Cross-Section of Expected Returns and Extreme Returns: The Role of Investor Attention and Risk Preferences

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Abstract

We extend and enrich the finding of a recent paper by Bali, Cakici, and Whitelaw (2011) that shows a negative and significant relation between maximum daily returns over the past one month and expected stock returns. We show that reversals continue for 6 months beyond the month of maximum daily returns. Thus mispricing is greater than documented in Bali, Cakici, and Whitelaw (2011). We add two new results. First we show that the subsequent month reversal of returns for stocks with extreme daily returns is related to investor attention and their portfolio rebalancing decisions at the end-of-the-month. Specifically the stocks that achieved their maximum daily returns towards the end of the month show greater reversals than other stocks. Second we link the subsequent month reversal of stocks with extreme daily returns to the risk preferences of investors. We show that the stocks that are associated with capital losses show greater reversals in the following month.

JEL classification: G12; G14; G20

Keywords: Expected Returns, Investor Attention, Risk Preferences

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Introduction

Financial economists have long been engrossed with explaining the cross-section of stock returns. The rational economic models in the mold of CAPM and APT have helped us understand the theoretical underpinnings of cross-section of stock returns[1]. These models rely on the diversification as an important mechanism to derive the expected cross-sectional relationship between stock returns and various measures of systematic risk assuming that investors avoid idiosyncratic risk by holding diversified portfolios. Recent empirical research however demonstrates that investors' portfolios are far from diversified and there may be even rational arguments for the documented lack of diversification[2]. Furthermore, last three decades of research has discovered a number of anomalies such as size, book-to-market, and momentum that cannot be explained unambiguously in the rational framework of CAPM and APT types of models. Some financial economists have advanced alternative rationales grounded in investor irrationality emanating from behavioral biases for these anomalies. The upshot of the recent research in asset pricing suggests that beyond diversification rationale, individual stock returns/firm attributes themselves hold key to explaining expected cross-section of returns. This paper is a modest attempt in that direction. We enrich the key finding of a negative and significant relation between maximum daily returns over the past one

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[1] Incomplete listing of such papers include Sharpe (1964), Lintner (1965), and Mossin (1966), Kraus and Litzenberger (1976), Harvey and Siddique (2000), and Smith (2007).

[2] See Odean (1999), Milton and Vorkink (2007), and Goetzmann and Kumar (2008) for empirical evidence and Van Nieuwerburgh and Veldkamp (2010) for theoretical arguments.

month and expected stock returns in an important recent paper by Bali, Cakici, and Whitelaw (2011)[3].

Specifically we first link Bali, Cakici, and Whitelaw (2011) work on the role of extreme daily returns in future stock returns to investor attention first mentioned in Kahneman (1973) and explored in several papers[4]. These papers argue that investors have limited attention and that plays a role in what stocks are traded by them. For instance, Barber and Odean (2008) reason and find evidence that the stocks that have had high returns recently catch the attention of the investors with regard to what to add to the portfolios. We extend that argument and propose that to the extent end-of-the-month is a convenient time for many investors to take their portfolio rebalancing decisions, the stocks that have had maximum daily returns achieved very close to the month-end will be far more noticeable by these inattentive investors. The extra demand generated from these investors will exaggerate the mispricing of these stocks. When the correction takes place in the subsequent month for Bali, Cakici, and Whitelaw (2011) documented stocks with extreme returns, this subset of stocks that had attained maximum returns close to the end-of-the-month will show larger reversals.

Second we contend that the stocks with extreme daily returns will be especially attractive to the investors sitting on paper losses in their current portfolios. This argument is motivated by the theoretical works of Barberis, Huang, and Santos (2003), Barberis, Huang, and Thaler (2003), and Grinblatt and Han (2005) who show that the

[3] These authors find that after controlling for MAX in the cross-sectional regressions of returns on idiosyncratic volatility, the coefficient on volatility is insignificant in some specifications or even significantly positive in others.

[4] See Barber and Odean (2008), Cohen and Frazzini (2008), Dyck and Zingales (2003), Hirshleifer and Teoh (2003), Hong and Stein (1999), Huberman and Regev (2001), Peng and Xiong (2006), Gabaix et al. (2006), Hirshleifer, Lim and Teoh (2009), and Dellavigna and Pollet (2009).

psychological biases of investors influence their risk attitude. These papers argue that prospect theory and mental accounting (PTMA, hereafter) motivated specifications of preferences have a systematic influence on cross-section of returns. For instance Grinblatt and Han (2005) and Frazzini (2006) use PTMA arguments to suggest that investors are risk-seeking in losses. We propose that these PTMA investors sitting on paper losses are attracted towards stocks that have experienced recent high returns in the hope that may help them in to recouping their losses. This phenomenon similar to our arguments on investor inattention above exaggerates the mispricing. Consequently these stocks should experience greater reversal in the subsequent month.

We first document the existence of Bali, Cakici, and Whitelaw (2011) results for our sample of stocks. We show that the reversal of returns for stocks with extreme daily returns is present for stocks with prices greater than $5.00 unlike many anomalies present in mostly stocks with prices less than $5.00. Furthermore we document that the reversal is not just confined to the subsequent month but continues to show up in the subsequent 5 months as well. Therefore the mispricing is more substantial than documented in Bali, Cakici, and Whitelaw (2011). More significantly our results are supportive of our two hypotheses. Our portfolio and firm-level investigations show that investor inattention adds to the mispricing of stocks with extreme daily returns. The subsequent month reversal of stocks with extreme daily returns is largely concentrated in stocks that achieved their highest daily returns close to the end-of-the month. Similarly our results show that risk-seeking attitude of investors with paper losses intensifies the mispricing of stocks with extreme daily returns. The reversals are larger and more significant for the extreme daily returns stocks that are associated with capital losses. Our results are robust to measurement of reversals using raw-returns or 4-factor Fama-French-Carhart adjusted alphas.

The remainder of the paper is organized as follows. The next section II describes the sample. Section III discusses the main results of the paper along with robustness tests. We conclude the paper in section IV.

II. Sample

We extract data of all common stocks (with share code 10 and 11)[5] of NYSE/AMEX/NASDAQ from CRSP daily and monthly files between July 1962 and December 2011. We use daily stock return data to compute maximum daily stock returns for each stock in each month. We call this variable MAX. In addition we also compute another variable called DMAX, calculated in unit of days as difference between the day the MAX return is observed and the last trading day of the same month.[6] Furthermore we use daily stock returns data to compute Scholes and William's beta (BETA), and capital gains overhang (CGO) used as a control variable used in the regressions. We use monthly stock return data to calculate measures of capital gains overhang (CGO), short-term reversal (REV), momentum (PRE12RET), liquidity (ILLIQ), and firm size (SIZE). Lastly we extract data from COMPUSTAT to compute Book-to-Market ratio (BTM). We provide details on the exact computation of these variables in the Appendix.

III. A. Preliminary Results

[5]This essentially removes all ADRs, SBIs, Units, REITS, closed-end funds and companies incorporated outside the U.S.A.
[6] We select firms that have at least 12 trading days each month.

We first document the existence of Bali, Cakici, and Whitelaw (2011) results for our sample of firms. Similar to Bali, Cakici, and Whitelaw (2011) we form decile portfolios based on maximum daily returns (MAX) each month from July 1962 to December 2011. The portfolios are formed with value and equal weighting schemes. To investigate if the overreaction effect is not just confined to small and illiquid stocks preferred by small investors, we examine two samples. The first sample includes all the stocks from CRSP files. Then we concentrate on the stocks with minimum initial price of $5.00 in the month of portfolio construction.

The Table 1 shows the subsequent month returns of the portfolios sorted on maximum daily returns. We also show the difference in the raw returns and Factor alphas of the portfolios with the lowest and maximum daily returns. The t-statistics shown are adjusted for auto-correlation using Newey-West (1987) method. We observe that portfolios with the highest maximum daily return stocks underperform the portfolios with the lowest maximum daily returns stocks in the subsequent months. For example in the sample of all stocks, the equally-weighted portfolios with the highest daily maximum returns yield raw return of 0.58% per month on average compared to 1.22% per month for the portfolios with the lowest daily maximum returns. The underperformance is statistically significant and found with Four Factor alphas also. We find similar underperformance in value-weighted portfolios. When we confine the sample to stocks whose initial price in the month of portfolio formation is $5.00 or greater, we find results that are similar to the entire sample though the magnitudes are smaller for value-weighted portfolios. Thus our results are qualitatively similar to what are found in Bali, Cakici, and Whitelaw (2011). In fact since we separately show our results for stocks with initial price of equal or greater than $5.00, it indicates that the overreaction results documented above are not driven by small priced, illiquid stocks preferred by small investors as is the case with many of the anomalies.

To check the robustness of the result that stocks with extreme daily returns in current month show short-term reversal in the subsequent month, we conduct firm-level Fama-MacBeth regressions every month. The dependent variable in these regressions is current month stock return. The primary explanatory variable of interest is the previous month maximum daily return for the stock. In addition we also include lagged value of other control variables such as stock beta (BETA), short-term reversal (REV), momentum (PRE12RET), liquidity (ILLIQ), Book-to-Market ratio (BTM), firm size (SIZE) as described in more detail in Appendix. We run the following regression specification:

$$R_{i,t} = \lambda_{0,t} + \lambda_{1,t} MAX_{i,t-1} + \lambda_{2,t} BETA_{i,t-1} + \lambda_{3,t} SIZE_{i,t-1} + \lambda_{4,t} BTM_{i,t-1} + \lambda_{5,t} MOM_{i,t-1} + \lambda_{6,t} REV_{i,t-1} + \lambda_{7,t} ILLIQ_{i,t-1} + \varepsilon_{i,t}$$

The Table 2 shows the time-series mean of the regression coefficients obtained from running monthly Fama-MacBeth regressions above. The t-statistics shown are adjusted for auto-correlation using Newey-West (1987) method. In univariate regressions, the coefficient of MAX is negative and statistically significant. Thus our firm-level regressions confirm Table 1 results that stocks with high maximum daily returns show reversal in returns in the subsequent month. When we include other control variables in the monthly regressions, the coefficient of our main variable of interest i.e. prior month maximum daily return remains negative and statistically significant. We obtain results that are similar whether we include all stocks or restrict the sample to stocks with price of $5.00 or more. The coefficients of other control variables imply statistically significant negative size effect, and positive value effect. The sample of stocks shows short-term reversal as captured by REV variable, but medium-term momentum (MOM).

In Table 3, we examine the performance of stocks sorted on maximum daily returns in months beyond one to see if the stocks with extreme daily returns in current month continue to exhibit reversal in stock returns in future too for stocks with price at least $ 5 in the month of portfolio formation. If the reversal continues to show up in months beyond one, this would highlight the magnitude of mispricing. In order to do this, we track the performance of the equally-weighted and value-weighted maximum daily returns decile portfolio for six months beyond the month of extreme daily returns. Our result indicate that from months 2 through 6, the difference in returns of the stocks with the highest daily maximum returns relative to the lowest daily maximum daily returns is consistent with month 1 pattern. That is stocks with the highest maximum daily return continue to underperform the stocks with the lowest maximum daily returns up to 6 months. However the magnitude of the underperformance diminishes as we move beyond month one. Furthermore, the differences in returns are statistically significant only using Four-Factor alphas and stronger for equally-weighted portfolios. Our results not tabulated for the sample without price restriction in the month of portfolio formation are largely similar to shown here in Table 3. Overall our analysis shows that the stocks with the highest daily returns continue to do poorly for up to 6 months though poor performance declines with time. Thus mispricing documented in Bali, Cakici, and Whitelaw (2011) is more severe than previously understood.

III. B. Investor Attention and Extreme Stock Returns

Motivated by Kahneman's (1973) assertion that attention is a scarce cognitive resource, several papers have examined the role of investors' inattention with respect to asset price dynamics (see Barber and Odean (2008); Cohen and Frazzini (2008); Dyck and Zingales (2003); Hirshleifer and Teoh (2003); Hong and Stein (1999); Huberman and Regev (2001); Peng and Xiong (2006), Gabaix et al. (2006); Hirshleifer, Lim and Teoh (2009); and Dellavigna and Pollet (2009)). These studies generally conclude that because of cognitive constraints, investors are often distracted and/or have limited attention. Barber and Odean (2008) argue that when it comes to adding stocks to the portfolios, the recent extreme winners catch the attention of the investors. To the extent end-of-the-month is a convenient time for many investors to take their portfolio rebalancing decisions, the stocks that have had maximum daily returns achieved very close to the month-end can plausibly catch the attention of these investors. Recent winners could be attractive to investors that may like to window dress their portfolios as well. This excess demand from these investors may aggravate the mispricing of these stocks pushing them beyond their fundamental value. Therefore it stands to reason that when the correction takes place in the subsequent month these stocks are likely to show larger reversals.

To examine the impact of proximity of extreme daily stock returns to the end of the month and their subsequent reversal, we calculate DMAX (distance of Max) as the number of days between the day when the maximum daily return (MAX) is observed and the last trading day of each month. Then we form decile portfolios on DMAX each month from July 1962 to December 2011 and report equal and value-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas. The t-statistics as before are adjusted for auto-correlation using Newey-West (1987) method. The results are tabulated in Table 4 for stocks with price at least $ 5 in the month of portfolio formation. We observe that both equal and value-weighted portfolios of stocks whose maximum daily returns are closer to end of the month as sorted by DMAX show systematically lower returns and Four Factor alphas in the subsequent month. The difference in raw return/Four Factor alpha between the portfolios with the extreme DMAX is statistically significant around 0.65% per month in Panel A of Table 4. We also observe that DMAX and subsequent months are positively correlated as shown by the mean cross-sectional correlation of 0.013 in Panel B. Furthermore the mean cross-sectional correlation between maximum daily returns (MAX) and DMAX is positive 0.022. In un-tabulated results for sample without price restriction in the month of portfolio formation we similar findings. These results are consistent with our hypothesis that investor attention exacerbates mispricing of stocks with extreme current month daily returns causing larger reversal in the subsequent month.

To further study the effect of investor inattention to extreme stocks' subsequent performance; we also make use of double-sorted portfolios. We first make quintile portfolios on by sorting stocks on DMAX each month from July 1962 to December 2011 and then sort stocks within each DMAX quintile into quintiles based on MAX. This helps us understand the incremental impact of DMAX on similar MAX stocks within a month. We report equal-weighted/value-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas for these double sorted portfolios in Table 5. The t-statistics reported in parentheses are adjusted for autocorrelation using the Newey-West (1987) method. We find that difference in returns of portfolios sorted on MAX within each DMAX quintile show reversal as documented earlier as shown in the last two columns. However the absolute reversal monotonically increases as the DMAX decreases. For example in Panel B, using raw returns, the difference in the monthly returns of the equal-weighted portfolios with quintile farthest from MAX (stocks with high DMAX) stocks is -0.36% that is statistically insignificant. The same difference in monthly returns for stocks closest to MAX (stocks with low DMAX) is statistically significant -1.51. The difference between -1.51 and -0.36 is statistically significant as well. We find similar results when the measure of returns is 4-factor Fama-French-Carhart alphas. Our results in Panel A with value-weighted portfolios echo our findings in Panel B. Therefore our analysis in Table 5 provides additional support to our argument that investor inattention add to the mispricing of stocks with extreme daily returns.

In order to add rigor to our analyses we conduct monthly Fama-MacBeth regressions at firm level, where dependent variable is current month return. To increase the power of the tests, firms in either in the lowest decile MAX portfolio or in the highest decile MAX portfolio are used in the regression. The independent variables are lagged values of our primary variables of interest i.e. MAX, and DMAX. The incremental impact of DMAX on MAX to explain monthly return is captured through and an interaction term that is MAX*DMAX. We also include lagged values of other control variables as defined in more details in appendix.

Specifically we run two specifications the following full regression:

$$R_{i,t} = \lambda_{0,t} + \lambda_{1,t}MAX_{i,t-1} + \lambda_{2,t}DMAX_{i,t-1} + \lambda_{3,t}MAX_{i,t-1} * DMAX_{i,t-1} + \lambda_{4,t}BETA_{i,t-1} + \lambda_{5,t}SIZE_{i,t-1} + \lambda_{6,t}BTM_{i,t-1} + \lambda_{7,t}MOM_{i,t-1} + \lambda_{8,t}REV_{i,t-1} + \lambda_{9,t}ILLIQ_{i,t-1} + \varepsilon_{i,t}$$

The results are shown in Table 6. Our main variable of interest i.e. the interaction between DMAX and MAX is significantly positive in all two regression specifications. Thus closer the stocks are to the end of the month when they attain their daily maximum return in that month, the more negative their returns are in the following month[7]. The MAX variable has the expected negative sign in the two specifications.

III. C. Prospect Theory and Mental Accounting (PTMA) and Extreme Stock Returns

The theoretical work of Barberis, Huang, and Santos (2003), Barberis, Huang, and Thaler (2003), and Grinblatt and Han (2005) endeavor to study the impact of psychological biases of investors on the risk attitude of investors and how this influences the cross-section of returns. In particular they find that PTMA motivated specifications of preferences have a systematic influence on cross-section of returns. Grinblatt and Han (2005) and Frazzini (2006) use PTMA arguments to propose that investors are risk-seeking in losses that lead to disposition effect i.e. the tendency to sell winners and holding on to losers in the portfolios. We propose that PTMA investors sitting on losses become more risk-seeking. This in turn attracts them towards stocks that experience high returns in order to recoup their losses. This heightens the mispricing of these stocks. Therefore these stocks experience greater reversal in the subsequent month. We

[7] The positive coefficient of interaction variable is due to the fact that DMAX is computed as the difference between the last trading day of the month and the day the stock achieved its highest return in that month.

use capital gains overhang variable (CGO) as in Grinblatt and Han (2005) to capture differing risk seeking attitude amongst investors. Following Grinblatt and Han (2005), we compute reference price (cost basis) RP_t for each stock at the end of every month from July of 1962 to end of December 2011 using previous up to three years of daily data[8]. Our estimate of reference price is as follows:

$$RP_t = \frac{1}{k}\sum_{n=1}^{T}\left(V_{t-n}\prod_{\tau=1}^{n-1}\left[1-V_{t-n+\tau}\right]\right)P_{t-n}$$

Where V_t is date t's turnover in the stock. T refers to number of trading days in the previous three years with available daily price and volume information. The term in the parentheses multiplying P_{t-n} is weights, and k is a constant that makes the entire weights sum to one. The weight on P_{t-n} reflects the probability that the shares purchased on date t-n have not been traded since. Our proxy for capital gains overhang for each stock at the end of each month t is

$$g_t = \frac{P_t - RP_t}{P_t}$$

P_t is the price of the stock at the end of month t. We make appropriate adjustments for stock-split, stock-dividends etc. in share turnover and share price variables while computing RP_t and g_t. Thus we have the capital gains overhang variable for each stock at the end of every month for the period between the July, 1962 and December, 2011.

[8] Use of T = 3 years though somewhat arbitrary recognizes the fact that longer time period are not useful as distant market prices have little effect on the reference price while it also gives us an accurate measure of unrealized capital gains (losses). Moreover Grinblatt and Han (2005) show that ability of capital gains overhang measure to predict future returns is insensitive to using 3, 5, or 7 years of past returns and volume data.

To test our hypothesis that investors with capital losses flock to stocks with extreme daily returns aggravating mispricing that shows up as greater reversal in subsequent months we adopt the following procedure. We first form quintile portfolios on capital gains overhang (CGO) and then form another set of quintile portfolios on MAX within each quintile portfolios on CGO from July 1962 to December 2011. We compute value-weighted and equal-weighted average monthly returns as well as 4-factor Fama-French-Carhart alphas in the following month after portfolio formation. The results are reported in Table 7. Consistent with our prediction, we find that portfolios of stocks with extreme daily returns that have had greater losses in the prior periods as proxied by low capital gains overhang also show greater reversals in the subsequent months. For example in Panel B, the difference in the monthly average alpha of stocks with maximum daily returns is 1.99% (-0.07) in the with the lowest (highest) capital gains overhang. The returns are similar when we examine the raw monthly returns of stocks sorted on capital gains overhang. The results are qualitatively similar for value-weighted portfolios in Panel A as well. Thus our results show that risk-seeking attitude of investors with losses amplifies the mispricing of stocks with extreme daily returns.

We also conduct our above analyses by controlling for other control variables at the firm level by running monthly Fama-MacBeth regressions, where dependent variable is current month return. This analysis is similar to our analysis to the incremental impact of DMAX on MAX at firm level for future stock returns. Here we study the impact of capital gains overhang on MAX for future stock returns. The independent variables are lagged values of our primary variables of interest i.e. MAX, CAP that is defined an indicator variable that is 1 if the capital gains overhang of a firm is in the lowest capital gains overhang decile portfolio, and it is 0 otherwise. The incremental impact of CAP on MAX to explain monthly return is captured through an interaction term that is MAX*CAP. To increase the power of the tests, firms in either in the lowest decile MAX portfolio or in the highest decile MAX portfolio are used in the regression. We also include lagged values of other control variables as defined in more details in appendix.

Specifically we run specifications the following full regression:

$$R_{i,t} = \lambda_{0,t} + \lambda_{1,t}MAX_{i,t-1} + \lambda_{2,t}CAP_{i,t-1} + \lambda_{3,t}CAP * MAX_{i,t-1} + \lambda_{4,t}BETA_{i,t-1} + \lambda_{5,t}SIZE_{i,t-1} + \lambda_{6,t}BTM_{i,t-1} + \lambda_{7,t}MOM_{i,t-1} + \lambda_{8,t}REV_{i,t-1} + \lambda_{9,t}ILLIQ_{i,t-1} + \varepsilon_{i,t}$$

We sort firms first into MAX decile portfolios and then further classified on capital gains overhang variable.

The results are shown in Table 9. Our main variable of interest i.e. the interaction between CAP (capturing capital gains overhang) and MAX is significantly negative in all three regression specifications. The MAX variable has the expected negative sign in the first two specifications for all months. The coefficient of MAX is mostly insignificant when we add idiosyncratic volatility (IVOL), and idiosyncratic skewness (ISKW) to the regression. In summary our results of this section establish that risk-seeking attitude of investors with losses magnifies the mispricing of stocks with extreme daily returns.

IV. Conclusion

We extend the findings of a recent paper by Bali, Cakici, and Whitelaw (2011) that shows a negative and significant relation between maximum daily returns over the past one month and expected stock returns. We show that reversals continue for 6 months beyond the month of maximum daily returns. Thus mispricing is greater than documented in Bali, Cakici, and Whitelaw (2011). We add two new results. First we show that the subsequent month reversal of returns for stocks with extreme daily returns is related to investor attention and their portfolio rebalancing decisions at the end-of-the-month. Specifically the stocks that achieved their maximum daily returns towards the end of the month show greater reversals than other stocks. Second we link the subsequent month reversal of stocks with extreme daily returns to the risk preferences of investors. We show that the stocks that are associated with capital losses show greater reversals in the following month. Our results are robust to measurement of reversals using raw-returns or 4-factor Fama-French-Carhart adjusted alphas.

Appendix: Definitions of Variables

MAX: MAX is the maximum daily return of a stock within a month:

$$MAX_{i,t} = \max(R_{i,1}, R_{i,2}, \ldots, R_{i,D_t}),$$

where $R_{i,d}$ (d = 1, 2, ..., D_t) is the return on stock i on day d and D_t is the number of trading days for stock i in month t,

SIZE: SIZE is the natural logarithm of the stock's month-end market capitalization (price times shares outstanding).

REV: REV variable is used to capture short-term reversals in stock returns and equals the return of stock i in month t; that is, $REV_{i,t} = R_{i,t}$.

BTM: BTM is firm's book-to-market ratio. Following Fama and French (1993), we compute BTM in month t of a year as the ratio of book value of equity for the fiscal year ending in prior calendar year and market equity at the end of December of the prior calendar year. Book value of equity, computed using Compustat data, is the stockholders' equity (DATA 216), plus balance sheet deferred taxes and investment tax credit (DATA 35), minus the book value of preferred stock (DATA56 or DATA10 or DATA 130, in that order) at the fiscal year end.

CGO: Similar to Grinblatt and Han (2005), for each stock i at the end of each month t, the capital gains overhang ($\text{CGO}_{i,t}$) is obtained as:

$$\text{CGO}_{i,t} = (P_{i,t} - RP_{i,t}) / P_{i,t} \ ,$$

where $P_{i,t}$ is the price of the stock i at the end of month t and $RP_{i,t}$ is the reference price for each stock i at the end of month t. The reference price, $RP_{i,t}$, is estimated as follows:

$$RP_{i,t} = \frac{1}{k} \sum_{n=1}^{T} \left(V_{i,t-n} \prod_{\tau=1}^{n-1} \left[1 - V_{i,t-n+\tau} \right] \right) P_{i,t-n} \ ,$$

where $V_{i,t}$ is turnover in the stock i on day t, T is the number of trading days in the previous three years with available daily price and volume information, and $P_{i,t-n}$ is price of security i on day $t-n$

PRE12RET: PRE12RET is the momentum variable. Following Jegadeesh and Titman (1993), the momentum variable for each stock in a given month is defined as its buy and hold return over the past 12 months.

IllIQ: IllIQ is the measure of illiquidity for a stock in a given month. Following Amihud (2002), Illiq is measured as the ratio of stock's absolute monthly return to its dollar trading volume:

$$ILLIQ_{i,t} = \left|R_{i,t}\right| \ / \ VOLD_{i,t}$$

where $R_{i,t}$ and $VOLD_{i,t}$ are the return and dollar volume, respectively, of stock i in month t.

BETA: We use the daily returns within a month to estimate stocks' beta and therefore employ the adjustment procedure of Scholes and Williams (1977) and Dimson (1979) to mitigate the impact of non-synchronous trading. Beta is estimated using following regression model:

$$R_{i,d} - R_{f,d} = a_i + \beta_{1,i}\ (R_{m,d-1} - R_{f,d-1}) + \beta_{2,i}\ (R_{m,d} - R_{f,d}) + \beta_{3,i}\ (R_{m,d+1} - R_{f,d+1}) + e_{i,d},$$

where $R_{i,d}$, $R_{f,d}$, and $R_{m,d}$ are the return on stock i on day d, the T-Bill return on day d, and the return on CRSP value-weighted market index on day d, respectively. The estimate of stock's beta is given by $\widehat{\beta}_i = \widehat{\beta}_{1,i} + \widehat{\beta}_{2,i} + \widehat{\beta}_{3,i}$.

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Table 1
Returns of Portfolios Sorted on MAX

We form decile portfolios on the maximum daily return (MAX) each month from July 1962 to December 2011 and report value and equal-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas. The autocorrelation adjusted t-statistics using the Newey-West (1987) method are reported in parentheses.

	No Price Restriction		Price ≥ $5	
	Value-weighted Returns	Equal-weighted Returns	Value-weighted Returns	Equal-weighted Returns
Low MAX	0.90	1.22	0.96	1.15
2	0.94	1.33	0.94	1.32
3	0.91	1.43	0.92	1.37
4	0.97	1.42	0.89	1.36
5	0.99	1.39	0.98	1.35
6	0.99	1.37	1.03	1.27
7	0.89	1.27	0.91	1.17
8	0.80	1.24	0.83	1.03
9	0.52	0.99	0.79	0.75
High MAX	0.03	0.58	0.29	0.17
High - Low	-0.86 (-2.57)	-0.64 (-2.01)	-0.67 (-2.36)	-0.98 (-4.03)
4-factor Alpha	-1.05 (-4.67)	-0.69 (-2.72)	-0.81 (-4.55)	-1.15 (-8.50)

Table 2
Firm-Level Fama-MacBeth Cross-Sectional Regression

This table reports the time-series means of coefficient estimates from cross-sectional regressions. Each month from July 1962 to December 2011, we run firm-level Fama-MacBeth cross-sectional regressions of month *t* individual stock returns on the lagged explanatory variables in month *t-1*. The explanatory variables include maximum daily return (MAX), Scholes and William's beta (BETA), log of market capitalization (Size), the book-to-market ratio (BTM), the buy and hold return over the previous 12 months (MOM), monthly stock return (REV), and the illiquidity measure (ILLIQThe detailed explanations on the variables are provided in the Appendix. The *t*-statistics, reported in parentheses, are adjusted for autocorrelation using the Newey-West method.

	MAX	BETA	SIZE	BTM	MOM	REV	ILLIQ
(1)	-0.079 (-7.01)						
(2)	-0.064 (-6.61)	-0.001 (-0.02)	-0.122 (-3.70)	0.153 (3.27)	0.906 (7.57)	-0.042 (-10.34)	-0.013 (-2.38)

Table 3

Returns of Portfolios Sorted on MAX over the 6 Months after Portfolio Formation

We form decile portfolios on the maximum daily return (MAX) each month from July 1962 to December 2011 and report equal-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas of High Max – Low Max portfolio. Month *t* is the *t* th(rd) month after portfolios are formed. The autocorrelation adjusted t-statistics using the Newey-West (1987) method are reported in parentheses.

	Month 2	Month 3	Month 4	Month 5	Month 6
Panel A: Value-weighted Returns					
Low MAX	0.93	0.97	0.95	0.89	0.81
2	0.93	0.86	0.95	0.88	0.86
3	0.95	0.97	0.97	0.96	0.90
4	0.98	0.89	0.90	0.91	0.96
5	0.91	0.97	0.90	0.90	0.90
6	1.00	0.90	0.85	0.92	0.87
7	0.91	0.89	1.01	0.88	0.99
8	0.76	0.83	1.08	0.87	0.82
9	0.75	0.80	0.82	0.93	0.85
High MAX	0.60	0.75	0.52	0.69	0.81
High - Low	-0.33 (-1.13)	-0.22 (-0.76)	-0.43 (-1.55)	-0.20 (-0.68)	0.01 (0.02)
4-factor Alpha	-0.43 (-2.30)	-0.35 (-1.88)	-0.69 (-3.75)	-0.42 (-2.14)	-0.23 (-1.11)
Panel B: Equal-weighted Returns					
Low MAX	1.14	1.11	1.14	1.12	1.06
2	1.19	1.17	1.14	1.16	1.12
3	1.23	1.17	1.20	1.15	1.18
4	1.25	1.18	1.19	1.15	1.17
5	1.21	1.18	1.19	1.18	1.14
6	1.19	1.20	1.22	1.17	1.12
7	1.19	1.18	1.19	1.11	1.10
8	1.03	1.16	1.14	1.09	1.10
9	1.00	1.03	1.07	1.00	1.04
High MAX	0.65	0.79	0.74	0.85	0.95
High - Low	-0.48 (-2.05)	-0.33 (-1.40)	-0.39 (-1.65)	-0.27 (-1.11)	-0.11 (-0.45)
4-factor Alpha	-0.67 (-4.82)	-0.49 (-3.36)	-0.57 (-3.69)	-0.38 (-2.45)	-0.26 (-1.79)

Table 4
Returns of Portfolios Sorted on DMAX

We calculate DMAX (distance of Max) as the number of days between the day when the maximum daily return (MAX) is observed and the last trading day of each month. Decile portfolios are formed on DMAX each month from July 1962 to December 2011 and report equal and value-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas. The autocorrelation adjusted t-statistics using the Newey-West (1987) method are reported in parentheses.

Panel A: Summary Statistics of Portfolios on DMAX

	Value-weighted Returns	Equal-weighted Returns	DMAX	MAX
Low DMAX	0.49	0.48	0.63	5.29
2	0.99	1.00	3.49	5.66
3	1.20	1.22	6.58	5.75
4	1.07	1.09	9.82	5.85
5	1.20	1.22	12.88	5.83
6	1.20	1.22	15.95	5.80
7	1.27	1.27	18.90	5.85
8	1.19	1.21	21.76	5.83
9	1.19	1.22	24.70	5.77
High DMAX	1.16	1.17	27.52	5.67
High - Low	0.66 (8.10)	0.69 (7.96)		
4-factor Alpha	0.63 (7.53)	0.64 (7.25)		

Panel B: Average Cross-sectional Correlation Coefficients

	Return	DMAX	MAX
Return	1	0.013	-0.038
DMAX		1	0.022
MAX			1

Table 5
Returns of Portfolios Sorted on MAX and DMAX

We calculate DMAX (distance of Max) as the number of days between the day when the maximum daily return (MAX) is observed and the last trading day of each month. Quintile portfolios are formed on DMAX first each month from July 1962 to December 2011 and then another quintile portfolio are formed on MAX within each DMAX quintile portfolio. Equal and value-weighted average monthly returns in the next month as well as 4-factor Fama-French-Carhart alphas are reported. The autocorrelation adjusted t-statistics using the Newey-West (1987) method are reported in parentheses.

Panel A: Value-weighted Returns

	Low MAX	2	3	4	High MAX	H - L	4-factor Alpha
Low DMAX	0.87	0.63	0.86	0.62	-0.10	-0.96 (-3.93)	-1.16 (-6.41)
2	1.06	1.08	1.05	0.98	0.63	-0.43 (-1.60)	-0.55 (-2.68)
3	0.99	0.85	1.00	0.75	0.69	-0.31 (-1.06)	-0.51 (-2.32)
4	0.95	1.08	1.13	1.03	0.69	-0.26 (-0.92)	-0.35 (-1.83)
High DMAX	0.87	1.08	0.96	0.87	0.72	-0.15 (-0.62)	-0.31 (-1.64)

Panel B: Equal-weighted Returns

	Low MAX	2	3	4	High MAX	H - L	4-factor Alpha
Low DMAX	1.13	1.22	1.08	0.56	-0.37	-1.51 (-7.07)	-1.69 (-12.47)
2	1.36	1.32	1.29	1.07	0.51	-0.86 (-3.81)	-1.01 (-7.76)
3	1.33	1.47	1.40	1.25	0.64	-0.69 (-3.16)	-0.82 (-5.64)
4	1.21	1.42	1.42	1.34	0.78	-0.42 (-1.86)	-0.64 (-4.49)
High DMAX	1.21	1.39	1.35	1.23	0.84	-0.36 (-1.67)	-0.50 (-4.43)

Table 6
Firm-Level Fama-MacBeth Cross-Sectional Regression
: Tests of The Role of DMAX

This table reports the time-series means of coefficient estimates from cross-sectional regressions. Each month from July 1962 to December 2011, we run firm-level Fama-MacBeth cross-sectional regressions of month *t*+1 individual stock returns on the lagged explanatory variables in month *t*. The explanatory variables include maximum daily return (MAX), Scholes and William's beta (BETA), log of market capitalization (Size), the book-to-market ratio (BTM), the buy and hold return over the previous 12 months (MOM,), monthly stock return (REV), and the illiquidity measure (ILLIQ). The detailed explanations on the variables are provided in the Appendix. The *t*-statistics, reported in parentheses, are adjusted for autocorrelation using the Newey-West method.

	MAX	DMAX	MAX*DMAX	BETA	SIZE	BTM	MOM	REV	ILLIQ
(2)	-0.116 (-7.43)	0.00002 (1.06)	0.003 (5.88)						
(2)	-0.094 (-6.23)	0.00003 (0.97)	0.002 (3.71)	0.002 (0.02)	-0.125 (-2.94)	0.155 (2.79)	0.906 (7.44)	-0.042 (-8.19)	-0.012 (-1.83)

Table 7
Returns of Portfolios Sorted on Capital Gains Overhang and then on MAX

We form quintile portfolios on capital gains overhang (CGO) and then form another quintile portfolios on MAX within each quintile portfolios on CGO from July 1962 to December 2011. Equal-weighted average monthly returns as well as 4-factor Fama-French-Carhart alphas in the following month after portfolio formation are reported. The detailed information on CGO is provided in the main text. The CGO is expressed as % in the following table. The autocorrelation adjusted t-statistics using the Newey-West (1987) method are reported in parentheses.

	CGO	Low MAX	2	3	4	High MAX	H - L	4-factor Alpha
Panel A: Value-weighted Returns								
CGO1	-58.4	1.21	1.18	0.88	0.69	-0.03	-1.24 (-4.27)	-1.33 (-5.25)
2	-17.2	1.08	0.86	0.78	0.50	0.00	-1.08 (-4.12)	-1.30 (-6.19)
3	-3.3	0.98	0.89	0.88	0.85	0.45	-0.52 (-2.24)	-0.73 (-4.07)
4	7.6	0.92	0.88	1.03	0.97	0.99	0.07 (0.32)	-0.04 (-0.24)
CGO5	21.4	1.08	1.11	1.24	1.43	1.39	0.31 (1.45)	0.17 (0.98)
Panel B: Equal-weighted Returns								
CGO1	-55.6	1.52	1.55	1.17	0.70	-0.41	-1.93 (-9.79)	-1.99 (-14.14)
2	-17.4	1.27	1.27	1.04	0.73	-0.24	-1.52 (-7.63)	-1.63 (-13.42)
3	-3.3	1.18	1.31	1.18	1.03	0.26	-0.91 (-4.37)	-1.13 (-9.13)
4	7.5	1.16	1.31	1.29	1.29	0.87	-0.29 (-1.33)	-0.52 (-3.68)
CGO5	22.5	1.39	1.58	1.64	1.71	1.56	0.17 (0.79)	-0.07 (-.0.45)

Table 8
Firm-Level Fama-MacBeth Cross-Sectional Regression
: Tests of The Role of Risk Preference

This table reports the time-series means of coefficient estimates from cross-sectional regressions. Each month from July 1962 to December 2011, we run firm-level Fama-MacBeth cross-sectional regressions of month *t*+1 individual stock returns on the lagged explanatory variables in month *t*. The explanatory variables include maximum daily return (MAX), Scholes and William's beta (BETA), log of market capitalization (Size), the book-to-market ratio (BTM), the buy and hold return over the previous 12 months (MOM,), monthly stock return (REV), capital gains overhang (CGO), and the illiquidity measure (ILLIQ). The detailed explanations on the variables are provided in the Appendix. The *t*-statistics, reported in parentheses, are adjusted for autocorrelation using the Newey-West method.

	MAX	CGO	MAX*CGO	BETA	SIZE	BTM	MOM	REV	ILLIQ
(2)	-0.085 (-6.40)	-0.005 (2.45)	0.163 (10.31)						
(2)	-0.054 (-5.48)	-0.007 (5.27)	0.157 (8.24)	-0.005 (-0.08)	-0.115 (-2.71)	0.148 (2.68)	0.902 (7.82)	-0.045 (-9.42)	-0.014 (-2.17)