Interday drifts in opening stock returns

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Abstract. *In present study, I make an effort to shed light on the actual mechanism of autocorrelations in individual stocks' opening returns. I analyze intraday price data on thirty stocks currently making up the Dow Jones Industrial Index. Employing the sample average and the sample median of opening stock returns for each of the trading days within the sample period as two alternative proxies for the general market opening returns, I document that if the previous day's market and individual stock's opening returns are taken together to explain the stock's opening returns, then the effect of the lagged general market opening returns is significantly negative, while the effect of the lagged stock's opening returns is significantly positive. Moreover, following days characterized by both positive and negative market opening returns, a given stock's opening returns tend to be higher if its previous day's opening returns were positive. Such price behavior seems to contradict the concept of market efficiency. Finally, I construct a number of portfolios based on the opening trading sessions and involving a long position in the stocks on the days when, according to the findings, their opening returns are expected to be high and a short position in the stocks on the days when, according to the findings, their opening returns are expected to be low. All the portfolios are found to yield significantly positive returns, providing an evidence for the practical applicability of the pattern of drifts in opening stock prices.*

Keywords: opening returns; return autocorrelations; stock market efficiency; stock price drifts and reversals.

JEL Classification: G11, G14, G19.
REL Classification: 11B, 11D.

1. Introduction

In the last few decades, an increasing number of papers have investigated stock market anomalies, reporting strong evidence that daily stock returns show empirical regularities that are difficult to explain using standard asset pricing theories. The main bottom line of these studies suggests that the use of historical data could be of some help for predicting future returns, with obvious implications for the efficiency of equity markets.

One of the most visible stylized facts in empirical finance is the autocorrelation of stock returns at fixed intervals (daily, weekly, monthly). This autocorrelation presents a challenge to the main models in continuous-time finance, which rely on some form of the random walk hypothesis. Consequently, there is an extensive literature on stock return autocorrelation; it occupies 55 pages of Campbell, Lo, and MacKinlay (1997). Most researchers suggest explanations based on non-synchronous trading as the cause of the positive return autocorrelation observed across international stock markets (Fisher, 1966, Scholes, Williams, 1977, Atchinson et al., 1987, Ahn et al., 2002). For example, Kadlec and Patterson (1999) argue that non-synchronous trading can explain 85%, 52%, and 36% of daily autocorrelations on portfolios of small, random, and large stocks, respectively. Accordingly, since daily returns are usually computed through a stock market index, the inclusion in the index of securities that are subjected to infrequent trading could cause positive stock return autocorrelation. However, since a significant level of first-order serial correlation has been found on common stock portfolios of large and actively traded firms (Perry, 1985, Safvenblad, 2000), non-synchronous trading seems to be not the only cause of correlation in daily market indexes. In this context, several studies suggest that the gradual incorporation of market-wide information may cause serial correlation in short-term stock returns Lo, MacKinlay, 1990, Sias, Starks, 1997, Chordia, Swaminathan, 2000). Other potential explanations for stock return autocorrelation include, but are not limited to, bid-ask bounce (Rhee, Wang, 1997); partial price adjustment, i.e. the observation that trade takes place at prices that do not fully reflect the information possessed by traders (Campbell, Lo, MacKinlay, 1997); and the time-varying risk premium (Anderson, 2006).

Over the last years, as increasing computer power and new statistical methods have permitted the analysis of very large datasets using intraday data, the focus has shifted to intraday patterns in stock returns and trading volumes. Blandon (2007) shows that while close-to-close stock returns are highly autocorrelated, daily returns calculated on an open-to-close basis do not exhibit significant levels of autocorrelation. Amihud and Mendelson (1987) and Stoll and Whaley (1990) report that the interday stock returns computed using open-to-open prices have

greater variance and show more evidence of reversals than comparable returns computed from close-to-close prices. They attribute this result to differences in trading mechanisms between the opening and closing transactions. Gerety and Mulherin (1994) estimate transitory volatility throughout the trading day based on hourly Dow Jones sixty-five Composite price index data, and find that the interday 24-hour volatilities decline steadily, reflecting information processing. A long-standing literature on intraday stock price patterns identifies the distinct U-shaped return and return volatility pattern over the trading day (Wood et al., 1985, Harris, 1986, Jain, Joh, 1988, Pagano et al., 2008). In other words, these studies indicate that average stock returns and return volatilities tend to be higher at the beginning and end of the trading day.

Several recent studies detect systematic correlations, both within and between subsequent trading days, between different intraday return measures. Kudryavtsev (2012) finds that, for the majority of stocks, open-to-close returns tend to be significantly lower, and in most cases negative, if on that respective day their opening returns are higher than the average or median opening return on the stocks in the sample. That is, relatively high opening stock returns may serve an indication for subsequent intraday price reversals and for even more pronounced intraday U-shaped return pattern. Furthermore, Kudryavtsev (2013) documents that stock returns in opening trading sessions tend to be higher following days with relatively low (either negative, or lower than the same day's average and median for the total sample of stocks) open-to-close returns. These findings are interpreted as reversals following stock price overreactions[1].

In present study, I make an effort to further develop the idea of the two above-mentioned studies. Since, according to Kudryavtsev (2012), open-to-close stock returns tend to be lower following relatively high opening returns at the beginning of the same trading day, and furthermore, according to Kudryavtsev (2013), opening stock returns tend to be higher following days with relatively low open-to-close returns, then one might expect opening returns to be higher following relatively high previous day's opening returns for the respective stock. In other words, there may exist interday (between two subsequent trading days) drifts in opening stock returns.

I analyze the opening and the opening returns on thirty stocks currently making up the Dow Jones Industrial Index, and find support for my research hypothesis. Namely, I detect that after controlling for the previous day's average or median opening return on the stocks in the sample (showing evidence of significantly negative autocorrelations), opening stock returns tend to be positively correlated with the respective stocks' previous day's opening returns. The result holds

separately following the days with positive and negative average opening returns within the sample[2].

Based on these findings, I construct a number of daily-adjusted portfolios involving a long (short) opening-session position in the stocks on the days when, according to the findings, their opening returns are expected to be high (low), and demonstrate that the returns on these portfolios are significantly positive.

The rest of the paper is structured as follows: In Section 2, I describe the data sample. Section 3 comprises the research hypotheses and the results. Section 4 concludes.

2. Data description

For the purposes of present research, I employ daily opening and closing prices of thirty stocks currently making up the Dow Jones Industrial Index over the period from January 2, 2002 to September 30, 2011 (overall, 2,456 trading days), as recorded at www.finance.yahoo.com. I adjust the prices to dividend payments and stock splits, by multiplying each actual price by the ratio of the respective day's reported adjusted (by Yahoo finance) closing to actual closing price. For each stock i in the sample and for each trading day t, except for the first day of the sampling period, I calculate:

- Stock's opening return ($R_{O,it}$), i.e., stock price's change from last day's closing price to today's opening price, as

$$R_{O,it} = \frac{P_{O,it}}{P_{C,it-1}} - 1 \tag{1}$$

where:
$R_{O,it}$ is stock i's opening return on day t; $P_{O,it}$ is stock i's opening price on day t; and $P_{C,it-1}$ is stock i's closing price on day t-1[3].

Table 1 comprises the basic descriptive statistics of the opening returns for the thirty sample stocks. At this stage, we may note that, as it might be expected for the largest industrial companies of the US, 21 (24) out of 30 stocks have positive mean (median) opening returns, the remaining 9 (6) showing negative, yet close to zero daily returns. Overall, the mean opening returns range from -0.116 to 0.158 percentage points, with standard deviations ranging from 0.663 to 2.045 percentage points.

3. Research hypotheses and results

3.1. Interday drifts in opening stock returns

The main goal of present study is to shed light on the nature and the characteristics of the interday correlations of opening stock returns. Based on previous results by Kudryavtsev (2012) who finds that, for the majority of stocks, open-to-close returns tend to be significantly lower, and in most cases negative, if on that respective day their opening returns are higher than the average or median opening return on the stocks in the sample, and by Kudryavtsev (2013) who documents that stock returns in opening trading sessions tend to be higher following days with relatively low (either negative, or lower than the same day's average and median for the total sample of stocks) open-to-close returns, I hypothesize that:

Hypothesis 1: A given stock's opening return on day t should be higher the higher was the stock's opening return on day t-1.

In other words, I suggest that if relatively high day-t opening stock returns serve an indication for subsequent intraday (open-to-close) price reversals, while relatively low day-t open-to-close stock returns serve an indication for subsequent reversals in day-t-1 opening returns, then we may expect interday (between day t-1 and day t) drifts, or positive autocorrelations, in opening stock returns.

In order to test Hypothesis 1, one should first of all take into consideration the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals. At the first glance, these results seem to contradict the Hypothesis, but, in fact, may refer to another effect which does not imply any contradiction. The point is that the above-mentioned findings may be driven by generally negative first-order autocorrelations in the opening returns of the stock market as a whole. In this case, the general picture of the correlations in opening stock returns may look as follows:

a) If on day t-1, the general market, either average or median, opening return is positive (negative), then, according to the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990), the general market opening return on day t may be expected to be negative (positive).

b) According to (a), day-t-1 opening returns for the majority of stocks are positive (negative), and day-t opening returns for the majority of stocks are negative (positive).

c) According to (b), stock i's opening returns are positive (negative) mostly on the days when the general market opening returns are also positive (negative), and in many cases, due to the negative autocorrelation in the general market

opening returns, stock i's opening returns on subsequent trading days are negative (positive), which, in the absence of any other explanatory factors, represents an evidence for the negative first-order autocorrelation in stock i's opening returns.

d) If Hypothesis 1 is true, it means that stock i's opening returns may actually be positively autocorrelated given the sign of the previous day's general market opening return. That is, given the sign and possibly the magnitude of the day-t-1 general market opening return, the day-t opening return on stock i may be higher the higher was stock i's opening return on day t-1.

Therefore, in order to check the validity of Hypothesis 1, first of all, I test the model where stock i's opening return on day t depends on the stock's opening return on day t-1, controlling for day-t-1 general market opening return. As two alternative proxies for the general market opening return, I employ the average (equally-weighted) and the median opening returns on the stocks making up the sample. That is, for each of the thirty sample stocks, I run two regressions:

$$OR_{it} = \beta_0 + \beta_1 AOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it} \tag{1}$$

where: OR_{it} represents stock i's opening return on day t; and AOR_{t-1} is the average day-t-1 opening return for the stocks in the sample.
and

$$OR_{it} = \beta_0 + \beta_1 MOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it} \tag{2}$$

where: MOR_{t-1} is the median day-t-1 opening return for the stocks in the sample.

Tables 2a and 2b report the results of regressions (1) and (2), respectively, for each of the sample stocks. First of all, we should pay attention to a very strong result regarding the effect of the general market opening returns on the next day's returns on individual stocks – with both market return proxies employed, the effect is negative for all the 30 stocks in the sample, being statistically significant at the 5% level for 27 of them, including 26 at the 1% level. Therefore, we may conclude that the reversals in opening stock returns documented by Amihud and Mendelson (1987) and Stoll and Whaley (1990) are actually driven by the negative effect of the previous trading day's general market opening returns and not by "stock-specific" price behavior.

Furthermore, both Tables clearly support Hypothesis 1. With average (median) proxy for the general market opening returns, the effect of the previous day's stocks' opening returns is positive for 27 (23) out of 30 stocks. Out of these 27 (23) positive regression coefficients 13 (12) are statistically significant, including 11 (11) at the 5% level, and 10 (10) at the 1% level. None of the remaining 3(7) negative coefficients is significant.

Thus, we may conclude that the negative, and usually non-significant, first-order autocorrelations in separate stocks' returns documented in previous literature represent a "combination" of two effects: on the one hand, a strong and significantly negative effect of previous day's average or median opening market returns, and on the other hand, not that strong but pretty consistent positive effect of previous day's opening returns on the stocks themselves, indicating that if the general market effect on stocks' opening returns is controlled for, then the latter, in fact, tend to exhibit *positive* first-order autocorrelations.

Now, having detected the positive effect of stocks' opening returns on their next day's opening returns, I am interested in verifying if the effect persists separately both for the days characterized by positive and negative opening market returns. Table 3a presents for each stock i in the sample, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \leq 0$), and the respective return differences, *given* that the previous days were characterized by positive average opening returns ($AOR_{t-1} > 0$). Table 3b provides similar statistics following the days characterized by non-positive average opening returns ($AOR_{t-1} \leq 0$). In other words, the Tables contain mean opening stock returns for the 2 x 2 sample partition by the sign of the previous days' average opening returns and individual stocks' opening returns, and perform comparisons given the sign of the previous days' average opening returns. Finally, Tables 3a and 3b report and compare, for the days characterized by $AOR_{t-1} > 0$ and $AOR_{t-1} \leq 0$, respectively, the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$[4].

Table 3a demonstrates that at the individual stocks' level, the positive effect of a stock's previous day's opening return is quite weak, given that that the previous day showed a positive average opening return. The number of positive and negative return differences between stocks' opening returns following $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$ is equal, yet, 5 of the positive and none of the negative differences are statistically significant. On the other hand, if we consider the equally-weighted daily portfolios of stocks, then the results clearly corroborate Hypothesis 1, showing a significantly higher mean opening return for the portfolio made up of stocks with $OR_{it-1} > 0$. We should also note that mean opening returns on both portfolios and on the vast majority of individual stocks are negative, indicating once again the generally negative effect of previous day's average opening returns.

Table 3b analyzes mean opening returns, given that that previous day showed a non-positive average opening return, and provides a strong support for Hypothesis 1 both at the individual stocks' level and for the equally-weighted portfolios. 22 out

of 30 mean opening return differences between the stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$ are positive, 5 of them being statistically significant, including two at the 5% level, and one at the 1% level. All the negative return differences are close to zero, and none of them is even close to being significant. The positive return difference between the mean opening returns of the portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$ is quite large (0.089% daily) and significant at the 1% level. Finally, we should note that mean opening returns on both portfolios and on the vast majority of individual stocks are positive, in line with the generally negative effect of previous day's average opening returns[5].

3.2. Interday drift-based trading strategy

In previous subsection, I have documented interday drifts in opening stock returns, suggesting that if the general market direction of the previous day's opening session is controlled for, then day-*t* opening return for a stock *i* tends to be higher the higher was the stock's opening return on day *t-1*. Now, the goal of this subsection is to verify if one can formulate profitable trading strategies that would be based on the expectation of interday drifts in opening returns.

Recall that Table 3a demonstrated that following the days characterized by positive average opening returns, individual stocks' opening returns tend to be negative and are significantly lower for the stocks whose previous day's opening returns were non-positive, while Table 3b indicated that following the days characterized by non-positive average opening returns, individual stocks' opening returns tend to be positive and are significantly higher for the stocks whose previous day's opening returns were positive. Therefore, the idea behind all the trading strategies I formulate is to hold an equally-weighted long position in the stocks with $OR_{it-1} > 0$ following the days of general decreases during the opening session, and an equally-weighted short position in the stocks with $OR_{it-1} \leq 0$ following the days of general increases during the opening session. The respective positions in stocks are taken at the end of each trading day, according to the general direction of the day's opening returns, and closed at the end of the next day's opening session.

For all the stocks in the sample and over the whole sampling period, I construct six alternative investment portfolios:

a) Portfolios based on the sign of the previous day's Average opening returns:

Portfolio AP: Portfolio that following the days of non-positive Average opening returns, implies an equally-weighted long position (for the days' opening sessions)

in the stocks whose previous day's opening returns were positive, and following the days of positive average opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive[6].

Portfolio AA: Portfolio that following the days of non-positive average opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive average opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio AM: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

b) Portfolios based on the sign of the previous day's median opening returns:

Portfolio MP: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and, following the days of positive median opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio MA: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio MM: Portfolio that following the days of non-positive median opening returns, implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and, following the days of positive median opening returns, implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Table 4 concentrates the basic daily performance measures over the sampling period for all the six portfolios. Strikingly, all the portfolios yield positive and highly significant mean daily returns. These results, first of all, provide a strong

support for my research hypothesis. That is, general market opening returns are negatively autocorrelated, but if we control for the sign of the previous day's market opening return, then, for an individual stock, opening returns tend to be higher following the days when they were relatively high (either positive, or higher than the sample average or median for the same day). Moreover, from the practical point of view, at least if trading commissions are not a problem, the six portfolios represent potentially profitable investment strategies. Mean opening returns of about 0.1 percentage point may, at the first glance, seem not quite impressive, but since we are talking about single-day opening returns, the mean annual return of about 37% on Portfolios AP or MP, for example, look promising (recall that the yield significantly positive returns).

Overall, the results in this section strongly indicate that interday drifts, contradicting market efficiency, are exhibited in stocks' opening returns, and, therefore, investment strategies built upon the expectation of such drifts may possess a non-negligible potential.

4. Conclusion

The main goal of present study is to shed light on the actual mechanism of autocorrelations in individual stocks' opening returns. I suggest that the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals may be driven by generally negative first-order autocorrelations in the opening returns of the stock market as a whole, and that, if the general market opening returns are controlled for, then individual stocks' opening returns may actually exhibit positive, rather than negative, autocorrelations, in line with the results by Kudryavtsev (2012, 2013) indicating reversals in stocks' open-to-close returns with respect to opening returns, and also reversals in the next day's opening returns with respect to today's open-to close returns. In other words, I expect to find drifts in opening returns caused by a kind of "reversals of reversals".

I analyze intraday price data on thirty stocks currently making up the Dow Jones Industrial Index, and find supporting evidence for my research hypothesis. Employing the sample average and the sample median of opening stock returns for each of the trading days within my sample period as two alternative proxies for the general market opening returns, I document that if the previous day's market and individual stock's opening returns are taken together to explain the stock's opening returns, then, in line with my hypothesis, the effect of the lagged general market opening returns is significantly negative, while the effect of the lagged stock's opening returns is significantly positive. Furthermore, to support my findings, I separately demonstrate that following days characterized by both

positive and negative market opening returns, a given stock's opening returns tend to be higher if its previous day's opening returns were positive.

Finally, I test if on the basis of these results it may be possible to define potentially profitable investment strategies. I construct a number of portfolios based on the opening trading sessions and involving a long position in the stocks on the days when, according to the findings, their opening returns are expected to be high and a short position in the stocks on the days when, according to the findings, their opening returns are expected to be low. All the portfolios are found to yield significantly positive returns, providing an evidence for the practical applicability of the pattern of drifts in opening stock prices.

To summarize, at least in a perfect stock market with no commissions, the daily-adjusted strategies based on the expectations of interday drifts in opening stock returns look promising. This may prove a valuable result for both financial theoreticians in their eternal discussion about stock market efficiency, and practitioners in search of potentially profitable investment strategies. Potential directions for further research may include expending the analysis to other stock exchanges and greater samples.

Notes

(1) The focus on long-term dynamics of stock returns' overreaction and subsequent reversals from the pioneering studies by Shiller (1984) and De Bondt and Thaler (1985) is more recently realigned to short-run return behavior, ranging over time periods from a few days up to a month, in the major part of the subsequent literature (Lehmann, 1990, Zarowin, 1989, Atkins, Dyl, 1990, Cox, Peterson, 1994, Park, 1995, Bowman, Iverson, 1998, Nam et al., 2001). A continuously growing body of literature concentrates on even shorter time intervals, and studies intraday price reversals (Grant et al., 2005, Zawadowski et al., 2006). The major focus of these studies is on identifying potentially profitable contrarian strategies built on a reverting behavior of stock prices in the short run.

(2) At the first glance, this result seems to contradict the findings by Amihud and Mendelson (1987) and Stoll and Whaley (1990) reporting that opening returns show some evidence of reversals, but, in fact, there is no contradiction (as explained in some more detail in Section 3). The point is that the average or median opening returns are negatively autocorrelated, and since most of positive (negative) opening returns for a given stock happen on the days when the average or median opening return is also positive (negative), the stock's next day's opening returns tend to be negative (positive), providing an evidence of a generally negative autocorrelation in opening stock returns. But if the effect of the previous day's median or average opening returns is controlled for, it appears that, following days with both positive and negative average returns, opening stock returns tend to be higher, the higher are the respective previous day's opening returns.

(3) During the sampling period, the database on Yahoo Finance was missing only two trading days for Kraft Foods stock and one trading day for The Travelers Companies stock. I assumed the missing days' opening and closing prices to be equal to the average of the previous and the next trading days' opening and closing prices, respectively, for the respective stock.

(4) To construct the equally-weighted portfolios, for each day t characterized by, say, $AOR_{t-1} > 0$ (previous day's average opening return was positive – relevant for Table 3a), I construct two portfolios, where the return on the first one is the equally-weighted opening return on all the stocks whose previous day's opening return was positive ($OR_{it-1} > 0$), and the return on the second one is the equally-weighted opening return on all the stocks whose previous day's opening return was non-positive ($OR_{it-1} \leq 0$). I furthermore, calculate mean returns on both portfolios over all the days like t.

(5) I have repeated the analysis presented in Tables 3a and 3b, employing the sign of the previous trading day's median (instead of average) opening returns for the stocks in the sample as a proxy for the general market opening returns. The results are qualitatively similar and available upon request from the author.

(6) This is, in fact, a portfolio based on the same approach as the one employed in Tables 3a and 3b.

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Appendix

Table 1. *Descriptive statistics of sample stocks' opening returns*

The table presents for each of the 30 sample stocks and over the sampling period (2,455 trading days), the basic descriptive statistics of the opening returns calculated as follows:

$$R_{O,it} = \frac{P_{O,it}}{P_{C,it-1}} - 1$$

where: $R_{O,it}$ is stock i's opening return on day t; $P_{O,it}$ is stock i's opening price on day t; and $P_{C,it-1}$ is stock i's closing price on day t-1.

Company (Ticker symbol)	Opening returns, %					
	Mean	Median	St. Deviation	Maximum	Minimum	% of positive
Alcoa Inc. (AA)	0.158	0.084	1.551	18.969	-11.636	58.62
American Express (AXP)	-0.008	0.004	1.212	8.201	-11.064	51.12
Boeing (BA)	0.033	0.015	1.004	9.636	-9.638	54.34
Bank of America (BAC)	0.104	0.015	2.045	26.050	-20.020	53.48
Caterpillar (CAT)	0.086	0.029	1.198	11.365	-10.945	57.03
Cisco Systems (CSCO)	0.026	0.022	1.410	16.379	-16.452	51.36
Chevron Corporation (CVX)	0.032	0.030	0.808	4.033	-8.638	56.74
E.I. Du Pont de Nemours (DD)	0.039	0.020	0.879	5.201	-7.156	54.75
Walt Disney (DIS)	-0.048	-0.003	1.094	15.941	-9.875	49.29
General Electric (GE)	0.086	0.026	1.275	17.511	-11.583	53.81
Home Depot Inc. (HD)	0.001	-0.002	1.047	8.841	-9.479	49.57
Hewlett-Packard (HPQ)	-0.116	-0.046	1.386	14.379	-20.034	45.46
IBM (IBM)	-0.061	-0.033	0.956	12.177	-10.028	45.25
Intel Corporation (INTC)	0.038	0.070	1.377	8.567	-18.117	54.26
Johnson & Johnson (JNJ)	0.005	0.008	0.715	6.092	-16.552	52.79
JP Morgan Chase & Co (JPM)	0.043	0.013	1.436	16.616	-11.570	53.36
Kraft Foods Inc. (KFT)	-0.013	0.002	0.829	5.433	-12.779	50.84
Coca-Cola (KO)	-0.009	-0.002	0.663	7.072	-4.787	49.37
McDonald's Corporation (MCD)	0.007	0.007	0.860	4.554	-9.366	51.93
3M Company (MMM)	0.017	0.007	0.756	8.270	-6.285	53.85
Merck & Company Inc. (MRK)	-0.022	0.009	1.110	6.543	-25.878	52.55
Microsoft Corporation (MSFT)	0.017	0.008	1.020	12.550	-11.080	50.47
Pfizer Inc. (PFE)	0.054	0.029	1.047	11.400	-15.100	53.89
Procter & Gamble (PG)	-0.043	-0.014	0.625	4.846	-6.057	46.07
AT&T Inc. (T)	0.053	0.038	0.933	5.734	-8.469	56.13
The Travelers Companies (TRV)	0.042	0.011	0.996	11.292	-9.025	53.40
United Technologies Corp. (UTX)	0.042	0.015	0.824	6.470	-7.192	54.58
Verizon Communications (VZ)	0.035	0.027	0.839	4.359	-7.286	55.56
Wal-Mart Stores Inc. (WMT)	0.018	0.011	0.735	5.044	-7.620	52.91
Exxon Mobil Corporation (XOM)	-0.005	0.011	0.801	4.215	-9.071	52.46

Table 2a. *Regression analysis of opening stock returns: General market opening returns proxied by average opening returns for the stocks in the sample*

The table presents the regression coefficients and the t-statistics for the following model:

$$OR_{it} = \beta_0 + \beta_1 AOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it}$$

where: OR_{it} represents stock i's opening return on day t; and AOR_{t-1} is the average day-t-1 opening return for the stocks in the sample.

Company (Ticker symbol)	Regression coefficients (t-statistics)		
	Intercept	AOR_{t-1}	OR_{it-1}
Alcoa Inc. (AA)	***0.0015 (4.78)	***-0.4667 (-7.08)	***0.1121 (3.66)
American Express (AXP)	-0.0001 (-0.15)	***-0.2140 (-3.75)	0.0204 (0.60)
Boeing (BA)	*0.0003 (1.73)	***-0.2479 (-6.49)	***0.0952 (3.47)
Bank of America (BAC)	**0.0010 (2.43)	***-0.6126 (-7.57)	***0.1641 (5.75)
Caterpillar (CAT)	***0.0009 (3.70)	-0.0041 (-0.08)	-0.0446 (-1.50)
Cisco Systems (CSCO)	0.0003 (1.01)	***-0.1571 (-2.87)	0.0003 (0.01)
Chevron Corporation (CVX)	**0.0003 (2.13)	***-0.1008 (-2.96)	-0.0135 (-0.44)
E.I. Du Pont de Nemours (DD)	***0.0004 (2.40)	***-0.1035 (-2.73)	-0.0354 (-1.14)
Walt Disney (DIS)	**-0.0004 (-1.99)	***-0.1666 (-4.12)	0.0375 (1.41)
General Electric (GE)	***0.0008 (2.97)	***-0.4038 (-7.06)	***0.2190 (6.77)
Home Depot Inc. (HD)	0.0001 (0.21)	***-0.1481 (-3.65)	0.0088 (0.32)
Hewlett-Packard (HPQ)	***-0.0011 (-4.02)	-0.0659 (-1.33)	0.0058 (0.22)
IBM (IBM)	***-0.0007 (-3.48)	-0.0137 (-0.36)	***0.1057 (3.69)
Intel Corporation (INTC)	0.0004 (1.53)	***-0.1734 (-3.27)	-0.0311 (-1.12)
Johnson & Johnson (JNJ)	0.0001 (0.52)	***-0.1306 (-5.28)	***0.0904 (3.62)
JP Morgan Chase & Co (JPM)	*0.0005 (1.67)	***-0.2921 (-4.28)	0.0131 (0.38)
Kraft Foods Inc. (KFT)	-0.0001 (-0.53)	***-0.1426 (-5.32)	***0.0805 (3.45)
Coca-Cola (KO)	-0.0001 (-0.55)	***-0.0764 (-3.29)	***0.0733 (2.90)
McDonald's Corporation (MCD)	0.0001 (0.54)	***-0.1464 (-5.01)	0.0226 (0.92)
3M Company (MMM)	0.0002 (1.25)	***-0.1319 (-4.50)	0.0440 (1.57)
Merck & Company Inc. (MRK)	-0.0002 (-0.90)	**-0.0872 (-2.40)	0.0127 (0.54)
Microsoft Corporation (MSFT)	0.0002 (0.97)	***-0.1745 (-4.37)	*0.0541 (1.91)
Pfizer Inc. (PFE)	**0.0005 (2.49)	***-0.1166 (-3.30)	***0.0698 (2.87)
Procter & Gamble (PG)	***-0.0004 (-3.05)	***-0.0911 (-4.13)	*0.0441 (1.73)
AT&T Inc. (T)	***0.0005 (2.59)	***-0.1924 (-5.48)	***0.1586 (5.84)
The Travelers Companies (TRV)	**0.0004 (2.24)	***-0.2112 (-5.39)	*0.0474 (1.67)
United Technologies Corp. (UTX)	***0.0004 (2.59)	***-0.1179 (-3.28)	0.0321 (1.02)
	**0.0004 (2.13)	***-0.1377 (-4.23)	**0.0578 (2.07)
Verizon Communications (VZ)	0.0002 (1.32)	***-0.0950 (-3.77)	0.0380 (1.54)
Wal-Mart Stores Inc. (WMT)	-0.0001 (-0.15)	***-0.1339 (-4.05)	0.0244 (0.82)
Exxon Mobil Corporation (XOM)			

Note: Asterisks denote two-tailed p-values: *$p<0.10$; **$p<0.05$; ***$p<0.01$.

Table 2b. *Regression analysis of opening stock returns: General market opening returns proxied by median opening returns for the stocks in the sample*

The table presents the regression coefficients and the t-statistics for the following model:

$$OR_{it} = \beta_0 + \beta_1 MOR_{t-1} + \beta_2 OR_{it-1} + \varepsilon_{it}$$

where: OR_{it} represents stock i's opening return on day t; and MOR_{t-1} is the median day-t-1 opening return for the stocks in the sample.

Company (Ticker symbol)	Regression coefficients (t-statistics)		
	Intercept	MOR_{t-1}	OR_{it-1}
Alcoa Inc. (AA)	***0.0015 (4.67)	***-0.5236 (-7.36)	***0.1040 (3.57)
American Express (AXP)	-0.0001 (-0.25)	***-0.2112 (-3.41)	0.0048 (0.15)
Boeing (BA)	0.0003 (1.60)	***-0.2787 (-6.36)	***0.0956 (3.45)
Bank of America (BAC)	**0.0010 (2.32)	***-0.6557 (-7.71)	***0.1436 (5.42)
Caterpillar (CAT)	***0.0009 (3.67)	-0.0264 (-0.48)	-0.0362(-1.24)
Cisco Systems (CSCO)	0.0003 (0.96)	**-0.1167 (-1.98)	-0.0212 (-0.80)
Chevron Corporation (CVX)	**0.0003 (2.06)	***-0.1111 (-2.82)	-0.0143 (-0.46)
E.I. Du Pont de Nemours (DD)	**0.0004 (2.33)	***-0.1371 (-3.14)	-0.0236 (-0.75)
Walt Disney (DIS)	**-0.0005 (-2.07)	***-0.1907 (-4.23)	0.0364 (1.39)
General Electric (GE)	***0.0007 (2.83)	***-0.4576 (-7.41)	***0.2131 (6.92)
Home Depot Inc. (HD)	0.0001 (0.12)	***-0.1433 (-3.15)	-0.0023 (-0.08)
Hewlett-Packard (HPQ)	***-0.0012 (-4.11)	-0.0388 (-0.71)	-0.0051 (-0.20)
IBM (IBM)	***-0.0007 (-3.59)	-0.0341 (-0.81)	***0.1288 (4.62)
Intel Corporation (INTC)	0.0004 (1.47)	***-0.1751 (-3.06)	-0.0414 (-1.57)
Johnson & Johnson (JNJ)	0.0001 (0.44)	***-0.1608 (-5.70)	***0.0981 (3.91)
JP Morgan Chase & Co (JPM)	0.0005 (1.58)	***-0.3141 (-4.38)	0.0021 (0.06)
Kraft Foods Inc. (KFT)	-0.0001 (-0.63)	***-0.1513 (-5.02)	***0.0747 (3.23)
Coca-Cola (KO)	-0.0001 (-0.61)	***-0.0913 (-3.45)	***0.0764 (3.00)
McDonald's Corporation (MCD)	0.0001 (0.46)	***-0.1761 (-5.38)	0.0252 (1.04)
3M Company (MMM)	0.0002 (1.16)	***-0.1479 (-4.39)	0.0443 (1.56)
Merck & Company Inc. (MRK)	-0.0002 (-0.95)	**-0.0962 (-2.36)	0.0110 (0.47)
Microsoft Corporation (MSFT)	0.0002 (0.88)	***-0.1718 (-3.93)	0.0396 (1.45)
Pfizer Inc. (PFE)	**0.0005 (2.44)	***-0.1186 (-3.00)	***0.0639 (2.66)
Procter & Gamble (PG)	***-0.0004 (-3.10)	***-0.1088 (-4.27)	*0.0496 (1.91)
AT&T Inc. (T)	**0.0005 (2.49)	***-0.2079 (-5.19)	***0.1544 (5.66)
The Travelers Companies (TRV)	**0.0004 (2.14)	***-0.2172 (-4.96)	0.0359 (1.28)
United Technologies Corp. (UTX)	**0.0004 (2.53)	***-0.1133 (-2.67)	0.0216 (0.66)
Verizon Communications (VZ)	**0.0003 (2.04)	***-0.1688 (-4.56)	**0.0648 (2.31)
Wal-Mart Stores Inc. (WMT)	0.0002 (1.25)	***-0.1054 (-3.69)	0.0368 (1.49)
Exxon Mobil Corporation (XOM)	-0.0001 (-0.23)	***-0.1573 (-4.07)	0.0299 (0.97)

Note: Asterisks denote two-tailed p-values: *$p<0.10$; **$p<0.05$; ***$p<0.01$.

Table 3a. *Opening stock returns following the days of positive and non-positive opening returns: Statistics following the days characterized by positive average opening returns.*

The table presents for each stock i, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \leq 0$), given that the previous days were characterized by positive average opening returns ($AOR_{t-1} > 0$). The table also reports the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$. The rightmost column reports the differences between the respective mean opening returns, and their significance.

Company (Ticker symbol)	Mean opening returns, %, for the days when:		
	$OR_{it-1} > 0$ (No. of days)	$OR_{it-1} \leq 0$ (No. of days)	Difference (t-statistic)
Alcoa Inc. (AA)	0.079 (1096)	0.050 (223)	0.029 (0.26)
American Express (AXP)	-0.103 (1034)	-0.021 (285)	-0.082 (-1.00)
Boeing (BA)	-0.023 (1004)	-0.049 (315)	0.026 (0.40)
Bank of America (BAC)	0.017 (1054)	-0.240 (265)	*0.257 (1.80)
Caterpillar (CAT)	0.036 (1087)	0.056 (232)	-0.020 (-0.22)
Cisco Systems (CSCO)	-0.046 (1037)	-0.134 (282)	0.088 (0.93)
Chevron Corporation (CVX)	-0.024 (1021)	-0.018 (298)	-0.006 (-0.12)
E.I. Du Pont de Nemours (DD)	-0.044 (1041)	-0.001 (278)	-0.043 (-0.67)
Walt Disney (DIS)	-0.125 (964)	-0.076 (355)	-0.049 (-0.78)
General Electric (GE)	0.028 (1098)	0.032 (221)	-0.004 (-0.05)
Home Depot Inc. (HD)	-0.070 (973)	-0.057 (346)	-0.013 (-0.19)
Hewlett-Packard (HPQ)	-0.017 (908)	-0.018 (411)	0.001 (0.10)
IBM (IBM)	-0.075 (919)	-0.139 (400)	0.064 (1.19)
Intel Corporation (INTC)	-0.073 (1081)	-0.053 (238)	-0.020 (-0.21)
Johnson & Johnson (JNJ)	-0.019 (968)	-0.084 (351)	*0.065 (1.65)
JP Morgan Chase & Co (JPM)	-0.100 (1060)	-0.061 (259)	-0.039 (-0.38)
Kraft Foods Inc. (KFT)	-0.066 (869)	-0.045 (450)	-0.021 (-0.38)
Coca-Cola (KO)	-0.012 (923)	-0.064 (396)	0.052 (1.29)
McDonald's Corporation (MCD)	-0.054 (954)	-0.023 (365)	-0.031 (-0.61)
3M Company (MMM)	-0.028 (995)	-0.035 (324)	0.007 (0.16)
Merck & Company Inc. (MRK)	-0.032 (971)	-0.145 (348)	*0.113 (1.73)
Microsoft Corporation (MSFT)	-0.063 (1032)	-0.030 (287)	-0.033 (-0.48)
Pfizer Inc. (PFE)	0.017 (1005)	0.016 (314)	0.001 (0.01)
Procter & Gamble (PG)	-0.074 (879)	-0.103 (440)	0.029 (0.82)
AT&T Inc. (T)	0.029 (1029)	-0.134 (290)	***0.163 (2.73)
The Travelers Companies (TRV)	0.045 (991)	-0.056 (328)	*0.101 (1.66)
United Technologies Corp. (UTX)	-0.015 (1018)	0.001 (301)	-0.016 (-0.35)
	0.001 (1034)	-0.092 (285)	*0.093 (1.67)
Verizon Communications (VZ)	-0.043 (991)	-0.011 (328)	-0.032 (-0.70)
Wal-Mart Stores Inc. (WMT)	-0.059 (981)	-0.018 (338)	-0.041 (-0.81)
Exxon Mobil Corporation (XOM)	-0.020 (1319)	-0.094 (1319)	**0.074 (2.55)
Equally-Weighted Portfolios			

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 3b. *Opening stock returns following the days of positive and non-positive opening returns: Statistics following the days characterized by non-positive average opening returns*

The table presents for each stock i, its mean opening returns, separately, following the days when its opening returns were positive ($OR_{it-1} > 0$) and non-positive ($OR_{it-1} \leq 0$), given that the previous days were characterized by non-positive average opening returns ($AOR_{t-1} \leq 0$). The table also reports the mean opening returns for the equally-weighted portfolios of stocks with $OR_{it-1} > 0$ and $OR_{it-1} \leq 0$. The rightmost column reports the differences between the respective mean opening returns, and their significance.

Company (Ticker symbol)	Mean opening returns, %, for the days when:		
	$OR_{it-1} > 0$ (No. of days)	$OR_{it-1} \leq 0$ (No. of days)	Difference (t-statistic)
Alcoa Inc. (AA)	0.232 (343)	0.263 (792)	-0.031 (-0.30)
American Express (AXP)	0.054 (221)	0.088 (914)	-0.034 (-0.38)
Boeing (BA)	0.179 (330)	0.075 (805)	0.104 (1.56)
Bank of America (BAC)	0.307 (259)	0.253 (876)	0.054 (0.38)
Caterpillar (CAT)	0.089 (313)	0.159 (822)	-0.070 (-0.91)
Cisco Systems (CSCO)	0.225 (224)	0.107 (911)	0.118 (1.14)
Chevron Corporation (CVX)	0.109 (372)	0.089 (763)	0.020 (0.41)
E.I. Du Pont de Nemours (DD)	0.112 (303)	0.130 (832)	-0.018 (-0.30)
Walt Disney (DIS)	0.108 (246)	0.001 (889)	0.107 (1.27)
General Electric (GE)	0.277 (223)	0.124 (912)	*0.153 (1.66)
Home Depot Inc. (HD)	0.194 (244)	0.049 (891)	**0.155 (1.96)
Hewlett-Packard (HPQ)	0.014 (208)	-0.067 (927)	0.081 (0.69)
IBM (IBM)	-0.013 (192)	0.011 (943)	-0.024 (-0.29)
Intel Corporation (INTC)	0.190 (251)	0.153 (884)	0.027 (0.37)
Johnson & Johnson (JNJ)	0.079 (328)	0.044 (807)	0.035 (0.70)
JP Morgan Chase & Co (JPM)	0.266 (250)	0.180 (885)	0.086 (0.86)
Kraft Foods Inc. (KFT)	0.049 (379)	0.036 (756)	0.013 (0.31)
Coca-Cola (KO)	0.012 (289)	0.011 (846)	0.001 (0.03)
McDonald's Corporation (MCD)	0.101 (321)	0.054 (814)	0.047 (0.79)
3M Company (MMM)	0.064 (327)	0.074 (808)	-0.010 (-0.21)
Merck & Company Inc. (MRK)	0.118 (319)	-0.014 (816)	*0.132 (1.71)
Microsoft Corporation (MSFT)	0.202 (207)	0.080 (928)	0.122 (1.59)
Pfizer Inc. (PFE)	0.245 (318)	0.040 (817)	***0.205 (3.09)
Procter & Gamble (PG)	-0.001 (252)	0.001 (883)	-0.002 (-0.16)
AT&T Inc. (T)	0.171 (349)	0.100 (786)	0.071 (1.14)
The Travelers Companies (TRV)	0.181 (320)	0.106 (815)	0.075 (1.10)
United Technologies Corp. (UTX)	0.159 (322)	0.080 (813)	0.079 (1.48)
	0.164 (330)	0.070 (805)	*0.094 (1.74)
Verizon Communications (VZ)	0.118 (308)	0.065 (827)	0.053 (1.06)
Wal-Mart Stores Inc. (WMT)	0.044 (307)	0.045 (828)	-0.001 (-0.03)
Exxon Mobil Corporation (XOM) Equally-Weighted Portfolios	0.161 (1135)	0.072 (1135)	***0.089 (2.71)

Note: Asterisks denote two-tailed p-values: *p<0.10; **p<0.05; ***p<0.01.

Table 4. *Historical performance measures of the portfolios based on the idea of drifts in opening stock returns*

The table presents the basic performance measures of opening returns over the sampling period (January 2, 2002 to September 30, 2011) for six portfolios constructed daily based on the expectation of drifts in opening stock returns and on the sign of previous day's opening market returns:

Portfolio AP: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio AA: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio AM: Portfolio that following the days of non-positive average opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive average opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Portfolio MP: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were positive, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were non-positive.

Portfolio MA: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions) in the stocks whose previous day's opening returns were higher than the sample average, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample average.

Portfolio MM: Portfolio that following the days of non-positive median opening returns implies an equally-weighted long position (for the days' opening sessions)

in the stocks whose previous day's opening returns were higher than the sample median, and following the days of positive median opening returns implies an equally-weighted short position (for the days' opening sessions) in the stocks whose previous day's opening returns were lower than the sample median.

Statistics	Portfolio performance measures (opening returns) over the sampling period (2454 days)					
	Portfolio AP	Portfolio AA	Portfolio AM	Portfolio MP	Portfolio MA	Portfolio MM
Mean, %	0.125	0.095	0.094	0.126	0.097	0.094
Median,%	0.060	0.077	0.079	0.057	0.075	0.075
Standard	0.791	0.662	0.650	0.793	0.666	0.653
Deviation, %	9.121	7.183	7.121	9.121	7.183	7.121
Maximum, %	-7.072	-4.154	-4.364	-7.072	-4.154	-4.364
Minimum, %	54.81	58.27	58.60	55.01	58.27	58.64
Percent of positive						
t-statistic (Mean=0)	***7.80	***7.09	***7.18	***7.84	***7.19	***7.15

Note: Asterisks denote two-tailed p-values: *$p<0.10$; **$p<0.05$; ***$p<0.01$.