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The impact of downside risk on UK stock returns[a]

Abstract
Purpose – This paper aims to investigate patterns in UK stock returns related to downside risk, with particular focus on stock returns during financial crises.

Design/Methodology/Approach – First, stocks are sorted into five quintile portfolios based on the relevant beta values (namely, classic beta, downside beta and upside beta, calculated by the moving window approach). Second, patterns of portfolio returns are examined during various sub-periods. Finally, predictive powers of beta and downside beta are examined.

Findings – The downside risk is observed to have a significant positive impact on contemporaneous stock returns and a negative impact on future returns in general. In contrast, an inverse relationship between risk and return is observed when stocks are sorted by beta, contrary to the classic literature. UK stock returns exhibit clear time sensitivity, especially during financial crises.

Originality/Value – This paper focuses on the impact of the downside risk on UK stock returns, assessed via a comprehensive sub-period analysis. This paper fills the gap in the existing literature, in which very few studies examine the time sensitivity in relation to the downside risk and the risk-return anomaly in the UK stock market using a long sample period.

Keywords Downside risk, stock returns, financial crisis

Paper type Research Paper

[a] The author thanks Professor Nick Taylor for his valuable comments and suggestions.

1 Introduction

This paper investigates the relationship between the downside risk and UK stock returns. Since the CAPM was first proposed, it was widely believed that the expected excess return of a stock varies linearly with its market beta, regardless of the change in the market excess return. However, by exploring market movements and stock returns, researchers observed that stock returns did not react symmetrically to market movements. Certain stocks tend to gain more in a rising market than they would lose in a falling market, while other stocks experience declines in a falling market far in excess of gains in a rising market. It follows that such stocks are less attractive than others due to low average payoffs. This paper demonstrates that the positive impact of the downside risk is reflected in the cross-section of stock returns, while when beta is controlled, the downside risk's negative impact on stock returns is observed in future stock returns. It is also observed that risk and return follow an inverse relationship, when stocks are sorted by beta, contrary to the classic literature. Furthermore, to test the time sensitivity, the risk-return relationship is examined by using sub-period analysis. This paper fills the gap in the existing literature, in which studies primarily focus on either stock performance over time during a particular financial crisis (therefore, examining a relatively short sample period) or the downside risk without considering its time sensitivity. As stock performance varies substantially over time, especially during bear markets (Ang et al, 2006), this paper contributes to the literature by using a 30-year sample period, covering a number of economic cycles, and in particular examines the downside risk in relation to stock performance and time sensitivity. This paper is organized as follows: section 2 reviews the existing literature on the downside risk, section 3 outlines a downside risk model, section 4 describes data, section 5 presents empirical results, section 6 examines the predictive power of the downside beta, and the final section concludes with a discussion of the present study's limitations and points at directions for future research.

2 Literature review

Measures of the downside risk have long been used in portfolio analysis, specifically, because treating risk asymmetrically yields a vast improvement over the traditional portfolio theory. The most commonly accepted downside risk measures are semi-variance and the lower partial moment (Nawrocki, 1999). A number of studies focus on the asymmetry of risk, particularly on downside losses rather than upside gains. Roy (1952) pointed out that investors are more concerned with the downside risk than with upside gains. Markowitz (1959) was the first to propose that semi-variance instead of variance be adopted as a risk measure, as semi-variance is particularly focused on downside losses. Consequently, a large number of studies exploring theoretical applications of semi-variance have been published. For instance, the theoretical superiority of semi-variance compared to variance is illustrated in Quirk and Saposnik's study (1962). Mao (1970) shows that investors are more sensitive to the downside risk as compared to upside gains. In the mid-1970s, another measure of downside risk called the lower partial moment was proposed. According to Bawa (1975) and Fishburn (1977), the lower partial moment can liberate investors from risk seeking to risk neutral and finally to risk aversion. Bawa (1975) was the first to define the lower partial moment as a below-target semi-variance, linking the lower partial moment to the semi-variance measure.

A large number of empirical tests have been conducted subsequent to the introduction of these two measures of the downside risk. Among such tests, a number of researchers attempted to combine measures of the downside risk with the original asset pricing model and the investors' utility function. This, in turn, has led to the emergence of new measures of downside risk. Bawa and Lindenberg (1977) proposed a modified CAPM that treated downside and upside risks asymmetrically. Developing the framework for behavioural finance, Kahneman and Tversky (1979) proposed the loss aversion preference. Gul (1991) advanced the disappointment aversion preference theory. According to that theory, risk-averse investors demand a premium to compensate for the downside risk borne in a falling market. Sing and Ong (1993) proposed the co-lower partial moment and extended it to classic CAPM. Ang and Chen (2002) proposed the downside conditional correlation as a new measure of downside risk. Moreover, Nielsen et al. (2008) proposed downside realized semi-variance as another measure of downside risk, constructed from high-frequency data.

Even though the concept of downside risk arose as early as the 1950s, early studies observed little evidence of downside risk being priced, as researchers did not specifically focus on the cross-sectional evaluation of the premium. For instance, Jahankani (1976) failed to observe any improvement in the standard CAPM resulting from normal betas being replaced by downside betas; however, portfolios used in his study were sorted only by classic CAPM betas. Similarly, Harlow and Rao (1989) failed to estimate the downside risk premium, instead measuring the downside risk under the maximum likelihood framework, with only the consistency of returns of the risk-free assets being tested across all portfolios. None of the cited studies examined the risk premiums of stocks that closely co-vary with a declining market.

However, Ang et al. (2006) successfully demonstrated that stocks with higher downside risk boast higher average returns, with the downside risk a significant risk factor affecting stock returns. Moreover, they estimated the downside risk premium to be 6% per annum in cross-section. On the other hand, Huang and Hueng (2008) argued that in a downside market, there is a significant and negative risk-return relationship. More recently, Gregory (2011) focused on the UK stock market risk premium, though not specifically during downside markets. Huang et al. (2012) failed to observe the downside risk component in a Value-at-Risk model. Galsband (2012) and Alles and Murray (2017) observed stock returns to be sensitive to downside shocks in emerging markets. Additionally, Giglio et al. (2016), Min and Kim (2016) and Ormos and Timotity (2016) proposed modeling the downside risk from the macroeconomic perspective, while Theodosiadou et al. (2016) explored time sensitivity of jumps in individual stock returns. In view of Ang et al. (2006), this paper examined whether individual UK stocks with higher downside betas earn, on average, higher returns during both the observation period and the next period, focusing particularly on time sensitivity of stock returns relative to the downside risk.

3 A model of downside risk

To price the downside risk theoretically, a disappointment aversion (DA) utility function first proposed by Gul (1991) is adopted. Use of the DA utility function effectively assumes that investors respond differently to downside losses compared to upside gains, specifically, with greater concern toward the former. A number of other models exist that focus on investors' loss aversion: Shumway (1997) advanced a behavioural model accounting for the level of investors' loss aversion, while Barberis and Huang (2001) developed a cross-sectional equilibrium model based on a risk-averse utility function with a mental accounting factor representing investors' loss aversion. Moreover, certain improvements have been proposed, as well as constraints on utility functions. For instance, Chen et al. (2001) added the short sale constraint, while Kyle and Xiong (2001) constructed the wealth constraint. However, none of the cited models directly relate measurement of the downside risk to cross-sectional stock returns in a perfect market.

Instead of adding too many constraints and behavioural conditions, taking the rational disappointment aversion utility function as the basis for asymmetric treatment of risk is the most reasonable way to measure the downside risk cross-sectionally. The advantage of such an approach is that, as the DA function is universally concave, portfolio allocation problems, especially those of optimal finite portfolio allocation, are solvable (Ang et al., 2006). The difference between the DA utility function adopted in this paper and the one in Gul's (1991) study is that the former is constructed under a rational representative agent framework, while the latter merely aims to solve the problem in an aggregate market, specifically in a consumption setting (Routledge and Zin, 2003). In this paper, wealth is measured by the market portfolio, with all assumptions complying with the CAPM.

Gul's (1991) disappointment aversion utility function is as follows:

$$U(\mu_W) = \frac{1}{K}\left(\int_{-\infty}^{\mu_W} U(W)dF(W) + A\int_{\mu_W}^{\infty} U(W)dF(W)\right), \quad (1)$$

where *U(W)* is the utility function of wealth *W* by the end of the period, *F(x)* is the cumulative density function of wealth *W*, and μ_W is a certain level of wealth. Following Gul (1991), *U(W)* is set to be a power utility function given by

$$U(W) = W^{(1-\gamma)} / (1-\gamma). \quad (2)$$

The parameter *A* in equation (1) is the disappointment aversion coefficient, $0<A\leq 1$, and *K* is a scalar, given by

$$K = \Pr(W \leq \mu_W) + A\Pr(W > \mu_W). \quad (3)$$

The event of wealth declining below μ_W it is called a disappointing outcome. The reason for *A* being between 0 and 1 is to allow disappointing outcomes to have more weight than the alternative. In other words, disappointment-averse investors are more concerned with the downside risk than the upside risk. On the other hand, if *A=1*, the disappointment aversion utility function becomes the mean-variance utility function (Ang et al., 2006).

A key component of the mean–variance utility function, the regular beta, is given by

$$\beta = \frac{\mathrm{cov}(xR_i, xR_M)}{\mathrm{var}(xR_M)}, \tag{4}$$

where xR_i is asset *i*'s excess return and xR_M is the market excess return. Beta could be a powerful parameter to explain and describe the risk-return relationship of each asset, as each asset's expected return will increase in a rising market and decrease in a declining market at high beta values. However, with investors comparatively more concerned with the downside risk, the disappointment aversion utility function's risk coefficient does not have enough explanatory power for the downside risk. To overcome this challenge, the downside beta, denoted by β^-, a measurement of downside risk, is introduced by Bawa and Lindenberg (1977)[1]. Mathematically, β^- is given by

$$\beta^- = \frac{\mathrm{cov}(xR_i, xR_M \mid xR_M < \overline{xR_M})}{\mathrm{var}(xR_M \mid xR_M < \overline{xR_M})}, \tag{5}$$

where $\overline{xR_M}$ is the average market excess return over the sample period.

On the other hand, a DA investor would prefer to hold stocks with high upside

[1] The downside beta measures the co-movement between the stock return and the return of market portfolio in a falling market. Stocks with larger downside betas are expected to suffer greater losses in a downside market, and vice versa.

potential payoffs available at discounts. Similarly to the downside beta, the upside beta is given by

$$\beta^{+} = \frac{\mathrm{cov}(xR_i, xR_M \mid xR_M \geq \overline{xR_M})}{\mathrm{var}(xR_M \mid xR_M \geq \overline{xR_M})} \quad , \tag{6}$$

where the notation is used consistently with the definition of the downside beta.

As the regular, upside and downside betas are not independent, to distinguish their effects, two more statistics were introduced by Ang et al. (2006) and further developed and tested in a number of studies, e.g., Galsband (2012), Liu et al. (2014), Min and Kim (2016) and Keenan and Sown (2017): the relative upside beta, denoted by $(\beta^{+}-\beta)$ and the relative downside beta, denoted by $(\beta^{-}-\beta)$. In the subsequent analysis, comparisons among regular, upside, downside, relative upside and relative downside betas relative to stock returns are summarized.

4 Data

Data for the UK market used in this paper are taken from DataStream and include ordinary common stock prices of companies in the FTSE All-Share Index, observed monthly from December 1979 to December 2010. Real estate investment funds and closed-end funds are excluded from the sample. Each stock is required to have at least 5 years of consecutive monthly adjusted price observations with at most 5 missing observations. The price of each stock is adjusted for splits, mergers and acquisitions, and dividends (dividends are subtracted from stock prices to perform the adjustment), resulting in the total of 565 stocks with the average annual return of 3.61% and the standard deviation of 22.21%. The UK one-month Gilt rate and FTSE All-Share Index values over the same period are collected for subsequent analysis.

5 Empirical results

To demonstrate the relationship between annual realized stock returns and various types of betas, results are summarized in the subsequent tables. All regular, downside and upside betas are estimated by OLS, with relative downside and upside betas, and downside beta less upside beta values computed subsequently.

In the process of computing betas, the moving window method is adopted with a three-year window used to calculate beta values for respective stocks. Therefore, once the first beta value for a given stock has been calculated, the next beta value for that stock is calculated by moving the window forward by one month. Once all types of betas have been computed, each type is sorted into five portfolios according to their values as of each month. Specifically, stocks are cross-sectionally sorted into five quintiles (113 stocks in each quintile), according to different types of corresponding beta measurements at each point in time. The low-beta portfolios contain stocks with the lowest 20% of betas among all stocks during each month, with the other four portfolios containing stocks, falling into 20 - 40%, 40 - 60%, 60 - 80% and 80 - 100%

percentile beta brackets. Once portfolios have been constructed, each portfolio's equally weighted average beta is calculated and assigned to be the portfolio beta. To demonstrate the sample period's impact and the predictive power of betas, both the same period and the following year's average annual excess return of each portfolio are calculated.

5.1 Whole sample analysis

The sample used in this paper contains a number of bear market periods, e.g., the "1989 market crash", the Dot-com crash and the subprime crisis. Overall, the UK sample is mostly characterized by bear markets; hence, unusual results are expected, and time sensitivity of downside and upside betas is observed.

Table 1 shows that, when the entire sample is used, several unusual results in realized returns and beta measurements are observed. According to the conventional definition of the risk–return relationship, high beta values are expected to correspond to high returns, and vice versa. However, Table 1 presents the opposite result.

[Insert Table 1 here]

When stocks are sorted by conventional beta values, the average beta estimate for the lowest beta portfolio is 0.32, while the estimate for the highest beta portfolio is 1.79, with the average beta estimates rising at relatively stable intervals from low to high, and the spread between the highest and the lowest beta estimates of 1.47. Although these beta estimates are smaller than expected, they are still within a reasonable range.

The average downside beta and upside beta estimates of 5 portfolios follow the direction of change, from low to high, of conventional beta estimates. Surprisingly, when it comes to realized returns, portfolios' average realized returns are observed to vary inversely with the respective beta estimates. The lowest-beta portfolio generated the return of 1.94% per annum, while the highest-beta portfolio suffered a loss of 2.82% per annum, the difference between the high and the low-beta portfolio values being -4.76%. The realized returns show a decreasing trend, going from low-beta to high-beta portfolio.

The same phenomenon is also observed when stocks are sorted by downside beta, upside beta and relative upside beta. When stocks are sorted by relative downside beta, returns exhibit a U-shaped pattern going from low-beta to high-beta portfolio. The annual return of the lowest relative downside beta portfolio is 0.3%, dropping below zero with the increase in relative downside beta. It then rises above zero, finally yielding 0.65% per annum for the highest relative downside beta portfolio. Although there is a tiny decline observed between the annual returns of the second highest and the highest relative downside beta portfolios, a U-shaped return pattern is still clearly observed.

An upward trend of annual returns from low-beta to high-beta portfolios is finally observed when stocks are sorted by the difference between the downside beta and the upside beta $(\beta^{-}-\beta^{+})$. The annual return of the low $(\beta^{-}-\beta^{+})$ portfolio is -3.62%, increasing with the rise in $(\beta^{-}-\beta^{+})$ and reaching 2.9% for the high $(\beta^{-}-\beta^{+})$ portfolio with the spread between high and low of 6.53%. Overall, Table 1 illustrates a surprising risk-return relationship with the pattern of returns being in complete contradiction with the conventional risk–return theory, and a non-linear relationship observed for stocks sorted by relative downside beta.

5.2 Sub-period analysis

The sample excluding the subprime crisis period

To examine the risk–return relationship and time sensitivity of the downside risk in more detail (especially when a relatively long sample contains a number of crises), a number of short and reshaped samples are chosen. Table 2 provides results for the sub-period from January 1980 to December 2007. The reason for choosing to analyze this period is the subprime crisis. Omitting data from January 2008 to December 2010 from the original dataset has the effect of removing the influence of the global financial crisis. Table 2 shows that, after shortening the sample, the realized return series in each panel becomes more realistic, with the average highest annual rate of return across all the panels at approximately 6%, as compared to a value close to zero for data in Table 1. However, focusing on the risk–return relationship, the results do not follow the classic portfolio theory, but exhibit patterns similar to those in Table 1. If stocks are sorted by relative downside beta, the returns follow a U-shaped pattern from the low-beta to the high-beta portfolio. The annual rate of return of the lowest relative downside beta portfolio is 4.19%, falling dramatically to 1.9% when the relative downside beta increases to the next brackets. Then, the rate of return starts to increase from the median beta portfolio at 2.36% finally reaching 2.53% for the highest relative downside beta portfolio. Despite a 0.9% drop between the annual returns of the second-highest and the highest relative downside beta portfolios, a U-shaped pattern in returns is still clearly observed.

[Insert Table 2 here]

Overall, while Table 2 shows a risk and return relationship similar to that of Table 1, the pattern of returns is still contrary to the conventional risk–return theory, furthermore, a U-shaped pattern is observed if stocks are sorted by relative downside beta. Moreover, the return values in Table 2 are much greater than the ones in Table 1 and are quite close to the expected excess returns, a phenomenon that can be attributed to removal of the subprime crisis period.

Comparing Tables 1 and 2, it is clear that although shortening the sample size still does not give the expected result, the annual returns appear more typical. For a further analysis of the risk–return relationship in view of Tables 1 and 2, all periods of financial crises are excluded, and a number of subsamples are considered.

The sample excluding the subprime crisis, the Dot-com crash and the "1989 market crash"

The data used to produce Table 3 are consistent with those used for Table 2, and exclude the subprime crisis (January 2008 to December 2010), the Dot-com crash

(March 2000 to October 2002) and the "1989 stock market crash" (October 1989). Bredin et al. (2007), Gregoriou et al. (2009) and Nneji et al. (2011) also focus on the crash periods in the UK equity market, however, neither of these studies specifically examine the downside risk. If stocks are sorted by beta, the returns exhibit a downward pattern with increasing beta values. Such a downward pattern is similar to ones observed in Tables 1 and 2, however, the spread between returns of the highest beta and the lowest beta portfolios is much narrower than the corresponding spread in the previous two tables, at only -2.98% compared to -4.76% in Table 1 and -6.88% in Table 2.

[Insert Table 3 here]

The difference between the return of the lowest beta portfolio in Panel 1 of Table 3 and the respective one in Table 2 is very small. However, the returns of the highest beta portfolios in Panel 1 of both tables are obviously very different, with the return in Table 3 of 2.98% per annum compared to the respective figure in Table 2 at only -0.93% per annum and the spread becoming narrower due to the increased return of the highest beta portfolio. Moreover, the returns of three middle-beta portfolios in Panel 1 of Table 3 are all relatively higher than those in Table 2. Although not as high as expected, the increase in the return of the highest-beta portfolio observed after discarding abnormal stock price movements during crisis period tends to change the return pattern. Apart from Panel 1, the pattern in the risk-return relationship observed in the other panels in Table 3 is fairly similar to that in Table 2.

Moreover, when stocks are sorted by relative downside beta, there is a clear U-shaped pattern in returns, without a small drop that appears in both Tables 1 and 2 for the highest relative beta portfolio. Furthermore, when stocks are sorted by $(\beta^{-} - \beta^{+})$, the upward pattern in returns appears similarly to those in Tables 1 and 2. However, the spreads between returns of the highest-beta and the lowest-beta portfolios in each panel in Table 3 are much lower than the corresponding spreads in Table 2, except when stocks are sorted by $(\beta^{-} - \beta^{+})$. Nonetheless, returns of the lowest-beta portfolios in both tables are quite close. In other words, the narrowing of spreads is due to the increase in returns of the highest-beta portfolio. As the only change made to the dataset is the omission of the crisis periods, it can be concluded that bear market periods indeed have a great impact on high than on low-beta stocks.

The Dot-com crash

To explore the impact of stock price movements during crisis periods on the risk–return relationship, the analysis specific to the Dot-com crash from March 2000 to October 2002 is conducted. The results are shown in Table 4. Unsurprisingly, stocks suffered huge losses, on average, over this period. Regardless of whether stocks are sorted by beta, downside beta, upside beta, relative downside beta and relative upside beta, none of the resulting portfolios generate a positive rate of return, while the spreads between the high-beta and low-beta portfolios are rather wide, from -18.77% to -29.78%. The five panels show that the highest-beta portfolio generates the lowest rate of return. If stocks are sorted by conventional beta, the highest-beta portfolio generates the lowest rate of return among all portfolios.

[Insert Table 4 here]

Focusing on the pattern of returns, a downward pattern appears in the first five panels when the corresponding beta measurement increases. In addition, the previously mentioned U-shaped return pattern, observed if stocks are sorted by relative downside beta, disappears and is replaced by a downward pattern. As in previous tables, if stocks are sorted by $(\beta^{-}-\beta^{+})$, the upward pattern of returns is observed again with all-negative values. Overall, Table 4 shows that abnormal stock price movements do not notably alter the return pattern and the risk–return relationship. However, it is clear that stocks, especially those of high-beta portfolios, suffered huge losses during the Dot-com crash. It shows again that high-beta stocks are influenced the most when downward stock price movements occur.

Time sensitivity and sub-period analysis

The time sensitivity of the downside risk is observed more clearly in the sub-period analysis. The original data are divided into three sub-periods, January 1980 - December 1989, January 1990 - December 1999 and January 2000 - December 2010. A sub-period could be determined by various benchmarks, with this paper following studies of Goetzmann and Ibbotson (2006) and Pesce (2015) by using every decade as a sub-period in accordance with the conventional determination of economic cycles. The results are shown in Tables 5, 6 and 7, respectively. The three tables show that the risk-return relationship is quite different in each sub-period.

First, there appears to be no steady relationship between return and the corresponding beta measurements in Table 5 that covers the 1989 market crash. The pattern of returns in each panel is non-linear, with U-shaped patterns being observed and the highest-beta portfolios consistently generating negative returns. Second, a different pattern of returns is shown in Table 6. When stocks are sorted by conventional beta, returns from the low to high-beta portfolios exhibit a downward pattern. The same patterns are observed when stocks are sorted by downside, upside and relative upside betas. When stocks are sorted by relative downside beta, returns from the low-beta to high-beta portfolios exhibit a U-shaped pattern.

[Insert Table 5 and Table 6 here]

Results for the period from January 2000 to December 2010, in Table 7, are more interesting. Consistently with findings of Ang et al. (2006), when stocks are sorted by conventional beta, returns plotted against beta estimates exhibit an upward pattern. When stocks are sorted by downside, relative downside, or relative upside beta, or by downside beta less upside beta, the upward pattern of returns versus corresponding beta measure becomes more evident. Finally, when stocks are sorted by upside beta, a clear downward pattern of returns is observed. Overall, this sub-period analysis reveals three different risk–return relationships depending on the sample period used.

[Insert Table 7 here]

To summarize, different types of portfolio return patterns appear when stocks are sorted by different beta measurements. The UK stock returns exhibit evidence of time sensitivity, especially during periods of financial crises and periods of low returns. When the entire constructed dataset is considered, an inverse pattern in returns versus beta appears, contrary to the conventional portfolio theory.

When the sample is shortened, the inverse pattern is still observed, however, the spreads between the highest-beta and lowest-beta portfolios become much narrower. If periods of notable financial crises are excluded from the dataset, an unexpected U-shaped pattern appears in returns of beta-grouped portfolios. In a sub-period analysis, three entirely different risk–return relationships are observed. The period from January 2000 to December 2010, with the subsample characterized by a long bull market, exhibits the risk-return relationship closest to that predicted by the conventional portfolio theory. This is difficult to explain but is most likely due to boom periods before and after the market slump offsetting the negative impact of the bull market.

6 Predictive power of downside beta

To investigate the predictive power of beta and downside beta, all stocks are sorted into five portfolios by values of beta, upside beta and downside beta. The previously described methodology is adopted, except that in the current analysis, the relationship between risk and excess returns one year in the future is calculated.

Table 8 shows that if stocks are sorted by conventional beta and downside beta, a

U-shaped pattern is observed in return versus beta. Notably, the second-lowest beta portfolio consistently generates the highest rate of return, while the highest-beta portfolio consistently suffers a loss. Overall, the predictive power of downside beta in the UK market is weak, however, the medium-ranked betas are consistently a positive signal of future returns to investors.

[Insert Table 8 here]

7 Conclusion

The UK stock returns exhibit unusual patterns when sorted by regular, downside and upside beta even after controlling for beta. If the full-length dataset is used, covering a number of financial crises, an inverse pattern of portfolio returns is observed, contrary to the classic literature. Such an anomaly can be expected in the short term, however, it is clearly demonstrated by this paper to persist in the long-run. To further explore this phenomenon, the sub-period analyses performed on modifications of the dataset tailored to contain only periods of financial crises and separately, excluding such periods, did not result in an observation of a consistent pattern in the risk-return relationship, while the predictive power of downside beta was observed to be weak. Overall, the UK data is clearly time-sensitive, especially during periods of financial crises. Moreover, high values of regular and downside betas have a negative impact on future returns. The inverse risk-return relationship indeed needs to be explored further. As the data sample is being examined with the primary focus on bear markets, it is suggested that time sensitivity could be a possible reason for the observed risk-return anomaly. The unusual risk-return pattern discussed in this paper implies that factors not conventionally well considered in asset pricing, such as the downside risk and time sensitivity, could have a pivotal impact on stock returns, causing a risk-return anomaly contrary to the long-acknowledged classic asset pricing literature. The results also suggest that, in the short term, the downside risk could reduce stock returns to investors, especially during financial crises. On the other hand, in the long term, predicting future returns by using the downside risk indicators such as downside beta and relative downside beta is difficult. Nevertheless, this study possesses an inevitable limitation: the construction of data sample examined in this paper requires each stock to have at least five years of consecutive data, resulting in omission of companies that were recently listed or did not stay in business for five years, and limiting the sample period, as the sample's end point in 2010 was chosen to ensure that a reasonable number of observations were included. As a result, the sample may be biased towards low-volatility stocks, observed to outperform high-volatility stocks during the sample period, even as the sample selection attempts to follow the pioneering studies of stock returns in the US market. In the course of future research, the risk–return relationship and the impact of downside risk in various stock markets will be examined, to perform a comprehensive comparison of stock markets with similar features and to validate the uniqueness of the anomaly found in the UK stock market.

Table 1 Stock Returns Sorted By Factor Loadings (Jan 1980-Dec 2010)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares from January 1980 to December 2010. The column labeled "return" reports the average annual stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	1.94%	0.32	0.51	0.36
2	0.66%	0.75	1.07	1.05
3	0.39%	1.00	1.39	1.45
4	0.35%	1.24	1.71	1.82
5 High	-2.82%	1.79	2.42	2.71
High - Low	-4.76%	1.47	1.91	2.36

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	1.24%	0.36	0.43	0.62
2	-0.06%	0.77	1.04	1.14
3	0.57%	1.01	1.39	1.47
4	-0.06%	1.23	1.73	1.75
5 High	-1.19%	1.73	2.50	2.41
High - Low	-2.43%	1.37	2.07	1.79

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	3.80%	0.41	0.81	0.19
2	0.60%	0.78	1.15	1.00
3	0.34%	1.00	1.38	1.45
4	-0.51%	1.21	1.62	1.87
5 High	-3.72%	1.70	2.14	2.88
High - Low	-7.52%	1.29	1.33	2.69

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	0.30%	0.66	0.65	1.41
2	-1.19%	0.86	1.11	1.37
3	-0.31%	1.01	1.39	1.49
4	1.04%	1.15	1.67	1.56
5 High	0.65%	1.41	2.28	1.55
High - Low	0.35%	0.75	1.63	0.14

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	3.65%	0.66	1.28	0.34
2	1.69%	0.83	1.25	1.03
3	0.61%	0.99	1.37	1.44
4	-1.14%	1.14	1.47	1.83
5 High	-4.28%	1.48	1.71	2.74
High - Low	-7.93%	0.82	0.43	2.39

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	-3.62%	1.24	1.34	2.45
2	-0.91%	1.05	1.34	1.72
3	0.73%	0.98	1.35	1.43
4	1.40%	0.91	1.38	1.14
5 High	2.90%	0.91	1.67	0.65
High - Low	6.53%	-0.33	0.33	-1.79

Table 2 UK Stocks Sorted By Factor Loadings (Jan 1980-Dec 2007)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares from January 1980 to December 2007. The column labeled "return" reports the average annual stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	5.95%	0.30	0.49	0.31
2	3.91%	0.73	1.05	0.98
3	3.00%	0.98	1.37	1.38
4	2.49%	1.20	1.66	1.75
5 High	-0.93%	1.74	2.36	2.64
High - Low	-6.88%	1.44	1.87	2.33

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	5.43%	0.35	0.41	0.56
2	3.11%	0.74	1.02	1.07
3	3.01%	0.98	1.36	1.41
4	2.34%	1.19	1.68	1.67
5 High	0.51%	1.68	2.45	2.34
High - Low	-4.92%	1.33	2.04	1.78

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	7.38%	0.39	0.78	0.15
2	3.64%	0.75	1.12	0.94
3	3.01%	0.97	1.35	1.38
4	1.97%	1.18	1.58	1.80
5 High	-1.59%	1.66	2.09	2.78
High - Low	-8.98%	1.27	1.31	2.64

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	4.19%	0.64	0.62	1.33
2	1.90%	0.84	1.09	1.32
3	2.36%	0.99	1.37	1.43
4	3.41%	1.12	1.63	1.50
5 High	2.53%	1.36	2.22	1.47
High - Low	-1.67%	0.72	1.60	0.14

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	6.58%	0.62	1.25	0.30
2	4.50%	0.79	1.21	0.97
3	3.32%	0.96	1.33	1.37
4	1.56%	1.11	1.44	1.75
5 High	-1.55%	1.46	1.69	2.65
High - Low	-8.12%	0.84	0.44	2.35

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	-0.66%	1.22	1.32	2.36
2	2.13%	1.03	1.32	1.66
3	3.35%	0.95	1.32	1.37
4	4.12%	0.87	1.34	1.07
5 High	5.46%	0.87	1.63	0.60
High - Low	6.11%	-0.35	0.32	-1.76

Table 3 UK Stocks Sorted By Factor Loadings (Excluding Financial Crises)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares January 1980 to December 2010 excluding the 1989 market crash (October 1989), the Dot-com bubble (March 2000 to October 2002) and subprime crisis (January 2008 to December 2010). The column labeled "return" reports the annual average stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	5.55%	0.31	0.53	0.31
2	5.25%	0.73	1.08	0.99
3	4.19%	0.98	1.40	1.38
4	3.10%	1.21	1.71	1.73
5 High	2.57%	1.71	2.40	2.53
High - Low	-2.98%	1.40	1.87	2.23

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	5.10%	0.36	0.45	0.56
2	4.43%	0.76	1.05	1.08
3	4.17%	0.98	1.40	1.39
4	3.41%	1.20	1.73	1.68
5 High	3.54%	1.65	2.49	2.22
High - Low	-1.56%	1.29	2.05	1.66

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	7.19%	0.39	0.82	0.17
2	5.01%	0.75	1.16	0.95
3	3.99%	0.98	1.40	1.37
4	3.00%	1.19	1.63	1.78
5 High	1.47%	1.64	2.12	2.67
High - Low	-5.73%	1.25	1.30	2.50

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	4.32%	0.65	0.65	1.28
2	3.43%	0.84	1.11	1.28
3	3.24%	0.99	1.40	1.42
4	4.54%	1.12	1.67	1.50
5 High	5.11%	1.35	2.29	1.46
High - Low	0.79%	0.70	1.64	0.18

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	6.98%	0.63	1.32	0.33
2	5.55%	0.80	1.26	0.98
3	4.08%	0.96	1.37	1.36
4	2.64%	1.11	1.48	1.73
5 High	1.41%	1.43	1.69	2.54
High - Low	-5.57%	0.80	0.37	2.20

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	1.94%	1.18	1.29	2.22
2	2.93%	1.02	1.33	1.62
3	4.43%	0.96	1.36	1.36
4	5.35%	0.89	1.40	1.09
5 High	6.00%	0.90	1.74	0.66
High - Low	4.06%	-0.28	0.45	-1.57

Table 4 UK Stocks Sorted By Factor Loadings (Mar 2000-Oct 2002)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares during the Dot-com bubble (March 2000-October 2002). The column labeled "return" reports the annual average stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	-1.64%	0.11	0.23	-0.05
2	-13.97%	0.60	0.88	0.82
3	-17.47%	0.94	1.30	1.44
4	-19.04%	1.27	1.71	2.06
5 High	-31.44%	2.04	2.64	3.59
High - Low	-29.79%	1.93	2.41	3.64

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	-2.39%	0.14	0.19	0.23
2	-13.58%	0.61	0.86	0.89
3	-17.19%	0.95	1.30	1.47
4	-21.62%	1.25	1.73	1.94
5 High	-28.79%	2.01	2.69	3.32
High - Low	-26.40%	1.86	2.50	3.09

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	-4.13%	0.19	0.49	-0.23
2	-13.21%	0.62	0.93	0.79
3	-16.67%	0.94	1.29	1.46
4	-18.86%	1.24	1.62	2.12
5 High	-30.69%	1.97	2.43	3.72
High - Low	-26.56%	1.78	1.94	3.95

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	-4.73%	0.48	0.43	1.26
2	-15.91%	0.74	0.97	1.28
3	-17.57%	0.95	1.30	1.49
4	-20.65%	1.21	1.68	1.83
5 High	-24.73%	1.58	2.38	2.00
High - Low	-20.00%	1.10	1.95	0.74

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	-9.70%	0.39	0.85	-0.10
2	-12.81%	0.64	0.97	0.80
3	-13.94%	0.93	1.27	1.45
4	-18.62%	1.20	1.54	2.10
5 High	-28.47%	1.80	2.14	3.61
High - Low	-18.77%	1.41	1.29	3.72

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	-24.94%	1.54	1.74	3.28
2	-15.44%	1.15	1.47	2.04
3	-15.12%	0.91	1.24	1.43
4	-14.38%	0.72	1.08	0.89
5 High	-13.69%	0.65	1.24	0.21
High - Low	11.24%	-0.89	-0.50	-3.07

Table 5 UK Stocks Sorted By Factor Loadings (Jan 1980-Dec 1989)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares from January 1980 to December 1989. The column labeled "return" reports the annual average stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	2.14%	0.41	0.61	0.53
2	1.07%	0.78	1.06	1.15
3	2.51%	0.96	1.30	1.42
4	2.13%	1.11	1.50	1.65
5 High	-2.73%	1.42	1.94	2.08
High - Low	-4.87%	1.01	1.33	1.55

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	2.40%	0.45	0.56	0.74
2	0.97%	0.79	1.05	1.20
3	1.87%	0.96	1.30	1.45
4	1.11%	1.10	1.52	1.58
5 High	-1.26%	1.38	2.00	1.86
High - Low	-3.66%	0.93	1.44	1.12

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	2.78%	0.48	0.82	0.39
2	0.94%	0.81	1.16	1.10
3	1.73%	0.96	1.31	1.41
4	2.04%	1.09	1.44	1.69
5 High	-2.37%	1.34	1.69	2.23
High - Low	-5.15%	0.86	0.87	1.84

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	2.54%	0.66	0.71	1.31
2	1.13%	0.84	1.08	1.36
3	1.78%	0.96	1.29	1.42
4	1.41%	1.03	1.47	1.40
5 High	-1.76%	1.19	1.86	1.33
High - Low	-4.31%	0.52	1.15	0.01

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	1.83%	0.65	1.15	0.50
2	1.46%	0.87	1.26	1.13
3	1.43%	0.96	1.31	1.41
4	0.91%	1.03	1.32	1.65
5 High	-0.55%	1.18	1.39	2.14
High - Low	-2.38%	0.53	0.25	1.64

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	0.52%	1.01	1.13	1.93
2	1.35%	0.97	1.23	1.58
3	1.97%	0.95	1.29	1.41
4	0.58%	0.90	1.32	1.17
5 High	0.66%	0.85	1.46	0.74
High - Low	0.14%	-0.16	0.33	-1.19

Table 6 UK Stocks Sorted By Factor Loadings (Jan 1990-Dec 1999)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares from January 1990 to December 1999. The column labeled "return" reports the average annual stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	2.59%	0.21	0.37	0.16
2	-1.08%	0.68	1.00	0.89
3	-3.03%	0.95	1.35	1.33
4	-3.53%	1.20	1.67	1.75
5 High	-8.02%	1.78	2.47	2.70
High - Low	-10.61%	1.58	2.10	2.53

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	1.43%	0.27	0.28	0.45
2	-1.41%	0.70	0.96	0.99
3	-2.90%	0.96	1.34	1.37
4	-3.64%	1.18	1.70	1.65
5 High	-6.55%	1.72	2.57	2.37
High - Low	-7.98%	1.45	2.29	1.92

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	3.66%	0.29	0.70	0.01
2	-1.74%	0.69	1.05	0.86
3	-2.33%	0.94	1.33	1.34
4	-3.79%	1.18	1.59	1.79
5 High	-8.87%	1.71	2.18	2.83
High - Low	-12.53%	1.42	1.48	2.81

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	-0.11%	0.56	0.49	1.21
2	-3.44%	0.80	1.04	1.26
3	-3.14%	0.95	1.34	1.37
4	-2.54%	1.11	1.64	1.50
5 High	-3.85%	1.38	2.34	1.50
High - Low	-3.74%	0.82	1.86	0.30

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	1.93%	0.55	1.23	0.19
2	-0.41%	0.74	1.16	0.89
3	-1.28%	0.93	1.31	1.33
4	-4.34%	1.11	1.44	1.75
5 High	-8.95%	1.48	1.70	2.68
High - Low	-10.88%	0.93	0.47	2.49

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	-7.33%	1.19	1.25	2.32
2	-3.45%	1.02	1.31	1.64
3	-1.72%	0.92	1.29	1.32
4	-0.57%	0.84	1.32	1.02
5 High	-0.01%	0.84	1.68	0.54
High - Low	7.32%	-0.35	0.43	-1.78

Table 7 UK Stocks Sorted By Factor Loadings (Jan 2000-Dec 2010)

This table presents the relationship between excess stock returns and factor loadings. The sample uses FTSE All Shares from January 2000 to December 2010. The column labeled "return" reports the average annual stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	1.11%	0.37	0.58	0.45
2	2.25%	0.81	1.15	1.14
3	2.66%	1.09	1.50	1.59
4	3.31%	1.38	1.88	2.01
5 High	2.67%	2.03	2.68	3.15
High - Low	1.56%	1.66	2.10	2.70

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	0.28%	0.42	0.51	0.71
2	0.72%	0.83	1.13	1.25
3	3.42%	1.09	1.50	1.60
4	2.99%	1.37	1.89	1.96
5 High	4.59%	1.98	2.76	2.82
High - Low	4.31%	1.56	2.25	2.10

Panel 3 Stocks Sorted by β^+

Portfolio	Return	β	β^-	β^+
1 Low	4.62%	0.49	0.91	0.24
2	2.87%	0.84	1.24	1.08
3	2.29%	1.08	1.48	1.58
4	1.33%	1.34	1.78	2.08
5 High	0.89%	1.93	2.38	3.36
High - Low	-3.73%	1.43	1.47	3.12

Panel 4 Stocks Sorted by Relative β^-

Portfolio	Return	β	β^-	β^+
1 Low	-0.73%	0.77	0.77	1.69
2	-0.31%	0.92	1.19	1.50
3	1.34%	1.11	1.51	1.66
4	4.63%	1.28	1.82	1.73
5 High	7.07%	1.60	2.49	1.75
High - Low	7.80%	0.83	1.71	0.06

Panel 5 Stocks Sorted by Relative β^+

Portfolio	Return	β	β^-	β^+
1 Low	-2.74%	1.43	1.56	2.91
2	-0.03%	1.13	1.44	1.89
3	2.19%	1.05	1.45	1.56
4	3.68%	0.99	1.48	1.22
5 High	7.14%	1.02	1.80	0.71
High - Low	9.54%	-0.43	0.22	-2.22

Panel 6 Stocks Sorted by $(\beta^- - \beta^+)$

Portfolio	Return	β	β^-	β^+
1 Low	-2.39%	1.45	1.58	2.92
2	0.32%	1.14	1.45	1.90
3	2.54%	1.07	1.46	1.57
4	4.03%	1.00	1.49	1.23
5 High	7.49%	1.03	1.81	0.72
High - Low	9.89%	-0.42	0.23	-2.20

Table 8 UK Stocks Sorted By Factor Loadings With Future Excess Return

This table presents the relationship future excess stock returns and factor loadings. The sample uses FTSE All Shares from January 1980 to December 2009, the following year's excess returns are taken as the future excess return. The column labeled "return" reports the average annual future stock returns over one-month gilt rate. "High-Low" reports the difference between portfolio 5 and portfolio 1.

Panel 1 Stocks Sorted by β

Portfolio	Return	β	β^-	β^+
1 Low	3.44%	0.30	0.49	0.31
2	4.01%	0.73	1.05	0.98
3	2.95%	0.98	1.37	1.38
4	1.62%	1.20	1.66	1.75
5 High	-3.43%	1.74	2.36	2.64
High - Low	-6.87%	1.44	1.87	2.33

Panel 2 Stocks Sorted by β^-

Portfolio	Return	β	β^-	β^+
1 Low	2.88%	0.35	0.41	0.56
2	4.49%	0.74	1.02	1.07
3	3.25%	0.98	1.36	1.41
4	1.40%	1.19	1.68	1.67
5 High	-3.43%	1.68	2.45	2.34
High - Low	-6.31%	1.33	2.04	1.78

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