Do extreme returns matter in emerging markets? Evidence from the Chinese stock market

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Abstract

Recent evidence in the U.S. and Europe indicates that stocks with high maximum daily returns in the previous month, perform poorly in the current month. We investigate the presence of a similar effect in the emerging Chinese stock markets with portfolio-level analysis and firm-level Fama-MacBeth cross-sectional regressions. We find no evidence of a MAX effect if we hold portfolios for just one month, but a MAX effect exists if we extend the holding period to three and six months. Contrary to U.S. and European evidence, the MAX effect in China does not weaken much less reverse the anomalous IV effect. Both the MAX and IV effects appear to independently coexist in the Chinese stock markets. Interpreted together with the strong evidence of risk-seeking behaviour among Chinese investors, our results are consistent with the suggestion that the negative MAX effect is driven by investor preference for stocks with lottery-like features.

JEL classification: F39; G12
Keywords: Cross-section of stock returns; Extreme returns; Predictability; China.

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1. Introduction

Motivated by recent evidence from Kumar (2009) that investors in the U.S. stock markets exhibit a preference for stocks with lottery-like characteristics, Bali, et al. (2011) investigate the role of extreme positive returns in the cross-sectional pricing of stocks in the U.S. Considering stocks that exhibit extreme positive returns to be lottery-like, they find that stocks with the highest maximum daily returns in the previous month (MAX), tend to perform poorly in the following month. For their decile portfolios, they report negative raw and risk-adjusted return spreads between portfolios with the highest and lowest maximum daily returns exceeding 1% per month. The negative relationship is robust even as they control for size, book-to-market, momentum, short-term reversals, liquidity, and skewness. Bali et al. (2011) also find that the MAX effect reverses the anomalous negative relationship between idiosyncratic volatility and stock returns (henceforth, the IV effect) first documented by Ang et al. (2006, 2009) in the U.S. markets, leading them to argue that MAX is the true effect and that idiosyncratic volatility is just a proxy for MAX.

Bali et al. (2011) explain the apparent negative MAX effect as a result of investor preference for stocks with lottery-like characteristics, in particular those with the potential to produce high maximum daily returns albeit with low probability. A preference for these stocks leads to overpayment which eventually results to underperformance in the following month. Such behaviour is consistent with two descriptive models of decision making under uncertainty -- Tversky and Kahneman's (1992) cumulative prospect theory (CPT), as recently extended by Barberis and Huang (2008) and Kothiyal et al. (2011) and the optimal expectations framework of Brunnermeier and Parker (2005) and Brunnermeier et al. (2007). Cumulative prospect theory is a non-expected utility model that accommodates overweighting of tails of distributions as a modelling device that captures the common preference for lottery-like (positively skewed) wealth distributions (Barberis and Huang, 2008). In the optimal expectations framework of Brunnermeier and Parker (2005) and Brunnermeier et al. (2007) decision makers deliberately choose to distort their beliefs by overestimating the probabilities of events in which their investments pay off well. Brunnermeier et al. (2005) show that this model leads to a) portfolios that are underdiversified, b) investors exhibiting a preference for lottery-like assets and c) that these lottery-like assets tend to have lower returns. Fong and Toh (2014) suggest that investor optimism generates a preference for lottery-type stocks thereby providing a behavioural underpinning to the optimal expectations framework.

Empirical evidence of the MAX effect in other markets is still very sparse. While Annaert, et al. (2013) and Walkshausl (2014) confirm the presence of a MAX effect in European markets and Nartea, et al. (2014) also document a negative MAX effect in the South Korean stock market, we are not aware of studies done in other Asian emerging stock markets. This paper investigates the presence of a MAX effect in China, the world's largest emerging market. By focussing on China we not only examine the world's largest emerging market but we are also presented with a unique opportunity to test Bali et al.'s (2011) "preference for lottery stocks" explanation of the MAX effect, in as much as Chinese investors have been shown to exhibit risk-seeking behaviour (see for example Ma, 1996; Ng and Wu, 2006; Lee and Wong, 2009; Fong, Wong, and Yong, 2010). Studies have also shown that social gambling is considered an acceptable form of entertainment within the Chinese culture (Raylu, and Oei, 2004; Loo, Raylu, and Oei, 2008) which leads to a predisposition for lottery-like stocks. If Bali et al.'s (2011) explanation is valid, we expect to document a negative MAX effect in the Chinese stock markets.

In less than twenty years China's two stock markets, located in Shanghai and Shenzhen, have grown from a handful of listed stocks to collectively become the second largest stock market in the world by the end of 2011 behind only the US stock markets and the largest emerging stock market. Inspite of this remarkable progress there is still enormous potential for growth since the proportion of their market capitalisation to China's GDP is only 49% as of the end of 2009 compared with 86% for the U.S. stock markets. In addition, the Chinese stock markets also lag their developed market counterparts in terms of financial sophistication and market efficiency. For instance short selling was not allowed until March 2010 when a pilot program designated 90 stocks as eligible to be sold short and/or purchased on margin. Inspite of this initiative short-selling is still not allowed for a majority stocks traded in the Chinese stock markets. As China continues to open its markets to foreign investors, understanding the factors that drive stock price movements in its stock markets has become an important issue.

For comparability we follow Bali, et al's (2011) portfolio sorting approach. We sort stocks according to maximum daily returns in the previous month, form portfolios on this basis and track the returns of these portfolios in the succeeding month, reforming portfolios monthly. We also vary the portfolio holding period to three and six months and confirm the robustness of our results with a double-sort procedure to control for various cross-sectional effects including size, book-to-market, momentum, short-term reversal, idiosyncratic volatility, closing price and skewness. In addition to portfolio analysis, we perform firm-level Fama-MacBeth cross-sectional regressions as further robustness tests.

Our results can easily be summarised. First, though we find no evidence of a MAX effect if we hold portfolios for just one month, we document a negative MAX effect if we extend the holding period to three and six months. Our results add to the existing evidence of a negative MAX effect in the U.S., European, and Korean stock markets and underscore the growing importance of extreme returns in asset pricing across equity markets. Interpreted together with the strong evidence of risk-seeking behaviour among Chinese investors documented in the extant literature, our results support Bali, et al.'s (2011) suggestion that the negative MAX effect is driven by investor preference for stocks with lottery-like features. Insofar as the negative MAX effect is driven by overpayment of investors for high MAX stocks which then leads to underperformance, we suggest that this could be due to price trading limits which cause lags in the adjustment of prices back to fundamental levels, by up to six months. We further suggest that the negative MAX effect persists due to severe short-selling constraints in the Chinese stock markets that limit arbitrageurs from trading this effect away. Second, we find that the MAX effect does not necessarily weaken the anomalous IV effect in the Chinese stock market contrary to the findings of Annaert et al. (2013) for European markets much less reverse it as documented by Bali et al. (2011) for the U.S. markets. In fact our results suggest that both the MAX and IV effects can independently coexist in the Chinese stock markets which emphasize the importance of in-country verification of certain anomalies initially documented in developed markets.

The rest of the paper is organized as follows: Section 2 describes our data and discusses our estimation procedures. It describes the single-sort method of portfolio analysis and the double-sort procedure that is used to control for various known effects. Section 3 reports the empirical results with section 3.1 dealing with results of portfolio-level analysis while section 3.2 reports results of firm-level Fama-MacBeth cross-sectional regressions. We use an alternative measure of extreme returns in section 3.3 and extend the portfolio holding period to three and six months in section 3.4. Section 4 concludes the paper.

2. Data and Methods

Daily and monthly stock returns and accounting data for individual firms were obtained from DataStream. We use A-shares listed in both the Shanghai and Shenzhen stock exchanges. The data set covered the period from January 1994 with 185 firms, to December 2013 with 2525 firms with an average of 1279 firms per month resulting in a total of 305,674 firm-month observations. The risk-free rate which is defined as the demand deposit rate was also obtained from DataStream. Market returns are the value-weighted returns of all firms used in the study.

Following common practice in the existing literature we eliminated investment trusts, closed-end funds, exchange traded funds, and preferred shares from the sample. We also deleted stocks with daily returns less than -100% and stocks with monthly returns greater than 200% to avoid the influence of extreme returns and possible data recording errors.

At the beginning of each month, we form tertile portfolios according to MAX, defined as the maximum daily return in the past calendar month-- high MAX (HMAX), medium MAX (MMAX), and low MAX (LMAX). We apply holding periods of one, three and six months and determine the raw and risk-adjusted returns (alpha) of each portfolio. Portfolios are reformed every month. The risk-adjusted return refers to the Fama-French (1993) three-factor model alpha (FF-3 alpha) estimated using the full sample of the time-series of value- or equal-weighted returns for each portfolio. We relate MAX in *t* with raw and risk-adjusted returns in month *t+1*, the three-month return ending in month *t+3*, and the six-month return ending in month *t+6*.

We control for several variables including size, book-to-market (BM), intermediate-term momentum, short-term reversals, closing price, skewness, and idiosyncratic volatility using dependent bi-variate sorts similar to that employed by Bali et al. (2011). First we sort on the control factor (i.e., size, value, momentum, and so on) into tertiles. Within each tertile we sort further into tertiles based on MAX. Then we average within each MAX category resulting in three portfolios with variation in MAX but similar levels in the control variable. For example, to control for size, stocks are first sorted into tertiles according to market capitalisation – Big, Medium, and Small. Within each size category, stocks are sorted again into tertiles according to MAX – high (HMAX), medium (MMAX), and low MAX (LMAX). Therefore, nine size-MAX portfolios are formed, namely Big-HMAX, Big-MMAX, Big-LMAX, Middle-HMAX, Middle-MMAX, Middle-LMAX, Small-HMAX, Small-MMAX, and Small-LMAX. To control for size, we construct a size-neutral portfolio by averaging the return (or alpha) spreads within each MAX category. To illustrate, a size-neutral HMAX portfolio is constructed by averaging the alpha spreads of the three HMAX portfolios within each size tertile, i.e., Big-HMAX, Middle-HMAX and Small-HMAX so that we have a high MAX portfolio which contains all sizes. We do the same for the MMAX, and LMAX portfolios. This process results in three portfolios with variation in MAX but similar levels in the control variable -- size. We replicate this procedure for the other control variables.

The size variable at the beginning of month *t* is defined as the log of the stock's market capitalization at the end of month t-1, BM is the stock's book-to-market ratio six months prior, i.e. at the end of *t-6*.[1] Following Jegadeesh and Titman (1993), the momentum variable at time *t* is the stock's 11-month past return lagged one month, i.e. return from month *t-12* to month *t-2*. The short-term reversal variable is defined following Jegadeesh (1990) as the stock's one month past return, i.e. return in month *t-1*. Closing price is the stock's final trading price at the end of month *t-1*. Skewness of stock *i* as of the beginning of month *t* is computed using daily returns in the past 22 trading days. Idiosyncratic volatility (IV) of stock *i* at the beginning of month *t* is defined as the standard deviation of daily residuals from the Fama-French three factor model (1) estimated using daily returns in month *t-1*. $R_{i,t}$ and *MKT* are excess returns of stock *i* and the market, respectively, over the risk-free rate. We generate daily values of *SMB* by sorting stocks at the beginning of every month *t* into three groups according to size (Small, Medium, Big). *SMB* is the difference in daily returns between the small- and large-stock portfolios. Similarly we generate daily values of *HML* by sorting stocks into three groups according to their book-to-market (BM) ratio in month *t-6* (High-, Medium-, and Low-BM). *HML* is the difference in daily returns between the High- and Low-BM stock portfolios. Portfolios are reformed every month.

$$R_{i,t} = \alpha + \beta_{MKT,\, i,\, m} MKT_t + \beta_{SMB,\, i\, ,m} SMB_t + \beta_{HML,\, i\, ,m} HML_t + \varepsilon_{i,t} \qquad (1)$$

3. Empirical Results

3.1 Portfolio Analysis

3.1.1 Univariate sorting

[1]Clubb and Naffi (2007) also show that expected book-to-market ratios also explain UK stock returns. However, in this study we only deal with past book-to-market ratios. Michou (2009) also reports that the predictive power of the book-to-market spread depends on portfolio formation strategies and the relative proportion of large-caps, small-caps, value, and growth stocks in the portfolio.

Table 1 shows the returns and FF-3 alpha of portfolios sorted on the maximum daily returns in the past month (MAX). We report results for both value- and equal-weighted portfolios. Columns 1 and 3 indicate the absence of MAX effect based on both equal- (EW) and value-weighted (VW) returns since while the difference between the returns of the high and low MAX portfolios is negative for both EW and VW returns, these return spreads are statistically insignificant. However both EW and VW FF-3 alpha spreads (henceforth alpha spreads) at -0.95% per month and -0.60% per month, respectively, are significant indicating the presence of a negative MAX effect, though these alpha spreads are significantly lower compared with the alpha spreads documented by Bali, et al. (2011) for the U.S. markets as well as the alpha spread documented by Nartea, et al. (2014) for Korea.

(Insert Table 1 about here)

Table 2 presents the characteristics of the MAX-sorted portfolios. Table 2 indicates that there appears to be no difference between high and low MAX stocks in terms of average size and momentum. However, Table 2 also shows that high MAX stocks tend to be low BM stocks, winners in the previous month, are higher priced, have positively skewed return distributions and have higher IV than low MAX stocks. The last two characteristics are consistent with high MAX stocks exhibiting lottery-like features. More importantly, these characteristics of high MAX stocks point toward lower returns in the succeeding month based on the BM effect, short-term reversal effect (Jegadeesh, 1990; Lehman, 1990), negative IV effect (Ang et al., 2006, 2009), and investor preference for positive skewness (Golec and Tamarkin, 1998; Mitton and Vorkink, 2007). Therefore, these variables could potentially explain the negative

MAX effect. We test this formally using dependent bivariate sorts and cross-sectional regressions and report the results in later sections.

(Insert Table 2 about here)

3.1.2 Bivariate sorting

In this section we control for size, BM, momentum, short-term reversal, closing price, skewness and IV to test the robustness of the apparent negative MAX effect for EW and VW portfolios using a battery of bivariate sorts and report the results in Table 3. Following Bali, et al. (2011) we focus our attention on the alphas since they control for the standard set of systematic factors.

(Insert Table 3 about here)

Our results show that the apparent negative MAX effect we document earlier is not entirely robust. Though the negative MAX effect survives as we control for size (panel A), BM (panel B), short-term reversal (panel D), closing price (panel E), and skewness (panel F), the bivariate sorts show that the MAX effect could potentially be explained momentum (panel C) and idiosyncratic volatility (panel G). The EW alpha spread reported in panel C is insignificant at -0.36% per month (*t-stat* = -1.6092) when we double-sort on momentum and MAX, while the VW alpha spread reported in panel G is insignificant at -0.31% per month (*t-stat* = -1.6677) when we double-sort on idiosyncratic volatility and MAX. In sum, the bivariate sorts indicate that the negative MAX effect in a one-month holding period is not robust and could potentially be explained by momentum and idiosyncratic volatility.

3.2 Firm-level cross-sectional regressions

Since dependent bi-variate sorts cannot be used to control for multiple effects simultaneously we also conduct firm-level Fama-MacBeth regressions. In addition, the portfolio analysis conducted earlier loses too much information through aggregation so we estimate the following model and its nested versions:

$$R_{i,t} = \beta_{0,t-1} + \beta_{1,t-1} MAX_{i,\,t-1} + \beta_{2,t-1} SIZE_{i,\,t-1} + \beta_{3,t-1} BM_{i,\,t-1} + \beta_{4,t-1} MOM_{i,\,t-1}$$

$$+ \beta_{5,t-1} REV_{i,\,t-1} + \beta_{6,t-1} CP_{i,\,t-1} + \beta_{7,t-1} SKEW_{i,\,t-1} + \beta_{8,t-1} IV_{i,\,t-1} + \varepsilon_{i,t-1} \qquad (2)$$

Realized stock return in month t, $R_{i,t}$, is regressed on one-month lagged values of the maximum daily return in the previous month (*MAX*), log of market capitalization (*SIZE*), book-to-market ratio (*BM*), momentum (*MOM*), short-term reversal (*REV*), closing price (*CP*), skewness (*SKEW*), and realized idiosyncratic volatility (*IV*). The variables are as defined earlier. Table 4 reports the time series averages of the slope coefficients over the 240 months from 1994:01-2013:12 for univariate regressions. The Newey-West t-statistics are given in parenthesis. The univariate regression shows a statistically significant negative relation between *MAX* and the cross-section of one-month ahead stock returns. The results also show significant negative coefficients for *SIZE*, *REV*, *SKEW*, and *IV* and a significant positive coefficient for *BM* consistent with expectations. The *CP* coefficient is significantly negative and while the momentum variable, *MOM*, has the expected positive coefficient it is not statistically significant.

(Insert Table 4 about here)

The result of the bivariate regressions with *MAX* reported in Table 5 shows that the MAX effect survives when we control for the variables individually. However, if we control for all nine variables simultaneously, the negative MAX effect disappears. Therefore our results suggest the absence of a MAX effect if we restrict the holding period to one month.

(Insert Table 5 about here)

3.3 Alternative measure of extreme returns

Bali et al. (2011) report that the negative MAX effect is stronger if they use the average of the five highest daily returns in the previous month to sort portfolios. They call this measure MAX(5). Hence we also test for evidence of a MAX effect using MAX(5) to sort portfolios. The results reported in Table 6 show that though the EW alpha spread is significantly negative, the VW alpha spread is not. These results indicate that the MAX effect is not necessarily stronger with MAX(5) contrary to the findings of Bali et al. (2011) in the U.S. markets.

(Insert Table 6 about here)

As an additional test we also perform firm-level Fama-MacBeth cross-sectional regressions as in equation 2 and report the results in Table 7. Similar to our results with MAX we also find in the univariate regression, a statistically significant negative relation between MAX(5) and the cross-section of one-month ahead stock returns. The result of the bivariate regressions with MAX(5) also reported in Table 7 shows that if we control for the variables individually, the MAX effect remains significantly negative. However just as in case with MAX, if we control for all nine variables simultaneously, the MAX(5) coefficient is no longer significant. Therefore whether we use MAX or MAX(5) we find no evidence of a MAX effect in the Chinese stock market when MAX portfolios are held for one-month.

(Insert Table 7 about here)

3.4 Extended holding periods

As the Chinese stock market is subject to trading price limits[2], it could be argued that stock prices may not have fully adjusted within the one holding month period that we have so far imposed in our analysis. If the negative MAX effect is driven by investors who overpay for stocks with extreme positive returns which then results in underperformance when prices settle to fundamental levels, we expect to find evidence of a stronger MAX effect when we employ a longer holding period. Hence we also investigate the presence of the MAX effect for extended holding periods of three and six months. Table 8 shows the three-month returns and FF-3 alpha of portfolios sorted on the maximum daily returns in the past month (MAX). Columns one and three of Table 8 show that similar to the results with a one-month holding period, the equal- and value-weighted raw return spreads are negative but insignificant even as we increase the holding period to three months. However, both EW and VW alpha spreads are significantly negative. This suggests a negative MAX effect in a three-month holding period and also suggests at least a three-month lag in the adjustment of prices back to fundamental levels.

(Insert Table 8 about here)

Even when we control for the various effects with bivariate portfolio sorts in Table 9, the alpha spreads remain significantly negative except for the EW alpha spread when we double-sort on momentum and MAX (panel C).

(Insert Table 9 about here)

[2] To reduce stock market's volatility and protect retail investors, the China Securities Regulatory Commission imposed trading price limits, which only allows stock prices to move up or down on a single trading day by a maximum of 10% from the last closing price. The policy artificially makes a barrier for the stock price to efficiently reflect any news impacting stocks, limiting the efficiency of the Chinese stock market.

The results become more interesting when we employ firm-level Fama-MacBeth cross-sectional regressions. The results of univariate regressions reported in Table 10 show a significantly negative MAX effect. We also observe significant size, BM, reversal and skewness effects with expected signs. Interestingly we also observe a highly significant anomalous negative IV effect consistent with the findings of Nartea et al. (2013).

(Insert Table 10 about here)

In Table 11, we report the results when we control for various effects individually with firm-level bivariate regressions. Table 11 shows that the MAX effect remains significantly negative in bivariate regressions. It is interesting to note that even when we control for all nine variables simultaneously the MAX effect remains, though it is only marginally significant. It is equally interesting to note that the negative IV effect survives in a multivariate setting that includes MAX. This indicates that both the MAX and IV effects appear to coexist in China and does not support the suggestion of Bali et al. (2011) that MAX is the true effect for which idiosyncratic volatility is only a proxy.

(Insert Table 11 about here)

Finally, we also examine the MAX effect in portfolios with a holding period of six months. The results are similar to the three-month holding period. Table 12 reports the six-month returns and FF-3 alpha of portfolios sorted on MAX and shows that the EW and VW return spreads are negative but insignificant. However, the alpha spreads are negative and highly significant, indicative of a negative MAX effect. The results of bivariate portfolio sorts reported in Table 13 show that none of the control variables can eliminate the negative alpha spreads hence none can explain the negative MAX effect. But more importantly, the Fama-MacBeth regressions in Tables 14 and 15 indicate a significantly negative MAX effect in univariate, bivariate and multivariate regressions. Our results suggest that the negative MAX effect could last as long as six months. Again it is interesting to note that both MAX and IV effects survive in a multivariate setting. So at worst, these two effects appear to be independent of each other in the Chinese stock market contrary to the suggestion of Bali et al. (2011) that idiosyncratic volatility effect could just be proxying for the MAX effect.

(Insert Table 12 about here)

(Insert Table 13 about here)

(Insert Table 14 about here)

(Insert Table 15 about here)

Overall, we find evidence of a negative MAX effect in the Chinese stock market but only in extended holding periods. This MAX effect is also apparently weaker than in the U.S. markets. We suggest that the persistence of the negative MAX effect stems from constraints to short-selling in the Chinese stock markets which limit the opportunity for arbitrage.

Our results are consistent with a market driven by investors with a preference for lottery-like stocks – those that have exhibited extreme positive returns in the past month. Indeed apart from anecdotal evidence, there is a body of literature that suggests risk-seeking behaviour among Chinese investors. Ng and Wu (2006) report that Chinese investors tend to prefer stocks with large betas and high idiosyncratic risk based on a comprehensive analysis of 64.22 million trades of 6.8 million institutional and individual investors in mainland China. Lee and Wong (2009) also suggest that Chinese investors tend to trade more heavily on riskier stocks based on an analysis of panel data drawn from the Shanghai stock market. This is consistent with Fong, Wong, and Yong (2010) who find evidence that mainland Chinese investors are more speculative and have higher risk appetites than Hong Kong and international investors. In an earlier study, Ma (1996) also documents evidence of risk-seeking behavior among mainland Chinese investors by establishing a positive relationship between share prices and domestic beta risk. In the psychology literature, Raylu and Oei (2004) report that gambling is an acceptable form of social activity in Chinese communities while in a related study, Loo, Raylu, and Oei (2008) find widespread social gambling among Chinese communities as it is a preferred form of entertainment. The results of both studies suggest a predisposition among Chinese investors to prefer lottery-like stocks. In sum, our results support the suggestion of Bali et al. (2011) that investor preference for lottery-like stocks drives the apparent negative MAX effect.

4. Concluding remarks

Motivated by Bali et al.'s (2011) findings of a significant role of extreme returns in the U.S. stock markets, we investigate the existence of the same in the world's largest emerging market. Insofar as the Chinese stock markets have been characterised as highly speculative, with the extant literature indicating a predisposition among Chinese investors to prefer riskier stocks, there is reason to believe that the negative MAX effect would also be evident in this market. However, unlike Bali et al's (2011) findings, we find no evidence of a MAX effect if we hold portfolios for just one month. But we find evidence of a negative relationship between extreme positive returns (MAX) and stock returns if we extend the holding period to three and six months. We suggest that this could be due to price trading limits resulting in a lag in the price adjustment back to fundamental levels. We also find that the MAX effect does not weaken, much less reverse the IV effect in the Chinese stock market contrary to the findings of Annaert et al. (2013) in European markets and of Bali et al. (2011) in U.S. stock markets. Our results suggest that both the MAX effect and the anomalous IV effect are separate effects and can coexist at least in the Chinese stock markets. Our results underscore the importance of country verification, especially in emerging markets, of apparent anomalies initially discovered in developed stock markets. Interpreted along with the strong evidence of risk-seeking behaviour among Chinese investors, our results support the suggestion of Bali et al. (2011) that the negative MAX effect is driven by investor preference for stocks with lottery-like features.

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Table 1. Returns on portfolios sorted by MAX

At the beginning of every month we sort stocks into tertiles according to their maximum daily return (MAX) in the past calendar month. We compute each portfolio's equal- and value-weighted raw returns for the current month. We also estimate each portfolio's alpha (α coefficient) from the FF3-factor model estimated using the full sample of monthly value- or equal-weighted returns for each portfolio. The last row shows the difference in monthly returns and differences in alpha between the high and low MAX portfolios. T-statistics are reported in parenthesis. We conduct the analysis for the full sample period 1994:01-2013:12.

	EW portfolios		VW portfolios	
	Average return	FF-3 alpha	Average return	FF-3 alpha
High MAX	-0.0018	-0.0176	-0.0047	-0.0142
	(-0.2512)	(-7.4485)	(-0.7020)	(-8.0863)
Medium MAX	0.0068	-0.0099	0.0032	-0.0068
	(0.9644)	(-4.5878)	(0.4825)	(-5.5476)
Low MAX	0.0081	-0.0081	0.0026	-0.0082
	(1.3290)	(-4.6275)	(0.4600)	(-5.2021)
High- Low	-0.0099	-0.0095	-0.0073	-0.0060
	(-1.0553)	(-3.2301)	(-0.8330)	(-2.4914)

Table 2. Characteristics of portfolios sorted by MAX

At the beginning of every month we sort stocks into tertiles according to their maximum daily return in the past calendar month (MAX). The table reports for each tertile the average of the monthly averages of various characteristics of the MAX-sorted portfolios over the period 1994:01-2013:12. Size at the end of month t is defined as the log of the firm's market capitalization at the end of month t, BM is the firm's book -to-market ratio six months prior, i.e. at the end of t-6. Following Jegadeesh and Titman (1993), Momentum at time t is the stock's 11-month past return lagged one month, i.e. return from month t-12 to month t-2. REV in month t is short-term reversal defined as the return on the stock in month t-1, following Jegadeesh (1990) and Lehmann (1990). CP is the closing price for stocks in the end of previous month. Skewness is the third standardized moment of returns of the past 22 trading days. IV is the standard deviation of the residuals of the FF3-factor model, using daily data for the previous 22 trading days. The last row is the difference between the high and low MAX portfolio. T-statistics are reported in parenthesis.

	Size	BM	Momentum	REV	CP	Skewness	IV
High MAX	7.7423	0.3517	0.0540	0.0490	1.7093	0.3148	0.0223
	(198.7460)	(41.5393)	(2.1524)	(6.0559)	(48.4633)	(16.2460)	(55.5820)
Med MAX	7.7170	0.3595	0.0399	-0.0046	1.6392	-0.0058	0.0162
	(201.8259)	(43.3159)	(1.7080)	(-0.6631)	(48.0044)	(-0.3063)	(49.4548)
Low MAX	7.6836	0.3753	0.0222	-0.0340	1.5479	-0.2189	0.0120
	(224.5881)	(44.1735)	(1.1092)	(-6.2555)	(52.2346)	(-10.8363)	(47.8076)
High- Low	0.0587	-0.0233	0.0308	0.0830	0.1614	0.5332	0.0102
	(1.1319)	(-1.9352)	(0.9576)	(8.5159)	(3.5032)	(19.0294)	(21.5167)

Table 3.Alpha of equal-weighted double-sorted portfolios

At the end of each month over 1994:01-2013:12, stocks are double-sorted 3x3, first by the control factor (size, BM, momentum, REV, CP, skewness, and IV) into three portfolios and then within each portfolio we sort stocks again by their maximum daily return in the past calendar month (MAX). The alpha of each portfolio is presented with t-statistics in parenthesis. Alpha refers to the FF-3model alpha using the full sample of monthly returns for each portfolio. To control for a particular factor, we average the alpha within each MAX category ending up with three portfolios with dispersion in idiosyncratic volatility but containing all values of the factor being controlled. Size, BM, momentum, REV, CP, skewness, and IV are as defined in Table 2. *LMAX*, *MMAX* , *HMAX* refer to low, medium, and high MAX portfolio, respectively; *BIG*, big size; *MED*, medium size; *SMA*, small size; *HBM*, *MBM* , *LBM* refer to high, medium, low book-to-market, respectively; *WNR*, winner; *MID*, middle; *LSR*, loser. *HCP, MCP, LCP* refer to high, medium, low CP ratio, respectively; *HSK, MSK, LSK* refer to high, medium, and low skewness. *LIV, MIV, HIV* refer to low, medium, and high idiosyncratic volatility, respectively.

	Equal-weighted				Value -weighted			
Panel A. Double sort on size (market capitalisation) and MAX								
	LMAX	*MMAX*	*HMAX*	*HMAX-LMAX*	*LMAX*	*MMAX*	*HMAX*	*HMAX-LMAX*
BIG	-0.0095	-0.0081	-0.0152	-0.0057	-0.0072	-0.0054	-0.0123	-0.0051
	(-5.2301)	(-4.0642)	(-6.6835)	(-1.6420)	(-4.4617)	(-4.2317)	(-6.3382)	(-2.00532)
MED	-0.0095	-0.0121	-0.0200	-0.0105	-0.0097	-0.0120	-0.0199	-0.0102
	(-4.2467)	(-4.8215)	(-7.4010)	(-3.018)	(-4.3630)	(-4.7864)	(-7.4244)	(-2.9287)
SMA	-0.0049	-0.0090	-0.0188	-0.0139	-0.0060	-0.0096	-0.0192	-0.0132
	(-3.0240)	(-3.9719)	(-7.2834)	(-4.5531)	(-3.3975)	(-4.1465)	(-7.4308)	(-4.1742)
AVE	-0.0111	-0.0097	-0.0180	-0.0069	-0.0076	-0.0090	-0.0171	-0.0095
	(-8.8228)	(-7.4073)	(-12.279)	(-3.5937)	(-7.0204)	(-7.4231)	(-12.231)	(-5.3574)
Panel B. Double sort on value (book-to-market) and MAX								
HBM	-0.0072	-0.0090	-0.0190	-0.0118	-0.0089	-0.0062	-0.0195	-0.0106
	(-3.1628)	(-3.6006)	(-6.3811)	(-2.7813)	(-3.5702)	(-2.2614)	(-6.9284)	(-2.8239)
MBM	-0.0106	-0.0089	-0.0155	-0.0049	-0.0120	-0.0090	-0.0154	-0.0034
	(-3.9386)	(-3.2040)	(-5.2352)	(-1.2140)	(-4.6790)	(-3.7931)	(-5.3986)	(-0.8729)
LBM	-0.0066	-0.0098	-0.0189	-0.0123	-0.0073	-0.0064	-0.0181	-0.0108
	(-2.6551)	(-3.9207)	(-6.3248)	(-3.1497)	(-2.6452)	(-2.5734)	(-5.3535)	(-2.4520)
AVE	-0.0120	-0.0092	-0.0178	-0.0058	-0.0094	-0.0072	-0.0177	-0.0083
	(-7.6038)	(-6.1419)	(-10.277)	(-2.4579)	(-6.1758)	(-4.9167)	(-10.050)	(-3.5552)
Panel C. Double sort on momentum (11/1/1) and MAX								
WNR	-0.0047	-0.0058	-0.0122	-0.0075	-0.0043	-0.0009	-0.0084	-0.0041
	(-2.0098)	(-2.3440)	(-4.7546)	(-1.7852)	(-1.7260)	(-0.4183)	(-3.4332)	(-1.1597)
MID	-0.0088	-0.0112	-0.0183	-0.0095	-0.0104	-0.0121	-0.0176	-0.0072
	(-4.0170)	(-4.6412)	(-7.2057)	(-2.8527)	(-4.3755)	(-5.4792)	(-6.7423)	(-2.0348)
LSR	-0.0108	-0.0160	-0.0223	-0.0115	-0.0129	-0.0175	-0.0201	-0.0072
	(-4.3900)	(-5.6806)	(-6.6769)	(-2.777)	(-5.1153)	(-6.0601)	(-6.3071)	(-1.7731)
AVE	-0.0140	-0.0110	-0.0176	-0.0036	-0.0092	-0.0102	-0.0154	-0.0062
	(-8.9372)	(-7.4069)	(-10.800)	(-1.6092)	(-6.4589)	(-7.1710)	(-9.5607)	(-2.8714)

				Panel D. Double sort on one-month past return and MAX				
WNR	-0.0099	-0.0144	-0.0230	-0.0131	-0.0047	-0.0102	-0.0185	-0.0138
	(-3.7051)	(-5.5725)	(-8.1812)	(-2.5195)	(-2.0191)	(-4.7613)	(-6.9979)	(-3.9754)
MID	-0.0056	-0.0109	-0.0159	-0.0103	-0.0052	-0.0097	-0.0111	-0.0059
	(-2.5186)	(-4.5922)	(-6.0748)	(-3.0242)	(-2.2285)	(-4.5355)	(-4.6073)	(-1.7749)
LSR	-0.0070	-0.0056	-0.0132	-0.0062	-0.0088	-0.0076	-0.0110	-0.0022
	(-2.6745)	(-2.2726)	(-4.8804)	(-1.6541)	(-3.4600)	(-3.2830)	(-4.0290)	(-0.5979)
AVE	-0.0086	-0.0103	-0.0174	-0.0088	-0.0062	-0.0092	-0.0135	-0.0073
	(-5.9361)	(-7.1322)	(-11.136)	(-4.1184)	(-4.5583)	(-7.3210)	(-9.1219)	(-3.6180)
				Panel E. Double sort on CP *and MAX*				
HCP	-0.0159	-0.0157	-0.0245	-0.0086	-0.0135	-0.0116	-0.0197	-0.0062
	(-8.1043)	(-6.7281)	(-9.2416)	(-2.3372)	(-8.0672)	(-7.5248)	(-8.4405)	(-2.1678)
MCP	-0.0088	-0.0112	-0.0174	-0.0086	-0.0085	-0.0079	-0.0122	-0.0037
	(-4.0952)	(-4.8083)	(-6.7225)	(-2.5732)	(-4.0746)	(-3.6722)	(-5.4081)	(-1.1880)
LCP	-0.0006	-0.0034	-0.0096	-0.0090	-0.0015	-0.0019	-0.0053	-0.0038
	(-0.3487)	(-1.4615)	(-3.8454)	(-2.9215)	(-0.6056)	(-0.7744)	(-2.0584)	(-1.0739)
AVE	-0.0063	-0.0101	-0.0172	-0.0108	-0.0078	-0.0071	-0.0124	-0.0046
	(-5..0962)	(-7.6060)	(-11.430)	(-5.5574)	(-6.5027)	(-5.9559)	(-8.9334)	(-2.4848)
				Panel F. Double sort on skewness and MAX				
HSK	-0.0094	-0.0129	-0.0196	-0.0102	-0.0097	-0.0118	-0.0181	-0.0084
	(-3.9329)	(-5.3707)	(-7.7423)	(-2.8279)	(-4.1958)	(-6.6411)	(-7.2493)	(-2.4727)
MSK	-0.0072	-0.0088	-0.0175	-0.0103	-0.0060	-0.0039	-0.0134	-0.0074
	(-3.1459)	(-3.9045)	(-6.6304)	(-2.9672)	(-3.2509)	(-2.0706)	(-5.2054)	(-2.3401)
LSK	-0.0084	-0.0091	-0.0158	-0.0074	-0.0079	-0.0081	-0.0114	-0.0035
	(-3.7670)	(-3.8914)	(-6.0664)	(-2.1727)	(-3.6260)	(-3.9394)	(-4.6459)	(-1.0510)
AVE	-0.0105	-0.0103	-0.0176	-0.0072	-0.0079	-0.0079	-0.0143	-0.0064
	(-7.6404)	(-7.6195)	(-11.897)	(-3.5509)	(-6.4543)	(-7.0926)	(-9.7753)	(-3.3787)
				Panel G. Double sort on IV and MAX				
HIV	-0.0138	-0.0178	-0.0224	-0.0086	-0.0128	-0.0131	-0.0200	-0.0072
	(-5.7008)	(-7.4376)	(-8.0244)	(-3.5522)	(-5.7499)	(-6.0922)	(-6.8484)	(-1.9780)
MIV	-0.0079	-0.0093	-0.0115	-0.0036	-0.0067	-0.0068	-0.0086	-0.0019
	(-3.4632)	(-4.1839)	(-4.8036)	(-1.0830)	(-3.1729)	(-3.5580)	(-4.1152)	(-0.6398)
LIV	-0.0061	-0.0076	-0.0093	-0.0032	-0.0090	-0.0062	-0.0093	-0.0003
	(-3.2645)	(-3.2539)	(-3.8339)	(-1.0421)	(-3.8440)	(-3.1841)	(-4.4590)	(-0.0963)
AVE	-0.0093	-0.0116	-0.0144	-0.0051	-0.0095	-0.0087	-0.0126	-0.0031
	(-7.2633)	(-8.7050)	(-9.8182)	(-2.6386)	(-7.4742)	(-7.3970)	(-9.1305)	(-1.6677)

Table 4. Univariate Fama-MacBeth regression results.

Each month from 1994:01 to 2013:12 we run a firm-level univariate Fama-MacBeth cross-sectional regression of the return on that month with one-month lagged values of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.0150	-0.2203							
(1.94)	(-5.32)							
0.0465		-0.0054						
(3.01)		(-3.27)						
-0.0043			0.0177					
(-0.60)			(2.26)					
0.0044				0.0050				
(0.64)				(1.10)				
0.0017					-0.0642			
(0.22)					(-4.40)			
0.0292						-0.0153		
(3.25)						(-7.60)		
0.0033							-0.0021	
(0.46)							(-2.01)	
0.0151								-0.7292
(2.01)								(-4.75)

Table 5. Bivariate and multi-variate Fama-MacBeth regression results with MAX.

Each month from 1994:01 to 2013:12 we run a firm-level bi-variate and multi-variate Fama-MacBeth cross-sectional regression of the return on that month with one-month lagged values of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.0616	-0.2255	-0.0069						
(3.84)	(-5.63)	(-3.47)						
0.0084	-0.2202		0.0156					
(1.08)	(-5.51)		(2.01)					
0.0178	-0.2443			0.0049				
(2.40)	(-6.49)			(1.11)				
0.0088	-0.1841				-0.0408			
(1.09)	(-4.75)				(-2.75)			
0.0380	-0.2013					-0.0145		
(4.01)	(-5.15)					(-7.22)		
0.0146	-0.2239						-0.0004	
(1.89)	(-5.22)						(-0.31)	
0.0174	-0.1244							-0.4615
(2.16)	(-3.21)							(-2.59)
0.0584	-0.0716	-0.0041	-0.0076	0.0082	-0.0418	-0.0107	-0.0011	-0.5398
(3.61)	(-1.62)	(-2.31)	(0.89)	(2.12)	(2.66)	(-6.25)	(-0.79)	(-3.95)

Table 6. Returns on portfolios sorted by MAX(5)

At the beginning of every month we sort stocks into tertiles according to the average of the five highest daily returns (MAX5) in the past calendar month. We compute each portfolio's equal- and value-weighted raw returns for the current month. We also estimate each portfolio's alpha (α coefficient) from the FF3-factor model estimated using the full sample of monthly value- or equal-weighted returns for each portfolio. The last row shows the difference in monthly returns and differences in alpha between the high and low MAX portfolios. T-statistics are reported in parenthesis. We conduct the analysis for the full sample period 1994:01-2013:12.

	EW portfolios		VW portfolios	
	Average return	FF-3 alpha	Average return	FF-3 alpha
High IV	-0.0014	-0.0165	-0.0040	-0.0127
	(-0.1860)	(-6.6390)	(-0.5879)	(-6.5307)
Medium IV	0.0069	-0.0110	0.0038	-0.0079
	(0.9691)	(-5.0139)	(0.5567)	(-5.7661)
Low IV	0.0077	-0.0079	0.0017	-0.0090
	(1.2861)	(-4.4590)	(0.3123)	(-5.6480)
High- Low	-0.0090	-0.0086	-0.0058	-0.0037
	(-0.9619)	(-2.7917)	(-0.6533)	(-1.4896)

Table 7. Fama-MacBeth regression results with MAX (5).

Each month from 1994:01 to 2013:12 we run a firm-level univariate Fama-MacBeth cross-sectional regression of the return on that month with one-month lagged values of the MAX (5) and bivariate and multivariate cross-sectional regression of the return on that month with one-month lagged values of the MAX (5) with other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX (5)	SIZE	BM	MOM	REV	CP	SKEW	IV
0.0178	-0.3978							
(2.25)	(-3.86)							
0.0653	-0.4302	-0.0059						
(4.04)	(-4.20)	(-3.55)						
0.0123	-0.4182		0.0134					
(1.57)	(-4.62)		(1.74)					
0.0193	-0.4199			0.0051				
(2.45)	(-4.48)			(1.15)				
0.0084	-0.3481				-0.0278			
(0.92)	(-2.53)				(-1.44)			
0.0333	-0.3576					-0.0139		
(4.08)	(-3.65)					(-7.03)		
0.0166	-0.3756						-0.0013	
(2.07)	(-3.66)						(-1.07)	
0.0173	-0.2399							-0.3378
(2.18)	(-2.10)							(-1.91)
0.0482	0.0085	-0.0035	0.0111	0.0082	-0.0466	-0.0110	-0.0013	-0.5431
(2.97)	(0.06)	(-2.01)	(1.31)	(2.39)	(-2.47)	(-6.61)	(-1.06)	(-3.65)

Table 8. Returns on portfolios sorted by MAX, three-month holding period.

At the beginning of every month we sort stocks into tertiles according to their maximum daily return in the past calendar month (MAX). We compute each portfolio's equal- and value-weighted raw returns for a three-month holding period. We also estimate each portfolio's alpha (α coefficient) from the FF3-factor model estimated using the full sample of value- or equal-weighted returns for each portfolio. The last row shows the difference in monthly returns and differences in alpha between the high and low MAX portfolios. T-statistics are reported in parenthesis. We conduct the analysis for the full sample period 1994:01-2013:12.

	EW portfolios		VW portfolios	
	Average return	FF-3 alpha	Average return	FF-3 alpha
High MAX	0.0031	-0.0253	-0.0086	-0.0201
	(0.2461)	(-6.4270)	(-0.7291)	(-6.8724)
Medium MAX	0.0182	-0.0107	0.0074	-0.0037
	(1.4972)	(-2.9016)	(0.6397)	(-1.7586)
Low MAX	0.0221	-0.0063	0.0098	-0.0042
	(2.0418)	(-1.9051)	(0.9697)	(-1.5265)
High- Low	-0.0191	-0.0190	-0.0184	-0.0159
	(-1.1578)	(-3.7191)	(-1.1838)	(-3.9443)

Table 9.Alpha of double sorted portfolios, three-month holding period.

At the end of each month over 1994:01-2013:12, stocks are double-sorted 3x3, first by the control factor (size, BM, momentum, REV, CP, skewness, and IV) into three portfolios and then within each portfolio we sort stocks again by their maximum daily return in the past calendar month (MAX). The alpha of each portfolio is presented with t-statistics in parenthesis. Alpha refers to the FF-3model alpha using the full sample of 3-month returns for each portfolio. To control for a particular factor, we average the alpha within each MAX category ending up with three portfolios with dispersion in idiosyncratic volatility but containing all values of the factor being controlled. Size, BM, momentum, REV, CP, skewness, and IV are as defined in Table 2. *LMAX*, *MMAX* , *HMAX* refer to low, medium, and high MAX portfolio, respectively; *BIG*, big size; *MED*, medium size; *SMA*, small size; *HBM*, *MBM* , *LBM* refer to high, medium, low book-to-market, respectively; *WNR*, winner; *MID*, middle; *LSR*, loser. *HCP*, *MCP* , *LCP* refer to high, medium, low-CP ratio, *HSK*, *MSK*, *LSK* refer to high, medium, and low skewness. *LIV, MIV, HIV* refer to high idiosyncratic volatility, respectively.

	Equal-weighted				Value -weighted			
	LMAX	*MMAX*	*HMAX*	*HMAX-LMAX*	*LMAX*	*MMAX*	*HMAX*	*HMAX-LMAX*
Panel A. Double sort on size (market capitalisation) and MAX								
BIG	-0.0095	-0.0059	-0.0216	-0.0121	-0.0036	0.0009	-0.0169	-0.0133
	(-2.7631)	(-1.6904)	(-5.4783)	(-2.0843)	(-1.2183)	(0.3857)	(-5.4819)	(-3.0830)
MED	-0.0105	-0.0143	-0.0286	-0.0181	-0.0104	-0.0146	-0.0282	-0.0178
	(-2.6098)	(-3.3294)	(-6.3820)	(-3.0062)	(-2.5757)	(-3.3935)	(-6.3240)	(-2.9564)
SMA	0.0004	-0.0095	-0.0279	-0.0283	-0.0014	-0.0110	-0.0289	-0.0275
	(0.1309)	(-2.4819)	(-6.5269)	(-5.3976)	(-0.4205)	(-2.7962)	(-6.6762)	(-5.0735)
AVE	-0.0127	-0.0099	-0.0260	-0.0134	-0.0051	-0.0082	-0.0247	-0.0195
	(-5.7622)	(-4.4186)	(-10.633)	(-4.0623)	(-2.5706)	(-3.9320)	(-10.642)	(-6.3847)
Panel B. Double sort on value (book-to-market) and MAX								
HBM	-0.0090	-0.0147	-0.0239	-0.0149	-0.0073	-0.0088	-0.0222	-0.0149
	(-2.0769)	(-3.4017)	(-4.6458)	(-2.0258)	(-1.5789)	(-1.8732)	(-4.6387)	(-2.2412)
MBM	-0.0091	-0.0062	-0.0166	-0.0075	-0.0114	-0.0102	-0.0141	-0.0027
	(-1.7929)	(-1.3344)	(-3.2080)	(-1.0297)	(-2.3517)	(-2.3942)	(-2.7938)	(-0.3857)
LBM	-0.0058	-0.0101	-0.0310	-0.0252	-0.0060	-0.0011	-0.0296	-0.0236
	(-1.2958)	(-2.3508)	(-5.8000)	(-3.6245)	(-1.0984)	(-0.2567)	(-5.0527)	(-2.9259)
AVE	-0.0153	-0.0103	-0.0238	-0.0085	-0.0082	-0.0067	-0.0220	-0.0137
	(-5.3232)	(-4.0656)	(-7.9376)	(-2.0530)	(-2.8442)	(-2.6148)	(-7.2400)	(-3.2749)
Panel C. Double sort on momentum (11/1/1) and MAX								
WNR	0.0011	0.0007	-0.0131	-0.0142	0.0055	0.0100	-0.0073	-0.0128
	(0.2403)	(0.1603)	(-2.6939)	(-2.0078)	(1.2426)	(2.3410)	(-1.7172)	(-2.1043)
MID	-0.0026	-0.0130	-0.0253	-0.0227	-0.0024	-0.0127	-0.0247	-0.0223
	(-0.6296)	(-3.1206)	(-5.6451)	(-3.7288)	(-0.5739)	(-3.5933)	(-5.1619)	(-3.4604)
LSR	-0.0164	-0.0247	-0.0374	-0.0210	-0.0189	-0.0251	-0.0411	-0.0222
	(-3.5031)	(-5.3925)	(-7.3038)	(-3.0279)	(-4.0310)	(-5.4012)	(-8.6313)	(-3.3046)
AVE	-0.0188	-0.0123	-0.0253	-0.0065	-0.0053	-0.0093	-0.0244	-0.0191
	(-7.0004)	(-4.8517)	(-9.0424)	(-1.6686)	(-2.0408)	(-3.8589)	(-9.1576)	(-5.1528)
Panel D. Double sort on one-month past return and MAX								
WNR	-0.0137	-0.0190	-0.0385	-0.0248	-0.0044	-0.0097	-0.0315	-0.0271
	(-2.9526)	(-4.2878)	(-7.9757)	(-3.8086)	(-1.0794)	(-2.3800)	(-6.6810)	(-4.3450)
MID	-0.0076	-0.0113	-0.0207	-0.0131	-0.0049	-0.0043	-0.0160	-0.0111
	(-1.8264)	(-2.8094)	(-4.9797)	(-2.2319)	(-1.2287)	(-1.1318)	(-4.3620)	(-2.0371)
LSR	-0.0003	-0.0004	-0.0147	-0.0144	-0.0036	0.0004	-0.0067	-0.0031
	(-0.0544)	(-0.0906)	(-3.3348)	(-2.2115)	(-0.7860)	(0.0903)	(-1.6310)	(-0.5092)
AVE	-0.0075	-0.0102	-0.0246	-0.0171	-0.0043	-0.0045	-0.0181	-0.0138
	(-2.9370)	(-4.1836)	(-9.5373)	(-4.6977)	(-1.7709)	(-1.9953)	(-7.4739)	(-4.0180)

Panel E. Double sort on CP *and MAX*

HCP	-0.0271	-0.0226	-0.0435	-0.0164	-0.0189	-0.0113	-0.0335	-0.0146
	(-7.5581)	(-5.7068)	(-10.200)	(-2.6657)	(-6.1803)	(-4.3123)	(-9.3279)	(-3.0732)
MCP	-0.0085	-0.0136	-0.0252	-0.0167	-0.0026	-0.0081	-0.0200	-0.0174
	(-2.3258)	(-3.5211)	(-6.0016)	(-2.9836)	(-0.7066)	(-2.3818)	(-5.3879)	(-3.3705)
LCP	0.0125	0.0059	-0.0053	-0.0178	0.0151	0.0112	0.0020	-0.0131
	(3.5356)	(1.3746)	(-1.2022)	(-3.1660)	(3.3140)	(2.4273)	(0.4234)	(-1.9704)
AVE	-0.0004	-0.0101	-0.0247	-0.0242	-0.0021	-0.0027	-0.0172	-0.0150
	(-0.1931)	(-4.2980)	(-9.9340)	(-7.2415)	(-0.9678)	(-1.3050)	(-7.3059)	(-4.6661)

Panel F. Double sort on skewness and MAX

HSK	-0.0093	-0.0151	-0.0313	-0.0220	-0.0049	-0.0124	-0.0262	-0.0213
	(-2.0915)	(-3.6012)	(-7.6879)	(-3.6580)	(-1.1848)	(-3.8194)	(-7.2558)	(-3.9038)
MSK	-0.0049	-0.0076	-0.0244	-0.0195	-0.0027	-0.0030	-0.0194	-0.0167
	(-1.1950)	(-1.9744)	(-5.3874)	(-3.2032)	(-0.7225)	(-0.8254)	(-4.5600)	(-2.9439)
LSK	-0.0075	-0.0072	-0.0204	-0.0129	-0.0044	-0.0028	-0.0115	-0.0071
	(-1.6923)	(-1.7849)	(-4.6313)	(-2.0731)	(-1.1077)	(-0.7644)	(-2.8878)	(-1.2551)
AVE	-0.0109	-0.0100	-0.0254	-0.0144	-0.0040	-0.0061	-0.0190	-0.0150
	(-4.4016)	(-4.2762)	(-10.131)	(-4.0924)	(-1.7598)	(-2.9998)	(-8.2893)	(-4.6529)

Panel G. Double sort on IV and MAX

HIV	-0.0162	-0.0215	-0.0368	-0.0206	-0.0155	-0.0154	-0.0334	-0.0179
	(-3.8553)	(-5.1335)	(-8.0032)	(-3.3071)	(-4.1121)	(-4.1874)	(-7.1513)	(-2.9616)
MIV	-0.0054	-0.0075	-0.0169	-0.0115	-0.0003	-0.0005	-0.0111	-0.0108
	(-1.2493)	(-1.9614)	(-4.2369)	(-1.9582)	(-0.0708)	(-0.1504)	(-3.2319)	(-2.1493)
LIV	-0.0061	-0.0062	-0.0094	-0.0033	-0.0073	-0.0004	-0.0059	0.0014
	(-1.6230)	(-1.4785)	(-2.2597)	(-0.5826)	(-1.7185)	(-0.0987)	(-1.6485)	(0.2496)
AVE	-0.0070	-0.0117	-0.0210	-0.0141	-0.0077	-0.0054	-0.0168	-0.0091
	(-2.9390)	(-4.9920)	(-8.5239)	(-4.1111)	(-3.3832)	(-2.6801)	(-7.3823)	(-2.8274)

Table 10. Univariate Fama-MacBeth regression results, three-month holding period.

Each month from 1994:01 to 2013:12 we run a firm-level univariate Fama-MacBeth cross-sectional regression of the three-month return (t+1 to t+3) with one-month lagged values (t) of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.0303	-0.3653							
(1.57)	(-4.35)							
0.1197		-0.0135						
(3.05)		(-3.20)						
-0.0118			0.0634					
(-0.63)			(3.24)					
0.0160				0.0070				
(0.88)				(0.70)				
0.0067					-0.1061			
(0.35)					(-4.13)			
0.0775						-0.0396		
(3.37)						(-7.91)		
0.0119							-0.0051	
(0.63)							(-2.34)	
0.0320								-1.2400
(1.67)								(-4.40)

Table 11. Bivariate and multi-variate Fama-MacBeth regression results with MAX, three-month holding period.

Each month from 1994:01 to 2013:12 we run a firm-level bivariate and multivariate Fama-MacBeth cross-sectional regression of the three-month return (t+1 to t+3) with one-month lagged values (t) of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.1389	-0.3630	-0.0137						
(3.54)	(-4.60)	(-3.28)						
0.0096	-0.3678		0.0565					
(0.50)	(-4.76)		(2.90)					
0.0329	-0.3533			0.0090				
(1.75)	(-4.73)			(0.94)				
0.0193	-0.3129				-0.0642			
(1.00)	(-4.21)				(-2.36)			
0.0880	-0.2866					-0.0378		
(3.82)	(-3.63)					(-7.50)		
0.0297	-0.3540						-0.0016	
(1.53)	(-3.57)						(-0.61)	
0.0353	-0.2471							-0.6670
(1.81)	(3.05)							(-2.05)
0.1446	-0.1604	-0.0099	0.0159	0.0144	-0.0431	-0.0310	-0.0026	-0.5819
(3.65)	(-1.97)	(-2.20)	(0.83)	(1.69)	(-2.33)	(-7.53)	(-0.90)	(-2.15)

Table 12. Returns on portfolios sorted by MAX, six-month holding period.

At the beginning of every month we sort stocks into tertiles according to their maximum daily return in the past calendar month (MAX). We compute each portfolio's equal- and value-weighted raw returns for a six-month holding period. We also estimate each portfolio's alpha (α coefficient) from the FF3-factor model estimated using the full sample of value- or equal-weighted returns for each portfolio. The last row shows the difference in monthly returns and differences in alpha between the high and low MAX portfolios. T-statistics are reported in parenthesis. We conduct the analysis for the full sample period 1994:01-2013:12.

	EW portfolios		VW portfolios	
	Average return	FF-3 alpha	Average return	FF-3 alpha
High MAX	0.0125	-0.0318	-0.0083	-0.0266
	(0.7002)	(-5.8575)	(-0.4884)	(-6.3024)
Medium MAX	0.03773	-0.0079	0.0187	0.0021
	(2.1118)	(-1.5779)	(1.1096)	(0.7101)
Low MAX	0.0448	-0.0050	0.0213	-0.0021
	(2.7672)	(-1.1028)	(1.3885)	(-0.5134)
High- Low	-0.0323	-0.0268	-0.0296	-0.0245
	(-1.3449)	(-3.8127)	(-1.2922)	(-4.1742)

Table 13.Alpha of double sorted portfolios, six-month holding period.

At the end of each month over 1994:01-2013:12, stocks are double-sorted 3x3, first by the control factor (size, BM, momentum, REV, CP, skewness, and IV) into three portfolios and then within each portfolio we sort stocks again by the maximum daily return in the past calendar month (MAX). The alpha of each portfolio is presented with t-statistics in parenthesis. Alpha refers to the FF-3model alpha using the full sample of six-month returns for each portfolio. To control for a particular factor, we average the alpha within each MAX category ending up with three portfolios with dispersion in idiosyncratic volatility but containing all values of the factor being controlled. Size, BM, momentum, REV, CP, skewness, and IV are as defined in Table 2. *LMAX*, *MMAX* , *HMAX* refer to low, medium, and high MAX portfolio, respectively; *BIG*, big size; *MED*, medium size; *SMA*, small size; *HBM*, *MBM* , *LBM* refer to high, medium, low book-to-market, respectively; *WNR*, winner; *MID*, middle; *LSR*, loser. *HCP*, *MCP*, *LCP* refer to high, medium, low-CP ratio, respectively; *HSK*, *MSK*, *LSK* refer to high, medium, and low skewness. *LIV, MIV, HIV* refer to high idiosyncratic volatility, respectively.

	Equal-weighted				Value -weighted			
	LMAX	*MMAX*	*HMAX*	*HMAX-LMAX*	*LMAX*	*MMAX*	*HMAX*	*HMAX-LMAX*
Panel A. Double sort on size (market capitalisation) and MAX								
BIG	-0.0105	0.0004	-0.0250	-0.0145	-5.72E-05	0.0104	-0.0191	-0.0190
	(-2.2197)	(0.0736)	(-4.4119)	(-1.7675)	(-0.0125)	(2.9981)	(-4.1235)	(-2.9272)
MED	-0.0115	-0.0158	-0.0365	-0.0250	-0.0113	-0.0158	-0.0357	-0.0244
	(-2.1612)	(-2.6474)	(-6.0147)	(-3.0937)	(-2.1087)	(-2.6364)	(-5.8784)	(-2.9950)
SMA	0.0028	-0.0064	-0.0316	-0.0344	0.0031	-0.0081	-0.0336	-0.0367
	(0.6543)	(-1.2346)	(-5.3889)	(-4.6739)	(0.6742)	(-1.5181)	(-5.6886)	(-4.9056)
AVE	-0.0134	-0.0073	-0.0310	-0.0176	-0.0028	-0.0045	-0.0295	-0.0267
	(-4.4434)	(-2.3497)	(-9.1069)	(-3.8635)	(-0.9767)	(-1.5451)	(-9.1578)	(-6.2455)
Panel B. Double sort on value (book-to-market) and MAX								
HBM	-0.0026	-0.0171	-0.0226	-0.0200	0.0050	-0.0040	-0.0206	-0.0256
	(-0.4451)	(-2.8144)	(-3.1850)	(-2.0344)	(0.7462)	(-0.6397)	(-3.1835)	(-2.7424)
MBM	0.0069	-0.0012	-0.0154	-0.0223	0.0015	-0.0057	-0.0155	-0.0170
	(0.9976)	(-0.1802)	(-2.0813)	(-2.2040)	(0.2207)	(-0.8128)	(-2.0553)	(-1.6889)
LBM	-0.0016	-0.0030	-0.0381	-0.0365	-0.0129	0.0039	-0.0376	-0.0247
	(-0.2547)	(-0.5023)	(-5.6185)	(-3.9375)	(-1.5179)	(0.6834)	(-5.0862)	(-2.1917)
AVE	-0.0109	-0.0071	-0.0254	-0.0144	-0.0021	-0.0019	-0.0246	-0.0224
	(-2.8384)	(-1.9282)	(-6.1845)	(-2.5651)	(-0.5049)	(-0.5296)	(-5.9241)	(-3.7891)
Panel C. Double sort on momentum (11/1/1) and MAX								
WNR	0.0049	0.0115	-0.0145	-0.0194	0.0110	0.0269	-0.0064	-0.0174
	(0.7492)	(1.9018)	(-2.3144)	(-2.0119)	(1.6455)	(4.6750)	(-0.1835)	(-2.0220)
MID	0.0075	-0.0068	-0.0293	-0.0368	-0.0039	-0.0086	-0.0323	-0.0284
	(1.1737)	(-1.2640)	(-4.5737)	(-4.0659)	(-0.6162)	(-1.9751)	(-4.8957)	(-3.0891)
LSR	-0.0177	-0.0253	-0.0453	-0.0276	-0.0172	-0.0267	-0.0507	-0.0335
	(-2.6012)	(-4.2075)	(-6.1973)	(-2.7665)	(-2.5555)	(-4.3009)	(-6.9609)	(-3.3809)
AVE	-0.0185	-0.0069	-0.0297	-0.0112	-0.0034	-0.0028	-0.0298	-0.0264
	(-4.6824)	(-2.0482)	(-7.6988)	(-2.0283)	(-0.8833)	(-0.8784)	(-7.9641)	(-4.9490)
Panel D. Double sort on one-month past return and MAX								
WNR	-0.0117	-0.0205	-0.0476	-0.0359	-0.0029	-0.0091	-0.0414	-0.0385
	(-1.8337)	(-3.3186)	(-7.3955)	(-4.1243)	(-0.4730)	(-1.5238)	(-6.2860)	(-4.2516)
MID	-0.0047	-0.0044	-0.0204	-0.0157	-0.0030	0.0041	-0.0126	-0.0096
	(-0.7472)	(-0.8344)	(-3.5784)	(-1.8480)	(-0.5118)	(0.8048)	(-2.3591)	(-1.2219)
LSR	-0.0008	-0.0010	-0.0200	-0.0192	-0.0017	0.0007	-0.0110	-0.0093
	(-0.1099)	(-0.1670)	(-3.4165)	(-2.0798)	(-0.2384)	(0.1327)	(-1.8631)	(-0.9908)
AVE	-0.0085	-0.0086	-0.0293	-0.0208	-0.0025	-0.0014	-0.0217	-0.0191
	(-2.2816)	(-2.5878)	(-8.4576)	(-4.0930)	(-0.6788)	(-0.4450)	(-6.2997)	(-3.7699)

				Panel E. Double sort on CP *and MAX*				
HCP	-0.0419	-0.0362	-0.0658	-0.0239	-0.0287	-0.0179	-0.0495	-0.0208
	(-8.2166)	(-6.5659)	(-10.818)	(-2.7933)	(-6.0270)	(-4.2322)	(-9.1781)	(-2.8789)
MCP	-0.0090	-0.0144	-0.0291	-0.0201	-0.0082	0.0006	-0.0236	-0.0154
	(-1.8602)	(-2.7989)	(-5.1597)	(-2.7252)	(-1.6250)	(0.1076)	(-4.2888)	(-2.0532)
LCP	0.0298	0.0240	0.0085	-0.0213	0.0491	0.0344	0.0165	-0.0326
	(5.6899)	(4.2146)	(1.4268)	(-2.6827)	(7.4612)	(5.6196)	(2.6464)	(-3.6001)
AVE	0.0098	-0.0089	-0.0288	-0.0386	0.0041	0.0057	-0.0189	-0.0229
	(3.1580)	(-2.8236)	(-8.4491)	(-8.3794)	(1.2677)	(1.8896)	(-5.7218)	(-4.9852)
				Panel F. Double sort on Skewness and MAX				
HSK	-0.0024	-0.0137	-0.0402	-0.0378	0.0039	-0.0039	-0.0364	-0.0403
	(-0.4168)	(-2.4021)	(-6.7875)	(-4.4542)	(0.6602)	(-0.7599)	(-6.5351)	(-4.9542)
MSK	0.0010	-0.0042	-0.0302	-0.0312	0.0098	0.0047	-0.0255	-0.0353
	(0.1911)	(-0.8248)	(-5.0593)	(-3.8651)	(1.8485)	(0.9614)	(-4.2443)	(-4.4094)
LSK	-0.0019	-0.0082	-0.0264	-0.0245	-0.0032	-0.0061	-0.0230	-0.0198
	(-0.3319)	(-1.4790)	(-4.3554)	(-2.8870)	(-0.5471)	(-1.1732)	(-3.9661)	(-2.3932)
AVE	-0.0091	-0.0087	-0.0323	-0.0232	0.0035	-0.0018	-0.0283	-0.0318
	(-2.7140)	(-2.7705)	(-9.3137)	(-4.8051)	(1.0622)	(-0.6038)	(-8.4479)	(-6.7677)
				Panel G. Double sort on IV and MAX				
HIV	-0.0194	-0.0291	-0.0488	-0.0294	-0.0139	-0.0261	-0.0470	-0.0331
	(-3.4924)	(-4.9780)	(-8.1506)	(-3.4648)	(-2.8583)	(-4.8373)	(-7.2099)	(-4.0663)
MIV	-0.0021	-0.0081	-0.0177	-0.0156	0.0014	0.0047	-0.0141	-0.0155
	(-0.3974)	(-1.5473)	(-3.0596)	(-1.9685)	(0.2778)	(1.4647)	(-2.5871)	(-2.0478)
LIV	-0.0091	0.0028	0.0005	0.0096	-0.0080	0.0083	0.0092	-0.0172
	(-1.5407)	(0.5115)	(0.0901)	(1.1408)	(-1.1872)	(1.4647)	(1.7290)	(2.0134)
AVE	-0.0036	-0.0115	-0.0220	-0.0184	-0.0068	-0.0044	-0.0173	-0.0105
	(-1.0702)	(-3.5642)	(-6.4214)	(-3.8566)	(-2.0929)	(-1.4495)	(-5.1748)	(-2.2398)

Table 14. Univariate Fama-MacBeth regression results, six-month holding period.

Each month from 1994:01 to 2013:12 we run a firm-level univariate Fama-MacBeth cross-sectional regression of the six-month return (t+1 to t+6) with one-month lagged values (t) of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.0150	-0.2203							
(1.94)	(-5.32)							
0.0465		-0.0054						
(3.01)		(-3.27)						
-0.0043			0.0177					
(-0.60)			(2.26)					
0.0044				0.0050				
(0.64)				(1.10)				
0.0017					-0.0642			
(0.22)					(-4.40)			
0.0292						-0.0153		
(3.25)						(-7.60)		
0.0033							-0.0021	
(0.46)							(-2.01)	
0.0151								-0.7292
(2.01)								(-4.75)

Table 15. Bivariate and multi-variate Fama-MacBeth regression results with MAX, six-month holding period.

Each month from 1994:01 to 2013:12 we run a firm-level bivariate and multi-variate Fama-MacBeth cross-sectional regression of the six-month return (t+1 to t+6) with one-month lagged values (t) of the MAX and other control variables. Each row reports the time-series averages of the slope coefficients and their associated t-statistics. MAX and the other control variables are defined in Table 2.

Intercept	MAX	SIZE	BM	MOM	REV	CP	SKEW	IV
0.2503	-0.6138	-0.0234						
(3.89)	(-7.44)	(-3.54)						
0.0147	-0.5820		0.1226					
(0.46)	(-6.54)		(3.93)					
0.0691	-0.5971			0.0003				
(2.24)	(-6.74)			(0.02)				
0.0573	-0.6171				-0.0074			
(1.77)	(-6.06)				(-0.20)			
0.1738	-0.4762					-0.0738		
(4.70)	(-5.35)					(-9.08)		
0.0624	-0.6179						-0.0001	
(1.93)	(-5.52)						(-0.04)	
0.0727	-0.4156							-1.0803
(2.26)	(-4.25)							(-2.52)
0.2583	-0.3522	-0.0142	0.0251	0.0128	0.0049	-0.0616	-0.0010	-0.7742
(4.10)	(-2.59)	(-2.10)	(0.67)	(1.07)	(0.19)	(-8.98)	(-0.30)	(-2.00)