the least favorably recommended ones earn negative abnormal gross returns. The small stocks exhibit the most positive portfolio 1 returns, at 0.575 percent per month, or 6.90 percent annually, and the most negative portfolio 5 returns, at −0.926 percent per month, or −11.1 percent annually. Annual turnover for each of the five small, medium-sized, and large firm portfolios is also presented in Table VIII. For small firms (which have the most extreme abnormal gross returns), the most highly recommended stocks have an annual turnover of 265 percent, whereas the least favorably recommended ones have an annual turnover of 357 percent. With an estimated round-trip transactions cost of 4.12 percent for these firms (recall the discussion in Section V), the total transactions costs generated by these turnover rates reduces annual portfolio returns by 10.92 and 14.71 percent for portfolios 1 and 5, respectively. Subtracting these costs, the abnormal net return to purchasing the most favorably rated small stocks or selling short the least favorably rated ones becomes negative.[25] Using an estimated

[24] Shleifer and Vishny (1997) argue that arbitrage has only a limited ability to align prices with fundamental values and that this limitation is greatest among securities with high volatility (such as small stocks). Pontiff (1996) adds that arbitrage will be limited when transaction costs are relatively high (as is again the case for small stocks).

[25] We also calculate portfolio returns separately for each of the three small firm deciles (again using the four-characteristic model). The most positive annual abnormal gross return on portfolio 1, 10.7 percent, is found in the lowest decile (smallest) stocks. (Annual turnover for that portfolio is 271 percent.) The most negative annual abnormal gross return on portfolio 5, 16.7 percent, is found for the middle decile stocks. (Annual turnover is 382 percent.) After subtracting transactions costs, neither return is significantly greater than zero. For a long position in portfolio 1 (short position in portfolio 5) to yield significant positive abnormal net returns, the round-trip transactions cost must be no more than 1.69 (1.91) percent. Given the findings of Keim and Madhavan (1998), it is unlikely that actual transactions costs fall below these levels.

Table VIII

Percentage Gross Monthly and Net Annual Returns Earned by Portfolios Formed on the Basis of Analyst Recommendations and Size, 1986 to 1996

This table presents the percentage gross monthly and net annual returns earned by portfolios formed by average analyst recommendations and firm size. The large (small) firm sample, B (S), includes firms with market capitalizations in the top (bottom) 30 percent of NYSE firms. The medium-sized firm sample, M, includes firms with market capitalizations between the 30th and 70th percentiles of NYSE firms. Raw returns are the mean percentage monthly returns earned by each portfolio. (Underneath each of the raw returns for portfolios 1–5 is the average monthly number of firms in that portfolio.) Market-adjusted returns are the mean raw returns less the return on a value weighted NYSE/AMEX/Nasdaq index. The gross monthly return for the four-characteristic model is the estimated intercept from a time-series regression of the portfolio excess return on the market excess return ($R_m - R_f$), a zero-investment size portfolio (SMB), a zero-investment book-to-market portfolio (HML), and a zero-investment price momentum portfolio (PMOM). Annual turnover is calculated as the average percentage of the portfolio's holdings as of the close of one day's trading that has been sold as of the close of trading on the next trading day, multiplied by the number of trading days in the year. The net annual return assumes that portfolios 1 and 2 are purchased, and 3, 4, and 5 are sold short. It is found by multiplying the absolute value of the gross monthly return by 12 and subtracting the annual turnover multiplied by the round trip cost of a trade. This cost is estimated at 0.727 percent for big firms, 1.94 percent for medium-sized firms, and 4.12 percent for small firms. Each t-statistic pertains to the null hypothesis that the associated return is zero. The t-statistics for returns that are significant at a level of 10 percent or better are shown in bold.

	Mean Raw Return			Mean Market-Adjusted Return			Gross Monthly Return from Four-Characteristic Model			% Annual Turnover			Net Annual Return from Four-Characteristic Model		
	S	M	B	S	M	B	S	M	B	S	M	B	S	M	B
Portfolio	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1 (most favorable)	1.800	1.654	1.468	0.575	0.430	0.244	0.575	0.387	0.251	265	409	618	−4.014	−3.285	−1.479
	560	114	17	**2.283**	**2.253**	1.213	**5.615**	**2.715**	1.293						
2	1.478	1.589	1.482	0.253	0.365	0.257	0.327	0.226	0.212	384	450	462	−11.895	−6.021	−0.819
	475	216	95	1.155	**2.557**	**2.843**	**3.602**	**2.314**	**2.730**						
3	1.253	1.309	1.270	0.029	0.084	0.045	−0.004	−0.027	−0.022	497	458	487	−20.425	−8.558	−3.272
	261	238	141	0.142	0.837	0.561	−0.041	−0.347	−0.366						
4	0.796	1.061	1.200	−0.429	−0.164	−0.025	−0.275	−0.169	−0.032	309	406	575	−9.426	−5.843	−3.792
	523	200	72	**−2.363**	**−1.585**	−0.193	**−3.717**	**−1.932**	−0.305						
5 (least favorable)	0.040	0.675	0.716	−1.184	−0.550	−0.508	−0.926	−0.596	−0.017	357	403	638	−3.594	−0.661	−4.434
	139	59	12	**−4.234**	**−2.960**	**−1.818**	**−5.057**	**−3.695**	−0.066						
P1–P5	1.759	0.979	0.752	1.759	0.979	0.752	1.502	0.984	0.268	622	812	1256	−7.608	−3.946	−5.913
	6.893	**4.025**	**2.040**	**6.893**	**4.025**	**2.040**	**7.302**	**4.516**	0.799						

round-trip transactions cost of 1.94 and 0.727 percent for medium-sized and large firms, respectively, it is apparent that they, too, do not provide profitable trading opportunities for investors.[26]

VII. Summary and Conclusions

The goal of this paper has been to estimate the abnormal returns, both gross and net of trading costs, that can be earned on each of several investment strategies designed to take advantage of analysts' stock recommendations. We document that over the 1986 to 1996 period, a portfolio of the stocks with the most (least) favorable consensus analyst recommendations provides an average annual abnormal gross return of 4.13 (−4.91) percent, after controlling for market risk, size, book-to-market, and price momentum effects. Consequently, a strategy of purchasing stocks that are most highly recommended by security analysts and selling short those that are least favorably recommended yields an abnormal gross return of 75 basis points *per month*. This return decreases if investors do not rebalance their portfolios daily or if they delay acting on changes in analysts' consensus recommendations.

There are three potential explanations for our findings: (1) random chance (that is, data-snooping), (2) a poor model of asset pricing, or (3) a market that is semistrong form inefficient in the sense that, absent transactions costs, investors would be able to profitably exploit the publicly available consensus recommendations.[27]

Many financial economists (for example, Fama (1998)) argue that the reported anomalies are simply a result of extensive data-snooping by academics. It is unlikely that our findings are due to random chance, for three reasons. First, the t-statistics associated with our portfolio returns are, in general, very high. Second, our results are robust to several different partitions of the data. Third, Stickel (1995) and Womack (1996), although not directly measuring the returns to investment strategies, also find there to be a significantly positive (negative) abnormal return associated with individual analyst upgrades (downgrades).

It is also unlikely that our results can be attributed to a poor asset pricing model. If they were, this would imply that highly recommended stocks, which earn higher average returns, are riskier than less favorably recommended

[26] For a long position in portfolio 1 (short position in portfolio 5) of the medium-sized stocks to generate significantly positive abnormal net returns, the round-trip transactions cost must be less than 0.32 (0.83) percent. Again, given the estimates of Keim and Madhavan (1998), it is unlikely that actual transactions costs are this low. For the large stocks there is no transactions cost that yields positive abnormal net returns for either portfolio 1 or 5.

[27] Although we refer to a market as semistrong inefficient whenever there are profitable opportunities to trade in the absence of transactions costs, others consider a market to be inefficient only if profits remain after subtracting these costs.

stocks, which earn lower average returns. However, there is no obvious source of increased risk from holding a well-diversified portfolio of highly recommended stocks.

We believe it is most likely that our results are evidence of a market that is semistrong inefficient (before transactions costs). Consistent with this notion, we find the difference between the returns of the most highly rated and least favorably recommended stocks to be most pronounced for small and medium-sized firms, where publicly available information is less likely to be widely disseminated. Neither of the competing explanations for our findings (data mining or a poor model of asset pricing) would lead us to expect stronger results among these sets of firms.

As we show, our investment strategies require a great deal of trading, and generate correspondingly high transactions costs. After accounting for these costs, we find that none of our strategies generates an abnormal net return that is reliably greater than zero. This strongly suggests that, although market inefficiencies exist, they are not easily exploitable by traders, thereby allowing these inefficiencies to persist (see Pontiff (1996)).[28]

Although traders cannot successfully exploit these market inefficiencies through the active investment strategies we examine, there is one group of investors who can take advantage of our findings—those who are otherwise considering buying or selling, and so will be incurring transactions costs in any case. For these investors, analyst recommendations remain valuable. *Ceteris paribus*, these investors would be better off purchasing shares in firms with more favorable consensus recommendations and selling shares in those with less favorable ratings.

Although none of the trading strategies we investigate yields positive abnormal net returns, it remains an open question whether other types of trading strategies could be profitable. Alternative strategies might include those that involve solely the recommendations of the analysts or brokerage houses with the best prior performance, or those that focus on measures other than the consensus. Regardless of the strategies chosen for study, the results of this paper make clear the importance of incorporating transactions costs into the analysis.

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[28] Others might state our conclusion somewhat differently—that the market is *efficient*, given that traders cannot profit from the publicly available consensus recommendations.

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