Low-Risk Anomaly: Evidence from India

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Abstract

The low-risk anomaly in the Indian equity market is explored using a broad universe of 4,400 companies over 15 years in India. The anomaly is characterised by a strong convex relationship between returns and volatility. We describe the methodology used to construct five low-risk factors using realised volatility, ex-ante beta, CAPM beta, and realised IVOL as measures of risk. Our findings demonstrate that lower-risk portfolios constructed using these measures exhibit higher risk-adjusted returns than high-risk portfolios. The strength of the anomaly is robust across firm size and does not appear to diminish over time. There is clear evidence of the low-risk anomaly in the Indian equities market even after controlling for the standard academic factors.

Keywords— Factors, Low Risk, Low Volatility, Indian Equity

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1. Introduction

Intuitively, investors should be paid for bearing idiosyncratic risk: the higher the risk, the higher the expected return, resulting in a positive relationship between non-systematic risk and returns in equilibrium. Under CAPM, the volatility of the stock return itself should not matter. Black, Jensen, and Scholes (1972) found a positive relationship between beta (another measure of volatility) and returns. However, the relationship was "too flat" compared to what CAPM predicted. Fama and French (1992) noted that "beta shows no power to explain average returns", and its estimate of the relationship between the two was statistically insignificant. If anything, their estimates indicated that the relation between beta and returns was negative.

Subsequently, several researchers have found a significant inverse relationship between future stock returns and different measures of return variability, such as volatility, beta, and idiosyncratic volatility. This phenomenon is known as the "low-risk" or "low-volatility" anomaly. Empirical evidence suggests that portfolio returns are convexly related to return variability in both US and international markets. Several studies, including those by Ang, Hodrick, Xing, and Zhang (2006, 2008), Blitz and van Vliet (2007), Baker, Bradley, and Wurgler (2011); Baker and Haugen (2012), and Frazzini and Pedersen (2014) have documented these findings controlling for several variables, from size and value to institutional ownership and analyst coverage. This low-volatility anomaly is seemingly pervasive: United States and international stocks (including India[1]), bonds, commodities, foreign exchange, and derivatives. These findings contradict economic intuition: a higher expected return should compensate for the higher expected risk.

Risk-based or rational and behavioural theories have been proposed to explain the anomaly. On the rational explanations Blitz, Falkenstein, and Van Vliet (2014) outline constraints and relative performance objectives.

- **Constraints**: Many investors cannot sell short or use leverage due to their mandates or lack of resources leading to the low-risk effect. Investors with the most optimistic expectations tend to increase the prices of risky assets. However, when there are not enough short-sellers, Miller (1977) argues that the relationship between risk and return is flattened. Internationally, short-selling is often restricted by mandate or access, and in India, regulations make short-selling very restrictive. The CAPM predicts a certain slope for the security market line, but Brennan (1971) and Black and Scholes (1974) showed that leverage constraints could flatten this line. Frazzini and Pedersen (2014) found that the low-risk anomaly tends to be stronger when leverage constraints are tighter.
- **Relative Performance rather than Absolute Performance**: A second explanation for the low-risk effect is that some investors focus on beating the market average rather than achieving absolute performance. While the CAPM assumes that investors only care about absolute returns, many investors are benchmark-relative and prefer to outperform the market relatively. Blitz and van Vliet (2007); Baker et al. (2011), under CAPM assumptions, low-risk stocks are unattractive to benchmark-relative

[1]See Agarwalla, Jacob, Varma, and Vasudevan (2014); Joshipura and Joshipura (2016); Pandey and Sehgal (2017); Joshipura and Peswani (2018); Raju and Teli (2022)

investors because they have high tracking errors and lower expected returns. Falkenstein (2009) shows that if investors only care about performance relative to others, the relationship between risk and return is flat in equilibrium, with no risk premiums left. This conflicts with the existence of a global equity premium. Building on the two-layered portfolio of Shefrin and Statman (2000), Blitz (2014) proposes a two-stage investment process to explain the low-risk anomaly. He argues that investors first rely on absolute performance criteria to make asset allocation decisions and then switch to a relative performance objective when selecting the securities within each asset class.

On the behavioural side, lottery-seeking preferences underpin the anomaly. Investors looking for a big payoff ("lottery seekers") find high-risk stocks attractive because they provide the possibility of unlimited gains with clearly understood downside risk[2]. Agarwal, Jiang, and Wen (2022) find that smaller (and more recently launched) funds with poor recent performance own "lottery-like" stocks, doubtless a last throw of the dice to boost performance required for survival. This behaviour is also observed in mutual funds due to the asymmetric nature of the relationship between AUM flows and performance, the motivation of asset managers to create high-beta products (Sirri and Tufano, 1998). In addition to lottery seeking, behavioural biases, such as attention-grabbing bias, representativeness bias, and overconfidence, can cause investors to irrationally prefer higher-risk stocks over lower-risk stocks (Blitz and van Vliet, 2007; Baker et al., 2011; Barber and Odean, 2008).

Hou and Loh (2016) conducted an analysis of the various explanations for the low volatility anomaly and grouped them into three categories: (i) lottery preferences, (ii) market frictions such as illiquidity, and (iii) a broad category of "other" factors that include uncertainty, short-selling restrictions, financial distress, investor neglect, growth options, earnings shocks, and other variables. Individually, each of these explanations represented less than 10% of the low volatility anomaly. However, when the explanations for lottery preferences were considered together, they explained almost half of the low volatility puzzle. Nevertheless, approximately half of the volatility puzzle remains unexplained.

When dealing with an anomaly, it is crucial to determine whether a substantial and stable group of investors is willing to trade against it. Market portfolios are the only portfolios that investors can own simultaneously because they represent the combined positions of all investors. Therefore, for an anomaly, as it has a portfolio that is not a market portfolio, some investors need to take the opposite position. Han and Kumar (2013) show retail investors predominantly hold and trade stocks with high idiosyncratic volatility that serves as a sustainable pool of investors who are "on the other side" of the low-risk anomaly trade. Note that benchmarked-constrained institutional investors will not participate in the low-risk anomaly.

[2]See Barberis and Huang (2008); Blitz and van Vliet (2007); Baker et al. (2011); Ilmanen (2012)

2. The Low Risk Anomaly

The general idea of low-risk strategies is to buy (overweight) low-risk assets and to short (underweight) high-risk assets. The academic literature typically estimates risk using metrics such as volatility or beta. Both are closely related metrics, as the beta of a stock to the market index is as follows:

$$\beta_i = \frac{\sigma_i \rho_{i,mkt}}{\sigma_{mkt}} \tag{1}$$

where, σ_i is the volatility of the stock i, $\rho_{i,mkt}$ is its correlation with the market, and σ_{mkt} is the volatility of the market. In cross-sectional comparisons, the market volatility is constant and hence irrelevant. As such, defining low-risk based on volatility or beta is effectively a choice on the added value of correlations.

The literature on the low-risk anomaly defines volatility as either realised volatility or idiosyncratic volatility. Beta also has two approaches, the ex-ante beta and CAPM realised beta. Blitz and van Vliet (2007); Blitz, Van Vliet, and Baltussen (2019) found that portfolios of low volatility stocks earn higher risk adjusted returns than portfolios of high volatility stocks and that other well-known effects, such as value and size, cannot explain the volatility effect. Ang et al. (2006, 2008) used short-term (1 month) idiosyncratic volatility (IVOL) and found that stocks with high IVOL in one month have low returns the next month, and these returns held when controlling for a variety of factors. Both studies remained close to the Fama and French (1993, 2015) factor construction approach.

Suppose that there is no correlation between risk and return. In this case, a hedge portfolio of long low-risk and short high-risk securities should result in an average return of zero and a negative CAPM beta. Frazzini and Pedersen (2014) construct a Betting-Against-Beta (BAB) factor that converts the zero premium associated with the flat risk-return relationship into a positive one with zero beta. This is achieved by dynamically adjusting the leverage of the long low-risk portfolio upwards to a beta of 1 while decreasing the leverage of the short high-risk portfolio to a beta of 1. Instead of estimating betas as slope coefficients of CAPM regression, Frazzini and Pedersen calculate ex ante betas by combining market correlations estimated using five years of overlapping three-day returns with volatilities estimated using one year of daily data. Novy-Marx and Velikov (2022) criticise the methodological assumptions behind BAB and argue that a large part of the premium is driven by dynamic hedging and shorting highly illiquid stocks in the bottom 1% of total market capitalisation. The beta anomaly is not that stocks with high betas have low returns; rather, it is that stocks with high betas have high volatilities and, thus, lower Sharpe ratios than low-beta stocks.

Although studies such as Agarwalla et al. (2014); Joshipura and Joshipura (2016); Ali and Badhani (2021); Peswani and Joshipura (2022); Raju and Teli (2022); Sehgal, Rakhyani, and Deisting (2022); Ali, Badhani, and Kumar (2022) show the existence of a low-risk anomaly in India, the evidence is not unequivocal. Rakhyani (2021) finds that there is a low-beta anomaly in India, but "*it is very small in respect to the size effect*" and that transaction costs easily nullify any low-beta premium. Pandey and Samanta (2016); Khandelwal and Chotia (2022) do not find evidence of the anomaly in the Indian capital markets.

Except for Agarwalla et al. (2014), most studies in the Indian market use the Nifty 200 or Nifty 500 constituents as the universe. Using a universe of approximately 900 stocks on average between 1997 and 2018, Peswani and Joshipura (2019) show the low-volatility effect is evident across size. Agarwalla et al. use a universe of approximately 3,500 stocks between 1993 and 2013 to show that the Betting Against Beta factor "*earns significant positive returns in India*". In 2021, they refined the universe to exclude, amongst other criteria, micro-cap and penny stocks, which in 2019-20, eliminated the over a quarter of the stocks from their starting universe for the period[3].

This paper makes a significant contribution to the growing body of research on the low-risk anomaly in the Indian equity market. Unlike previous studies, we use a much larger universe of approximately 4,400 companies, with an average of 2,350 firms being evaluated on any month, and categorize them into Top 200, 201-500, 501-1000, and 1000+ to demonstrate that the low-risk anomaly exists across size categories. This classification provides practitioners with valuable insights into low-volatility products available in the Indian market while providing researchers evidence from a significantly larger sample of firms. In addition, our analysis covers the period from 2007 to 2023, providing out-of-sample evidence from earlier studies that the anomaly persists over time.

Furthermore, we present clear evidence of the low-risk effect using various metrics, including realised volatility, beta, or IVOL, and show that the results are robust to portfolio construction and time. We use both market cap value and equal weight variants of the Fama French breakpoints and methodology for portfolio construction, and Frazzini and Pedersen (2014)'s novel weights. The sub-portfolios for each factor are well-diversified, making them pragmatic estimators of the true low-risk premium in Indian equities.

Moreover, we provide a detailed methodology for creating five low-risk beta-neutral factors that follow a long-short strategy. The mehodology follows the accepted Fama and French (2015) methodology adapted for the Indian context (Raju, 2022b). This effort is part of an ongoing project to offer a comprehensive and updated monthly set of academic factor data for the Indian equity market, analogous to the Ken French dataset[4]. Practitioners and researchers can access this dataset, which includes the Fama French 3 and 5 Factors and Momentum Factor for the Indian Market, on the Invespar website (https://invespar.com/research).

In summary, this study contributes to the literature on the low-risk anomaly in the Indian equity market by using a much larger universe, providing out-of-sample evidence, demonstrating the anomaly's robustness, and offering a comprehensive set of academic factor data for practitioners and researchers.

[3]See https://faculty.iima.ac.in/~iffm/Indian-Fama-French-Momentum/
[4]Available at https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The rest of this paper is organised as follows: Section 3 discusses our methodology and data sources; Section 4 presents our results; and we conclude in Section 5.

3. Methodology and Data

3.1. Methodology

We construct equal-weight and market-cap weighted decile portfolios at the end of each month by ranking stocks on the following:

1. **Realised Volatility**: following Blitz and van Vliet (2007), we use 3-year volatility.
2. **Beta**

   (a) ***Ex-ante Beta***: following Frazzini and Pedersen (2014), we estimate ex ante beta for the stock i based on:

   $$\hat{\beta}_i^{TS} = \hat{\rho}\frac{\hat{\sigma}_i}{\hat{\sigma}_m} \tag{2}$$

   where $\hat{\sigma}_i$ and $\hat{\sigma}_m$ are the estimated stock and market volatilities, and $\hat{\rho}$, their correlation. While Frazzini and Pedersen use daily data, we use monthly data in our estimates of ex ante beta with a rolling standard deviation of 1 year for volatilities and a 5-year horizon for the correlation as "*correlations appear to move more slowly than volatilities*" (Frazzini and Pedersen, 2014).13 Second, since we use only monthly data, rolling 1- and 5-year windows with at least 12 and 36 observations are used to calculate volatilities and correlations, respectively. Furthermore, we shrink the time series beta estimate for the stock i (β_i^{TS}) toward the cross-sectional mean (β^{XS}) (see Vasicek (1973); Frazzini and Pedersen (2014)):

   $$\hat{\beta}_i = w_i\hat{\beta}_i^{TS} + (1 - w_i)\hat{\beta}_{XS} \tag{3}$$

   Equation 3 requires w_i to be estimated separately for each stock. Rather than having stock-specific and time-varying shrinkage factors, it is common in the literature (Frazzini and Pedersen, 2014; Agarwalla et al., 2014) to use a single w for all stocks. We set $w = 0.70$ and $\beta^{XS} = 1$ for all periods and in all stocks[5].

   (b) **CAPM Beta** Novy-Marx and Velikov (2022) criticise the "novel beta estimation technique" used by Frazzini and Pedersen (2014) and prefer the more traditional beta estimation as slope coefficients of CAPM regressions. We estimate the CAPM betas (B_{CAPM}) using rolling monthly returns for 36 months. We use the market factor returns from Agarwalla, Jacob, and Varma (2013) and Raju (2022b) as the independent variable in the CAPM equation.

[5]The bayesian shrinkage factor by Vasicek (1973) $w_i = 1 - \sigma^2_{i,TS}/(\sigma^2_{i,TS} + \sigma^2_{XS})$, where $\sigma^2_{i,TS}$ is the rolling 60-month variance of the beta estimate for security i, and σ^2_{XS} is the cross-sectional variance of the betas. The pooled average w is 0.78 for all stocks in our universe of Indian stocks. This compares with the pooled average of 0.7 of Agarwalla et al. (2014) and is close to the mean w of 0.61 for the universe of US equity reported by Frazzini and Pedersen (2014). Using $w = 0.6$ or 0.8 does not change our results.

3. **Idiosyncratic Volatility** (IVOL) Following standard academic practice (see Ang et al. (2006)), we measure idiosyncratic risk against the three-factor model Fama and French (1993) (FF3). IVOL is the standard deviation of the residuals from regressions of monthly excess returns on the FF3, using 36 consecutive monthly returns[6]:

$$r_{it} - r_{ft} = a_i + b_i(R_{Mt} - r_{ft}) + s_i SMB + h_i HML + \epsilon_{it} \tag{4}$$

where r_{it} is the monthly return of the stock i, r_{ft} the risk-free rate, both for the month t and $(R_{Mt} - r_{ft})$, SMB and HML represent the market, size, and values, respectively. IVOL, following Ang et al. (2006) is:

$$IVOL = \sqrt{\mathrm{Var}(\epsilon_{it})} \tag{5}$$

where ϵ_{it} is the residual error term from Equation 4.

We have a common measurement approach by adopting monthly returns across all our low-risk measures and a minimum 36-month window of measurement. We construct low-risk market neutral and self-financing factor portfolios using two methods:

1. **Frazzini and Pedersen portfolios and weights for the BAB$_{FP}$ factor**: We follow Frazzini and Pedersen (2014) and construct long-short beta portfolios to estimate the BAB$_{FP}$ factor returns. All stocks are ranked in ascending order according to their ex ante beta estimated from Equation 3 to construct the factor. Each month, stocks are assigned to one of two portfolios, low-beta and high-beta, using the median estimated ex-ante beta as the breakpoint. The portfolios are weighted by ranked betas - lower beta securities have larger weights in the low beta portfolio, while higher beta stocks have larger weights in the high beta portfolio. If z is the vector of ex ante beta ranks ($z_i = \mathrm{rank}(\beta_{it})$) at portfolio formation and let $\bar{z}$ be the mean rank of z, the portfolio weights of the low-beta and high-beta portfolios are:

$$\begin{aligned} w_H &= k(z - \bar{z})^+ \\ w_L &= k(z - \bar{z})^- \end{aligned} \tag{6}$$

where $k = 2/(\sum_{i=1}^{n} |z_i - \bar{z}|)$. To construct the BAB$_{FP}$ factor, the high- and low-beta portfolios are rescaled to have a beta of one at the time of portfolio formation. The BAB$_{FP}$ is a beta-neutral portfolio that is long the low-beta portfolio and short sells the high-beta portfolio.

$$r_t^{BAB_{FP}} = \frac{(r_t^L - r_{f,t})}{\grave{\beta}_{t-1}^L} - \frac{(r_t^H - r_{f,t})}{\grave{\beta}_{t-1}^H} \tag{7}$$

where r_t^L and r_t^H are the weighted returns in the low beta and high beta portfolios for time t, $r_{f,t}$ is the risk-free rate for t, and $\grave{\beta}_{t-1}^L$ and $\grave{\beta}_{t-1}^H$ are the realised beta of the low- and high-beta portfolios using CAPM regression of excess returns of the respective portfolios against the market factor. We do not follow

[6]We do not use Ang et al.'s short-duration method, rather preferring to evaluate IVOL using 36 months (see Li, Sullivan, and Garcia-Feijóo (2014)).

Frazzini and Pedersen (2014), who use the matrix product of the ex ante beta vector and the respective weight from equation 6.

2. **Fama and French portfolio construction**: We adopt the more standard Fama and French (2015) methodology for portfolio construction with suitable adaptations for the Indian market detailed in Raju (2022b). Each month, the stocks are classified into two size categories: *Big* stocks are those in the top 90% of the market cap for the month and *Small* stocks are those in the bottom 10%. Independently, the five low-risk metrics (realised volatility (VOL), ex ante beta (Beta_{FP}), CAPM beta (Beta_{CAPM}) and IVOL for each stock are calculated for the months, and three portfolios (Low-Risk, Neutral, and High-Risk) created using the 30th and 70th percentiles of respective metrics for the *Big* stocks. Fama and French (2015) use this break point to minimise the effect of outliers in less liquid *Small* stocks. The weights for each stock in the respective portfolio are its market cap proportion.

   The long-short low-risk factor portfolio is constructed using portfolios based on size and each of the low-risk metrics. The double-sorted portfolios are value-weighted and constructed each month and include all the relevant stocks in our universe. The factor portfolio is long the *Big* and *Small* low-risk portfolios, short-sells the *Big* and *Small* high-risk portfolios, and market beta-neutral.

$$r_t^{LR} = \frac{1}{2}\left(\frac{(r_t^{BL} - r_{f,t})}{\grave{\beta}_{t-1}^{BL}} + \frac{(r_t^{SL} - r_{f,t})}{\grave{\beta}_{t-1}^{SL}}\right) - \frac{1}{2}\left(\frac{(r_t^{BH} - r_{f,t})}{\grave{\beta}_{t-1}^{BH}} + \frac{(r_t^{SH} - r_{f,t})}{\grave{\beta}_{t-1}^{SH}}\right) \tag{8}$$

   where r_t^{LR} is the return of the Low-Risk beta-neutral factor portfolio for the month t, r_t^{BL} and r_t^{SL} are the period returns for the *Big* Low-Risk and *Small* Low-Risk portfolios, r_t^{BH} and r_t^{SH} are the period returns for the *Big* High-Risk and *Small* High-Risk portfolios, $r_{f,t}$ the period risk-free returns, and $\grave{\beta}^{BL}$, $\grave{\beta}^{SL}$, $\grave{\beta}^{BH}$, and $\grave{\beta}^{SH}$ the rolling 36-month realised CAPM betas of the two low and high-risk portfolios, respectively.

We create five different low-risk factors VOL, BAB_{FP}, BAB_{FF}, BAB_{CAPM}, and IVOL using the low-risk measures and portfolio construction methods outlined above, and summarised in Table 1. Following standard academic construction, each low-risk factor is a portfolio that goes long low-beta assets, leveraged to a beta of 1, and shorts high-beta assets, deleveraged to a beta of 1. By the leveraging and deleveraging, we make all these factors beta neutral (and hence almost market neutral) by using rolling 36-month realised CAPM betas for the respective portfolios that make up a factor. The BAB_{FP}, with its novel construction, contrasts and emphasises the role of construction in empirical asset pricing models.

We calculate the return over the month following portfolio formation for each decile and factor portfolio. From this time series, we calculate the mean return, the standard deviation, the skew, and the Sharpe ratio. We use the approach of Memmel (2003) to statistically test the significance of the difference between two Sharpe ratios.

$$z = \frac{sr_i - sr_j}{\sqrt{\frac{1}{T}\left(2(1-\rho_{i,j}) + \frac{1}{2}(sr_i^2 + sr_j^2 - sr_i sr_j(1+\rho_{i,j}^2))\right)}} \tag{9}$$

Table 1: Summary of low-risk beta-neutral factors

Low-Risk Factor	Metric	Portfolio Schema	Weight Scheme	Factor Return
VOL	3-year realised volatility (VOL)	2x3 double Sorted on Size and VOL	Market Weight	$\frac{1}{2}\left(\frac{(r_t^{BL}-r_{f,t})}{\beta_{t-1}^{BL}}+\frac{(r_t^{SL}-r_{f,t})}{\beta_{t-1}^{SL}}\right)-\frac{1}{2}\left(\frac{(r_t^{BH}-r_{f,t})}{\beta_{t-1}^{BH}}+\frac{(r_t^{SH}-r_{f,t})}{\beta_{t-1}^{SH}}\right)$
BAB_{FP}	ex-ante $Beta_{FP}$	Low and High Beta Portfolios	Beta Rank Weights	$\frac{(r_t^{L}-r_{f,t})}{\beta_{t-1}^{L}}-\frac{(r_t^{H}-r_{f,t})}{\beta_{t-1}^{H}}$
BAB_{FF}	ex-ante $Beta_{FP}$	2x3 double Sorted on Size and $Beta_{FP}$	Market Weight	$\frac{1}{2}\left(\frac{(r_t^{BL}-r_{f,t})}{\beta_{t-1}^{BL}}+\frac{(r_t^{SL}-r_{f,t})}{\beta_{t-1}^{SL}}\right)-\frac{1}{2}\left(\frac{(r_t^{BH}-r_{f,t})}{\beta_{t-1}^{BH}}+\frac{(r_t^{SH}-r_{f,t})}{\beta_{t-1}^{SH}}\right)$
BAB_{CAPM}	36-month $Beta_{CAPM}$	2x3 double Sorted on Size and $Beta_{CAPM}$	Market Weight	$\frac{1}{2}\left(\frac{(r_t^{BL}-r_{f,t})}{\beta_{t-1}^{BL}}+\frac{(r_t^{SL}-r_{f,t})}{\beta_{t-1}^{SL}}\right)-\frac{1}{2}\left(\frac{(r_t^{BH}-r_{f,t})}{\beta_{t-1}^{BH}}+\frac{(r_t^{SH}-r_{f,t})}{\beta_{t-1}^{SH}}\right)$
IVOL	36-month IVOL	2x3 double Sorted on Size and IVOL	Market Weight	$\frac{1}{2}\left(\frac{(r_t^{BL}-r_{f,t})}{\beta_{t-1}^{BL}}+\frac{(r_t^{SL}-r_{f,t})}{\beta_{t-1}^{SL}}\right)-\frac{1}{2}\left(\frac{(r_t^{BH}-r_{f,t})}{\beta_{t-1}^{BH}}+\frac{(r_t^{SH}-r_{f,t})}{\beta_{t-1}^{SH}}\right)$

where sr is the Sharpe ratio of, $\rho_{i,j}$ is the correlation between the portfolios i and j and T is the number of observations.

3.2. Data

The data used to construct low-risk portfolios are sourced from Refinitiv and Datastream. Specifically, we use the Worldscope India database (Datastream code *WSCOPEIN*) which includes 4,331 firms that are or were listed on the NSE or BSE. To provide a comprehensive view of the market capitalisation distribution for these firms, we present data at the end of September, coinciding with the annual formation of size portfolios, in Table A1. The number of firms covered annually during the period has progressively increased from almost 1,900 in 2007 to approximately 2,600[7] in 2022. On average there are 2,350 firms on any given month. The total market capitalisation has grown five times during the period, from ₹49 trillion in 2007 to ₹256 trillion in 2022. The average market capitalisation of firms in our universe has increased four times between 2007 and 2022, from ₹26 billion to over ₹98 billion.

The factor data and risk-free rates used in our analysis are sourced from Invespar's "Data Library: Fama French 3 and 5 Factors and Momentum Factor for the Indian Market"[8] (Raju, 2022b,a) for the period between October 2004 and February 2023. For the market factor and risk-free rates used to calculate the CAPM betas before October 2004, we use the "Fama French and Momentum Factors: Data Library for Indian Market"[9] from the Indian Institute of Management, Ahmedabad (Agarwalla et al., 2013). The market factor represents the market value weighted returns of all relevant stocks during the period.

The underlying data for calculating the several low-risk metrics is sourced directly from Refinitiv or Datastream. We used the field *191E* from Datastream to obtain data on 3-year volatility, while the betas are computed

[7]The specific exclusions to deal with dead firms, firms with negative book values, firms with no reported market value, penny stocks and micro-cap stocks are detailed in Raju (2022b).

[8]Available at https://invespar.com/research.

[9]Available at https://faculty.iima.ac.in/~iffm/Indian-Fama-French-Momentum/.

using monthly total returns from Datastream and the Market Factor from the factor libraries. The IVOL was calculated using the monthly total returns for stocks from Datastream and the Fama-French 3-Factor model returns from Invespar's Data Library. Finally, the total returns of Nifty100 are sourced from the Nifty Indices website[10].

4. Results and Discussion

4.1. The Low Risk Anomaly

Figure A1 shows the best-fit lines for decile portfolios constructed using the four low-risk measures, namely, realised volatility, ex ante beta, realised CAPM beta, and realised IVOL. Panel A shows these for equal-weighted (EW) and panel B for market-weighted (MW) decile portfolios. Our sample data spans between October 2007 and February 2023 (184 monthly returns). In both the EW and the MW portfolios, the lower-risk portfolios exhibit higher-risk adjusted returns. The EW portfolios display greater variability in the strength of the anomaly, whereas the evidence of the anomaly is more consistent among the MW portfolios. In both weighting schemas, the evidence for the low-risk anomaly is clear. For EW, the convexity is more defined in the beta sorted portfolios, where the Sharpe ratios increase across the early deciles and then decreases as risk increases. For volatility sorted portfolios, the increase in Sharpe ratio across the early deciles is less visible. Peswani and Joshipura (2019) in their study also observed that excess returns "monotonically decrease from the portfolio of low-volatility stocks (P1) to the portfolio of high-volatility stocks (P5)". For MW portfolios, as we will see, the top-heavy nature of the Indian equities market reflects the trajectory of the large cap firms across risk deciles.

This study contributes to the literature on the low-risk anomaly by examining portfolios created based on both size and low-risk measures. The unique feature of this study is the inclusion of a wide universe of firms, which allows for extending the results of prior research that has utilized smaller universes. The sample of firms is categorized into four size categories based on market capitalization, namely Top 200, 201-500, 501-1000, and 1000+. The Top 200 category represents the 200 largest firms by market cap and constitutes the most liquid segment of the top-heavy Indian equities market. Notably, these firms are likely constituents of popular indices such as the Nifty and S&P BSE 200. The Top 200, along with the firms categorised as 201-500, are comparable to the Nifty 500 index.

After classification by size, firms are ranked based on their low-risk metric, and decile portfolios are formed for each size group. This double-sort method generates 40 portfolios (4x10) for each low-risk metric. The results, depicted in Figure A2, show the compounded excess returns and annualized standard deviations for each decile portfolio, along with the convex lines of best fit. The graphs are presented for each low-risk metric, with Panel A displaying the four charts for each size-low-risk metric EW portfolio, while Panel B shows the MW portfolios for each risk metric. All size-low-risk decile portfolios exhibit convex lines of best fit for the Sharpe ratios,

[10] https://www.niftyindices.com/

providing evidence that the low-risk anomaly exists across size. The double-sorted methodology is a robust technique to evaluate if the low-risk anomaly is related to size of firm. The "out-of-sample" evidence is shown in Figure A3. Earlier studies covered periods upto September 2018, often with smaller universes. We show the low risk anomaly is robust over time, as we separately consider October 2007 to September 2018, overlapping with earlier studies, and the "out-of-sample" period since September 2018. The result holds irrespective of the weighting schema or the choice of low-risk metric.

Comprehensive statistics on excess returns, standard deviations, Sharpe ratios, and other pertinent measures for the decile portfolios of EW and MW are presented in Tables A2. These portfolios were built monthly on the four chosen low-risk metrics. In addition, the table reports the statistics for the Nifty 100 total return index and a relevant "Average Universe". For EW portfolios, the average universe is the monthly average of all decile portfolios, whereas, for MW portfolios, it is the market factor.

Our study reveals that although the performance of low-risk portfolios may not consistently outperform the average market returns, there is significant evidence to suggest a difference in mean excess returns between the lowest- and highest-risk deciles. Specifically, for EW and MW portfolios, the three lowest decile portfolios demonstrate a mean excess return difference against the three highest decile portfolios of 13.9% and 22.5% , respectively. In contrast, the difference between the lowest- and highest-risk deciles is 18.3% for EW and 28.0% for MW portfolios. These findings are in agreement with earlier research, such as Ang et al. (2006); Blitz and van Vliet (2007), where no evident correlation exists between the selected risk measures and returns, except for the underperformance of higher-risk stocks. Thus, although low-risk portfolios may not ensure higher absolute returns, investing in the lowest-risk deciles may offer significantly higher risk-adjusted returns when compared to the highest-risk deciles.

Within the EW portfolios, there is a deliberate and consistent increase in standard deviations from D_1 to D_10. The annualised standard deviation of excess returns for the Nifty 100 time series is 22.2%, which falls between the mean annualised standard deviation of D_1 portfolios for EW deciles (18.4%) and D_2 (24.9%) portfolios, and also the mean annualised standard deviation for D_1 portfolios for MW deciles (19.7%) and D_2 (21.7%). Notably, the average annualised standard deviation of D_1 for the EW portfolio (18.4%) is only about two-thirds that of the equivalent Average Universe (30.1%). Holding the Nifty 100 implies an implicit bias towards the low-risk anomaly. However, due to the top-heavy nature of the Indian equity market, the reduction in the annualised standard deviation of the MW D_1 portfolio (19.7%) relative to the standard deviation of the market factor (23.5%) is significantly lower. The EW portfolio D_10 (37.7%) and MW D_10 portfolio (43.4%) both exhibit significantly higher variance in excess returns.

As changes in variance of returns outweigh changes in returns themselves, Sharpe ratios decrease with increasing risk across the deciles. This pattern is particularly apparent when using $\mathrm{VOL}_3 6m$ and IVOL_{36m} as low-risk metrics. The deciles based on beta show a more traditional convex shape, with increasing Sharpe ratios as risk increases before ultimately decreasing. This turn occurs between the D_4 and D_5 portfolios for EW and D_2 portfolios for MW. Regardless of the low-risk metric and portfolio construction (EW or MW), the Sharpe ratios for D_10 are significantly lower than their Average Universe counterparts. In contrast, for the EW scenario, D_1 portfolios using VOL_{36m} and IVOL_{36m} exhibit a statistically significant higher Sharpe ratio compared to the Average Universe.

Summary statistics for two subsamples which split the entire period in half, namely October 2007 to July 2015 and July 2015 to February 2023, are presented in Tables A3 and A4. In addition, Table A5 shows the results for the "out-of-sample" period after September 2018. Although absolute returns and volatilities differ between subperiods, the main conclusions on the existence of a low-risk anomaly remain consistent. Specifically, the low-risk anomaly persists, and the lower decile portfolios exhibit higher Sharpe ratios than portfolios consisting of higher risk stocks. In their analysis of the low-risk anomaly in multiple markets, Blitz and van Vliet (2007) conclude "*that the volatility effect is a stronger and less ambiguously defined effect than the beta effect*". in the case of Indian equities, the volatility effect is more marked than the beta effect: as seen in the Sharpe ratios of the respective D_1 less D_10 portfolios. Further, the strength of the low-risk effect in Indian equities using volatility-based measures does not appear to diminish over time indicating that the low-risk anomaly is robust.

Table A6 presents the results of the 6-factor regression (Market, Size, Value, Profitability, Investment, and Momentum) for each EW decile portfolio in Panel A, and the MW decile portfolios in Panel B. The model's explanatory power, as measured by the Adjusted R-squared, (EW average Adj R-squared 0.93 (Min 0.67 and Max 0.98) and MW average Adj R-squared 0.84 (Min 0.47 and Max 0.95)). In both, EW and MW, the explanatory power is weakest at the edges of the decile portfolios, indicating the potential for an empirical asset pricing anomaly. The D_1 portfolios sorted by ex ante beta and CAPM beta for the EW and MW weighting schemas show the lowest Adj R-squared. For deciles D_2 through D_8, the explanatory power of the FF6 model is very comprehensive. None of the EW or MW decile portfolios exhibits any positive alpha over the FF6 midel. There is a statistically significant average alpha spread in the D_1 less D_10 portfolios: higher-risk portfolios perform worse than lower-risk portfolios. The average alpha spread for EW is 2.1% and 2.7% for MW monthly.

The regressions show that in EW schema, the higher-risk portfolios are more exposed to $Small$ size. D_1 portfolios show a smaller SMB coefficient (EW 0.47) than D_10 portfolios (EW 1.04). Under the MW schema, as we have already seen with the NIFTY 100 portfolio, the D_1 portfolios using volatility ranks are exposed to Big size, while the beta ranked portfolios donot exhibit a clear preference for size. All EW deciles show increased exposure to $Small$ size as risk increases. In MW deciles, the relationship between increased $Small$ coefficients as the deciles increase is clearer for volatility ranked portfolios. For beta ranked MW portfolios, the Market Factor is the single most significant discriminator. In fact, of all the other factors, only RMW shows a trend across the deciles irrespective of the weighting schema or the choice of low-risk metric: the higher risk portfolios are more exposed to $Weaker$ firms than lower risk portfolios.

The findings demonstrate that lower-risk portfolios constructed higher risk-adjusted returns than higher risk portfolios. The effects are robust over time, portfolio construction criteria and after controlling for the Fama-French five factors and the momentum factor. There is some evidence in our results that the Size and Profitability factors are related to the low-risk anomaly.

4.2. The Low Risk Factors

In the Fama-French 2x3 methodology (Fama and French, 2015), factors are constructed using portfolios weighted by market cap formed based on size and low-risk metrics. To construct low-risk factors, stocks are classified into two market cap categories and four low-risk metric categories. The *Big* firms account for 90% of the market cap in the equity universe, while the *Small* firms are those in the remaining 10% of the India market cap at the end of September each year (Raju, 2022b). Low-risk breakpoints are the 30th and 70th percentiles of the respective ratios for the *Big* stocks at the end of each month.

In addition to the Fama-French construction, for the sake of completeness, we also construct the Betting-against-Beta (BAB_{FP}) factor following Frazzini and Pedersen (2014) who split the universe of stocks at the end of each month into two categories using the median of the cross section of the ex-ante beta. Table A7 shows the median number of firms in each of the 2x3 portfolios used to create low-risk factors following the Fama-French methodology (VOL, BAB_{FF}, BAB_{CAPM}, and IVOL) as well as BAB_{FP}. The number of firms for each subportfolio is generally well diversified, except for the first two years of our sample period (see Raju and Agarwalla (2021) for the number of stocks in diversified portfolios in India).

Table A8 presents the summary statistics of the subportfolios that make up the five low-risk factors. As the BAB_{FP} factor is not constructed using the 2x3 Fama-French methodology, we only show the Long and Short sub-portfolios for this construct. For VOL, BAB_{FF}, BAB_{CAPM}, and IVOL, the table displays various portfolios such as *Big* (*Big* Low risk - *Big* High risk), *Small* (*Small* Low risk - *Small* High risk), Big minus Small (B-S), Long ([*Big* Low risk + *Small* Low risk]/2), Short ([*Big* High risk + *Small* High risk]/2), and Long minus Short (L-S). The table provides annualised excess returns, standard deviations, t-Statistics, the CAPM Alpha, CAPM Beta and their SEs, and the CAPM Adj R-squared for each portfolio. It is worth noting that none of the portfolios is beta-adjusted. Thus, all of them exhibit a significant market beta, except for the B-S portfolio, which shows a beta significantly lower than the other portfolios. As expected, the Long portfolios have betas (average 0.8) lower than 1, while the Short portfolios have betas (average 1.4) well above 1. Furthermore, the *Big*, *Small*, L-S, and B-S portfolios all show negative CAPM betas. The L-S portfolios exhibit significantly negative betas (average -0.6), indicating that a naive long-short market-value neutral construction is not beta-neutral. As factors should ideally not be correlated, the naive long-short approach needs to be adapted to make it beta-neutral.

Despite the above, the L-S portfolio has an attractive excess return (average 6.9%) and a significant t-

Statistic (average 2.0), indicating its performance compared to the market as a long-short factor. In all five variants, the *Big* portfolios also show statistically significant performance reflecting the popularity of large-cap, low-volatility strategies in India.

Figure A4 shows the average compound returns and standard deviations of excess Nifty100 returns, the five factors from Fama and French, the momentum factor and the five low-risk factors from Table 1 (VOL, BAB_{FP}, BAB_{FF}, BAB_{CAPM} and IVOL) throughout the period. All low-risk factors exhibit attractive risk-return characteristics, with LVOL and IVOL showing lower risk and higher returns than the market factor and the excess returns of Nifty100. Among the BAB factors, BAB_{FP} performs better than BAB_{FF} and BAB_{CAPM}, consistent with the findings of Novy-Marx and Velikov (2022).

Table A9 summarises the beta-neutral long-short low-risk factors, showing the Nifty100 for comparison. Significant t-statistics for VOL, BAB_{FP}, BAB_{CAPM}, and IVOL indicate robust evidence of positive long-term average returns. The five low-risk factors have a lower standard deviation than the Nifty100. As seen visually in Figure A4, VOL and IVOL have Sharpe ratios well above that of the Nifty100. Among the BAB variants, only BAB_{FP} has a statistically significant t-value in the difference in its Sharpe ratio.

The five low-risk factor versions demonstrate a significant (at 5% level) positive alpha in the CAPM regression, while showing a low market beta. The factor construction uses estimates of realised beta from the prior months, resulting in a low, rather than zero, market beta. Note that the beta SE for all five low-risk factor variants does not reject the hypothesis that beta equals zero. The Nifty100, in contrast, has a market beta close to 1 with no evidence of alpha.

The Fama-French 5-Factor + Momentum regression improves the explanatory power. Now only the VOL and IVOL variants show a significant alpha. The beta coefficients of the market for all variants of factors are still close to zero. Nifty100's market beta gets closer to 1. Exposure to *Small* size is statistically significant in all BAB variants, unlike Nifty100, which shows expected exposure to *Big* size. Exposure to *Small* echoes the criticism of BAB by Novy-Marx and Velikov (2022)[11]. The BAB_{FP} factor has the highest *Small* size coefficient resulting from both the weighting schema and the breakpoint, as they argue using international data.

VOL, IVOL, BAB_{FF}, and BAB_{CAPM} show exposure to *Robust* and *Conservative* firms, both of which are related to quality "factor" (see Geppert and Zhao (2018)). This does not imply that quality subsumes low-risk. It is just that the Profitability and Investment factors help explain some of the returns for these low-risk factors. The beta-based BAB_{FP} and BAB_{CAPM} factors show exposure to momentum. Finally, VOL, BAB_{FF}, and BAB_{CAPM} are exposed to expensive firms (negative HML coefficients; significant at the 5% level). Overall, the 6-factor model does not have a high explanatory power with a low Adj R-squared for all factors.

[11] "*BAB achieves its high Sharpe ratio, and large, highly significant alpha relative to the common factor models, by hugely overweighting micro- and nano-cap stocks*" (Novy-Marx and Velikov, 2022).

The six-factor regressions show small but important nuances in the return drivers for the low-risk factor variants. Volatility-based factors are exposed to quality, while for beta-based factors, size does some of the heavy lifting in the explanation of returns. An implication for practitioners is that a mix of volatility- and beta-based low-risk strategies could be more advantageous than following a single measure.

This is reiterated in the correlation between factors in Table A10. This table shows the full period correlation between monthly returns of various factors and the Nifty100 from September 2007 to February 2023. Factors include size, value, profitability, investment, momentum, and our five low-risk factor variants. The correlations between the traditional Fama and French 5-factors, momentum and low-risk factors are low (a mean using absolute paired correlation values of 0.19). All five low-risk factors have a low negative correlation with the market factor. The three BAB variants show a modest correlation with WML. VOL, BAB_{FF}, and BAB_{CAPM} also show a modest correlation with RMW and a modest negative correlation with HML. Of note is the low correlation between the quality factors (Investment and Profitability) and the low-risk factors. The evidence of low-risk being subsumed by quality is not clear.

Between the low-risk factors, expectedly, BAB_{FF}, and BAB_{CAPM} have the highest correlation. Over long cycles, the ex-ante and realised beta should converge. VOL shows moderate correlation (0.68-0.70) with BAB_{FP} and BAB_{CAPM}, highlighting that the relationship between volatility and beta is close but not perfect. VOL and IVOL are also moderately correlated. BAB_{FP} is the least correlated with the other low-risk factors. The novel weighting scheme and the non-Fama-French methodology are significant contributors to this.

5. Conclusion

Using a large universe of firms over 15 years, our findings provide clear evidence of the low-risk anomaly in the Indian equities market. The anomaly is robust to the type of low-risk metric used and over time. Volatility-based metrics seem to offer better performance than beta-based portfolios in our observation period and equity universe. Factor construction plays an essential role in the ability to estimate true anomaly returns. We do not have a preference for one low-risk metric over the other. However, like other factor literature, we suggest that a combination of measures might be preferable to using single metrics for low-risk. Although the literature in India has not conclusively shown the "lottery seeking" behaviour in India, our findings suggest that searching for other explanations for the low-risk anomaly is a fruitful avenue for future research.

Our second objective was to outline a methodology common to that adopted in the accepted academic literature for five popular international low-risk factors in the Indian context for researchers and practitioners. Long-short beta-neutral factors are not investable portfolios in themselves; instead, they add to the list of formal academic factors available monthly. In the coming weeks, we hope to publish these factors and subportfolios as part of the "Data Library: Fama French 3 and 5 Factors and Momentum Factor for the Indian Market" available online.

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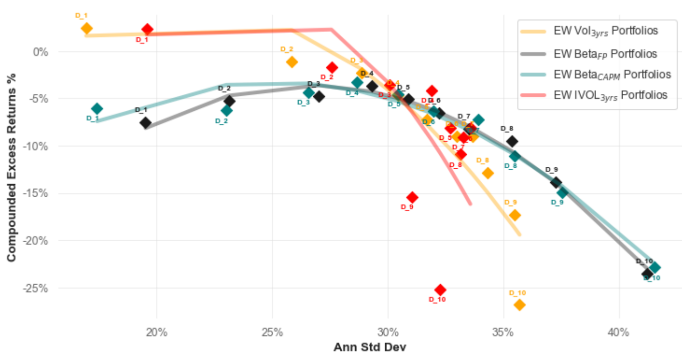
Table A1: Descriptive statistics of the market capitalisation of companies

	Num Firms (Active)	Market capitalisation - percentile (Rs million) 10%	30%	50%	70%	90%	Total Mkt Cap (Rs billions)	Average Mkt Cap (Rs millions)
2007-09-28	1,875	150	494	1,367	4,907	35,347	49,064	26,168
2008-09-30	2,006	95	328	926	3,067	23,312	39,193	19,538
2009-09-30	2,050	120	405	1,131	3,840	31,122	55,123	26,889
2010-09-30	2,085	169	585	1,744	5,911	44,076	70,030	33,588
2011-09-30	2,206	125	388	1,206	3,923	34,604	58,441	26,492
2012-09-28	2,351	103	318	1,018	3,790	33,663	64,737	27,536
2013-09-30	2,352	81	248	727	2,805	25,599	62,377	26,521
2014-09-30	2,348	133	452	1,509	6,204	47,312	93,125	39,661
2015-09-30	2,372	145	490	1,600	6,247	50,169	96,358	40,623
2016-09-30	2,393	191	629	1,996	7,814	61,057	109,301	45,675
2017-09-29	2,553	222	694	2,232	9,342	78,801	132,295	51,819
2018-09-28	2,663	201	573	1,860	8,301	74,793	143,963	54,061
2019-09-30	2,606	147	439	1,396	5,951	69,555	145,331	55,768
2020-09-30	2,569	146	437	1,465	6,720	76,636	152,847	59,497
2021-09-30	2,569	282	891	3,039	15,050	138,745	253,167	98,547
2022-09-30	2,598	422	1,282	3,937	17,123	133,454	255,601	98,384

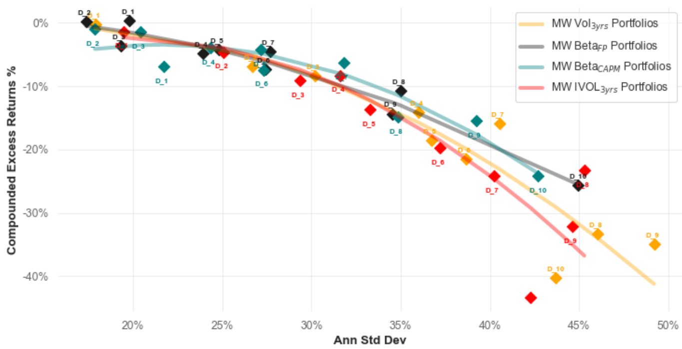
The table shows the cross-sectional percentiles and total and average market capitalisation for various periods ending September 30 for firms included in our study. Following Fama and French (2012), a firm's market capitalisation is taken as the market capitalisation on September 30 of the relevant year.

Fig. A1: Annualised returns and standard deviations of decile portfolios: October 2007 - February 2023

Panel A: Equal Weighted Decile Portfolios



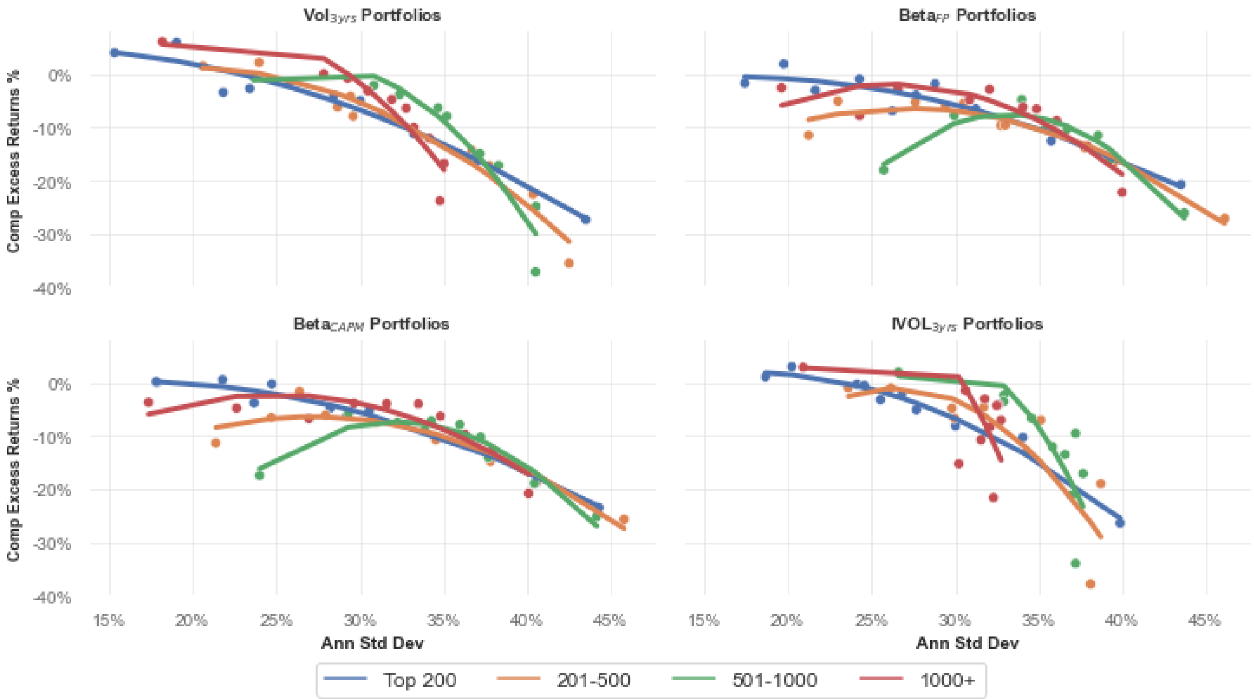
Panel B: Market Weighted Decile Portfolios



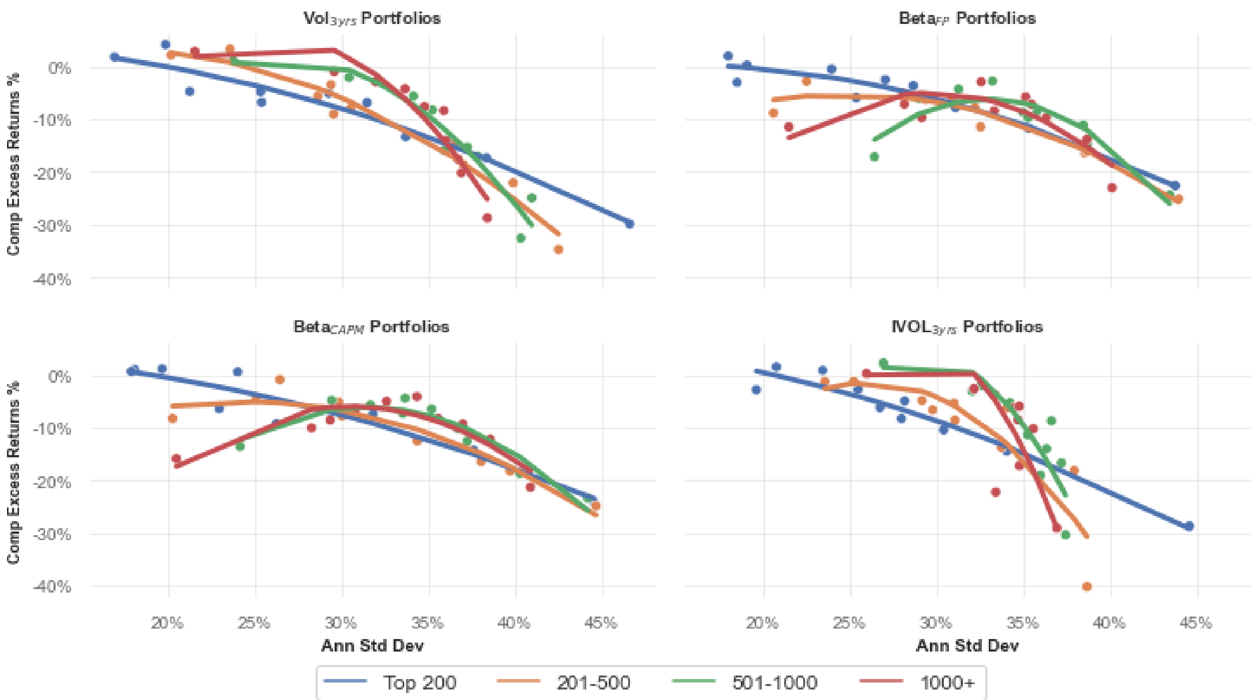
Decile portfolios are created based on the respective low-risk metric (realised volatility, ex-ante beta, realised CAPM beta, and realised IVOL). For each decile portfolio, the time series of monthly returns are calculated using equal weights and market weights. Using the returns over the risk-free rate, annualised mean returns and standard deviations are plotted, and a polygonal line of best fit is drawn for the deciles for each metric.

Fig. A2: Annualised returns and standard deviations of Size-Low-risk decile portfolios: October 2007 - February 2023

Panel A: Equal Weighted Size-Low-risk Decile Portfolios



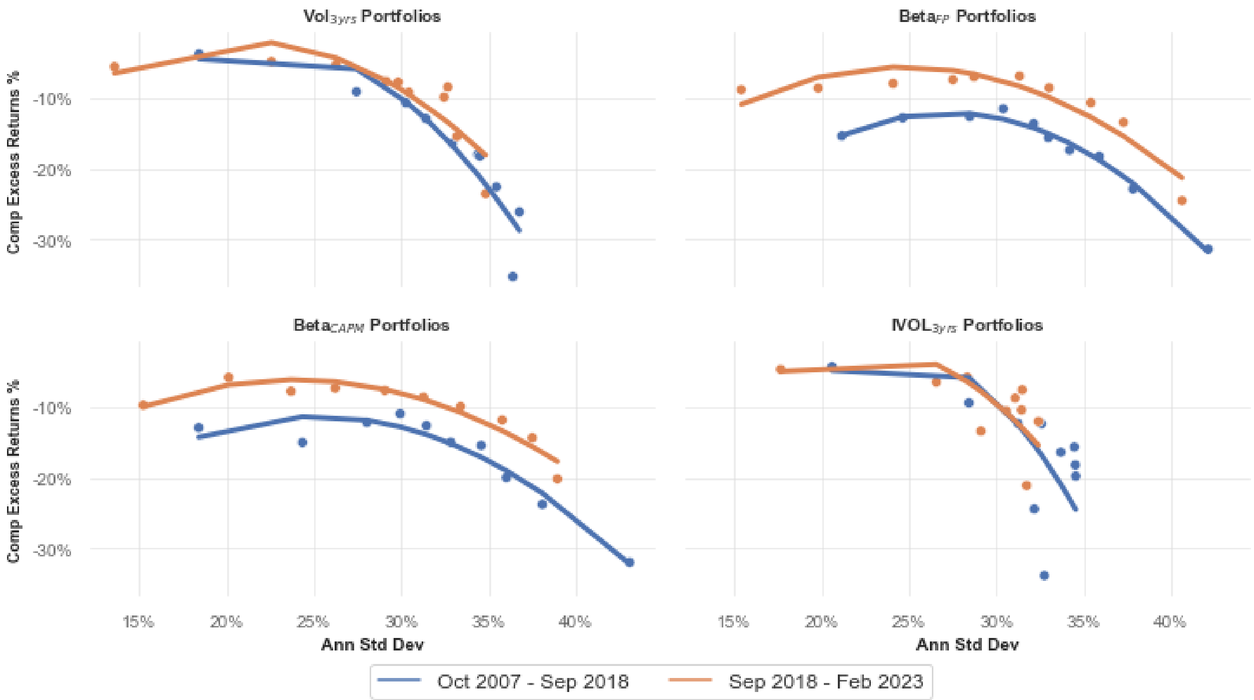
Panel B: Market Weighted Size-Low-risk Decile Portfolios



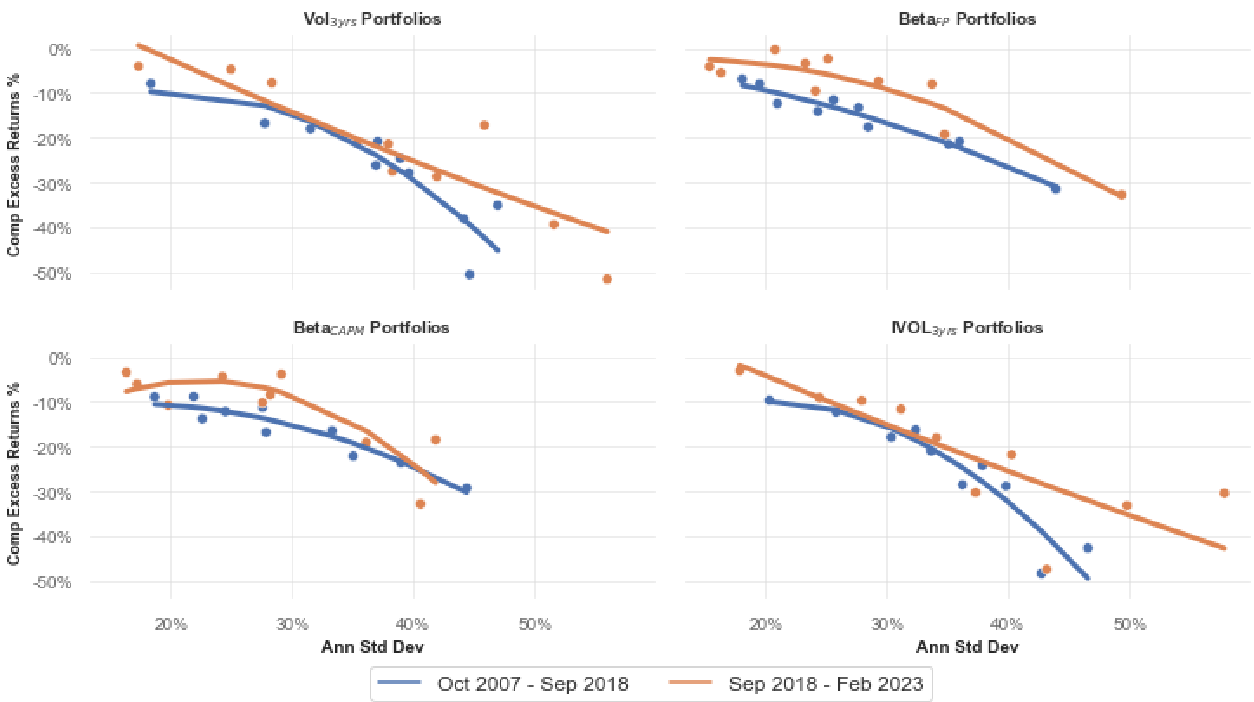
Each month, we categorise firms into four groups, Top 200, 201-500, 501-1000, and 1000+, based on their relative market cap value. For each size category, we then create decile portfolios based on the respective low-risk metric (realised volatility, ex-ante beta, realised CAPM beta, and realised IVOL) for . For each decile portfolio, the time series of monthly returns are calculated using equal weights and market weights. Using the returns over the risk-free rate, annualised mean returns and standard deviations are plotted, and a polygonal line of best fit is drawn for the deciles for each metric. Each panel has four charts, one for each low-risk metric.

Fig. A3: Annualised returns and standard deviations of decile portfolios: sub-periods October 2007 - September 2018 and September 2018 - February 2023

Panel A: Equal Weighted Decile Portfolios



Panel B: Market Weighted Decile Portfolios



Decile portfolios are created based on the respective low-risk metric (realised volatility, ex-ante beta, realised CAPM beta, and realised IVOL). For each decile portfolio, the time series of monthly returns are calculated using equal weights and market weights. Using the returns over the risk-free rate, annualised mean returns and standard deviations are plotted, and a polygonal line of best fit is drawn for the deciles for each metric. The two periods are October 2007 - September 2018, reflecting overlap with earlier studies and September 2018 - February 2023, the "out-of-sample" period.

Table A2: Summary full-period results of decile portfolios based on different low-risk metrics: October 2007 - February 2023

Panel A: Equal Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
	Excess Return (%)	2.47	-1.07	-2.31	-4.66	-7.25	-9.02	-9.04	-12.84	-17.30	-26.86	28.77	7.90	-8.86
	Std Deviation (%)	16.95	25.83	28.85	30.43	31.67	32.96	33.68	34.32	35.50	35.70	22.50	22.17	30.12
	Sharpe Ratio	0.15	-0.04	-0.08	-0.15	-0.23	-0.27	-0.27	-0.37	-0.49	-0.75	1.28	0.36	-0.29
	SR t-value vs Avg Universe	12.83	12.05	13.30	11.15	7.27	2.63	2.63	-7.52	-11.72	-15.28	9.68	12.15	
VOL_36M	Skewness	-1.02	-0.91	-0.66	-0.77	-0.59	-0.47	-0.27	-0.25	-0.13	-0.04	-0.78	-0.33	-0.48
	CAPM Alpha	-0.05	-0.36*	-0.45*	-0.63**	-0.85***	-1.00***	-0.99***	-1.33***	-1.74***	-2.73***	2.68***	-0.13	-1.01***
	Alpha SE	(0.14)	(0.20)	(0.25)	(0.27)	(0.30)	(0.31)	(0.35)	(0.36)	(0.38)	(0.40)	(0.37)	(0.08)	(0.28)
	CAPM Beta	0.68***	1.03***	1.13***	1.18***	1.21***	1.26***	1.25***	1.27***	1.30***	1.29***	-0.61***	0.92***	1.16***
	Beta SE	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.02)	(0.04)
	CAPM Adj R-squared	0.88	0.88	0.85	0.82	0.79	0.80	0.76	0.75	0.73	0.71	0.40	0.96	0.81
	Excess Return (%)	-7.53	-5.26	-4.76	-3.66	-5.09	-6.56	-8.25	-9.47	-13.84	-23.54	7.82	7.90	-8.59
	Std Deviation (%)	19.52	23.11	27.01	29.29	30.89	32.21	33.49	35.37	37.27	41.22	28.22	22.17	30.33
	Sharpe Ratio	-0.39	-0.23	-0.18	-0.12	-0.16	-0.20	-0.25	-0.27	-0.37	-0.57	0.28	0.36	-0.28
	SR t-value vs Avg Universe	-2.67	2.94	7.60	12.49	11.48	8.41	4.39	1.53	-6.99	-13.33	3.90	11.95	
EX_ANTE_BETA	Skewness	0.08	-0.58	-0.54	-0.45	-0.49	-0.57	-0.35	-0.46	-0.37	-0.20	-0.29	-0.33	-0.47
	CAPM Alpha	-0.82***	-0.69**	-0.65**	-0.55*	-0.67**	-0.79***	-0.93***	-1.02***	-1.41***	-2.33***	1.51***	-0.13	-0.99***
	Alpha SE	(0.31)	(0.27)	(0.27)	(0.29)	(0.29)	(0.30)	(0.31)	(0.32)	(0.34)	(0.36)	(0.33)	(0.08)	(0.28)
	CAPM Beta	0.59***	0.85***	1.03***	1.12***	1.18***	1.23***	1.28***	1.35***	1.43***	1.59***	-0.99***	0.92***	1.16***
	Beta SE	(0.07)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)	(0.09)	(0.02)	(0.04)
	CAPM Adj R-squared	0.50	0.73	0.79	0.80	0.80	0.80	0.80	0.80	0.81	0.81	0.68	0.96	0.81
	Excess Return (%)	-6.05	-6.26	-4.34	-3.32	-4.53	-6.37	-7.25	-11.05	-14.91	-22.90	7.56	7.90	-8.45
	Std Deviation (%)	17.42	23.02	26.54	28.65	30.45	31.98	33.89	35.50	37.55	41.52	29.71	22.17	30.00
	Sharpe Ratio	-0.35	-0.27	-0.16	-0.12	-0.15	-0.20	-0.21	-0.31	-0.40	-0.55	0.25	0.36	-0.28
	SR t-value vs Avg Universe	-1.72	0.42	7.33	12.08	12.52	9.29	7.46	-2.73	-8.18	-12.39	3.71	11.94	
CAPM_BETA	Skewness	0.28	-0.52	-0.55	-0.56	-0.53	-0.39	-0.45	-0.31	-0.30	-0.20	-0.28	-0.33	-0.45
	CAPM Alpha	-0.68**	-0.76***	-0.61**	-0.52*	-0.62**	-0.78***	-0.84***	-1.17***	-1.51***	-2.27***	1.59***	-0.13	-0.98***
	Alpha SE	(0.29)	(0.29)	(0.28)	(0.28)	(0.29)	(0.30)	(0.31)	(0.32)	(0.32)	(0.35)	(0.29)	(0.08)	(0.28)
	CAPM Beta	0.52***	0.81***	0.99***	1.09***	1.16***	1.23***	1.30***	1.36***	1.45***	1.61***	-1.09***	0.92***	1.15***
	Beta SE	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.06)	(0.02)	(0.04)
	CAPM Adj R-squared	0.49	0.68	0.77	0.79	0.80	0.80	0.80	0.80	0.82	0.83	0.74	0.96	0.81
	Excess Return (%)	2.35	-1.65	-3.57	-4.14	-8.09	-8.14	-9.11	-10.91	-15.41	-25.19	29.17	7.90	-8.44
	Std Deviation (%)	19.56	27.56	30.06	31.91	32.69	33.57	33.26	33.14	31.04	32.26	17.61	22.17	30.01
	Sharpe Ratio	0.12	-0.06	-0.12	-0.13	-0.25	-0.24	-0.27	-0.33	-0.50	-0.78	1.66	0.36	-0.28
	SR t-value vs Avg Universe	13.30	12.04	11.25	12.35	4.10	4.66	0.80	-4.20	-10.80	-14.93	11.56	11.93	
IVOL_36M	Skewness	-0.45	-0.65	-0.54	-0.50	-0.52	-0.38	-0.35	-0.41	-0.22	-0.22	-0.79	-0.33	-0.46
	CAPM Alpha	-0.08	-0.41**	-0.56**	-0.59**	-0.92***	-0.91***	-0.99***	-1.15***	-1.57***	-2.56***	2.48***	-0.13	-0.97***
	Alpha SE	(0.15)	(0.21)	(0.25)	(0.28)	(0.31)	(0.33)	(0.35)	(0.35)	(0.37)	(0.39)	(0.34)	(0.08)	(0.28)
	CAPM Beta	0.79***	1.10***	1.19***	1.24***	1.25***	1.27***	1.23***	1.22***	1.10***	1.14***	-0.36***	0.92***	1.15***
	Beta SE	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.02)	(0.04)
	CAPM Adj R-squared	0.88	0.87	0.85	0.83	0.80	0.78	0.75	0.75	0.69	0.69	0.22	0.96	0.81

Panel B: Market Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
	Excess Return (%)	-0.31	-6.85	-8.44	-14.19	-18.58	-21.53	-15.96	-33.35	-34.99	-40.32	42.63	7.90	10.43
	Std Deviation (%)	17.88	26.68	30.21	35.97	36.74	38.66	40.52	46.05	49.19	43.68	33.56	22.17	23.53
	Sharpe Ratio	-0.02	-0.26	-0.28	-0.39	-0.51	-0.56	-0.39	-0.72	-0.71	-0.92	1.27	0.36	0.44
	SR t-value vs Avg Universe	-13.77	-17.25	-16.45	-17.06	-16.80	-16.99	-14.88	-16.46	-16.21	-16.71	5.87	-6.24	
VOL_36M	Skewness	-1.29	-1.19	-0.85	-1.00	-0.78	-0.66	-0.28	-0.75	-0.82	0.14	-0.47	-0.33	-0.48
	CAPM Alpha	-0.29***	-0.88***	-1.00***	-1.46***	-1.87***	-2.15***	-1.55***	-3.21***	-3.19***	-4.21***	3.92***	-0.13	0.00***
	Alpha SE	(0.11)	(0.13)	(0.20)	(0.24)	(0.31)	(0.33)	(0.41)	(0.54)	(0.59)	(0.48)	(0.52)	(0.08)	(0.00)
	CAPM Beta	0.73***	1.10***	1.23***	1.46***	1.45***	1.52***	1.51***	1.68***	1.77***	1.53***	-0.80***	0.92***	1.00***
	Beta SE	(0.04)	(0.04)	(0.05)	(0.06)	(0.05)	(0.05)	(0.07)	(0.07)	(0.09)	(0.08)	(0.10)	(0.02)	(0.00)
	CAPM Adj R-squared	0.90	0.94	0.90	0.90	0.85	0.85	0.76	0.73	0.71	0.67	0.31	0.96	1.00
	Excess Return (%)	0.34	0.13	-3.62	-4.90	-4.21	-7.33	-4.55	-10.72	-14.36	-25.68	13.92	7.90	10.43
	Std Deviation (%)	19.82	17.37	19.30	23.90	24.81	27.43	27.66	34.97	34.51	44.91	38.64	22.17	23.53
	Sharpe Ratio	0.02	0.01	-0.19	-0.21	-0.17	-0.27	-0.16	-0.31	-0.42	-0.57	0.36	0.36	0.44
	SR t-value vs Avg Universe	-6.76	-8.17	-13.42	-14.66	-14.87	-15.26	-13.82	-16.13	-16.59	-16.44	-0.61	-6.24	
EX_ANTE_BETA	Skewness	-0.23	-1.14	-0.49	-1.36	-0.92	-0.90	-0.72	-0.62	-0.44	-0.45	0.20	-0.33	-0.48
	CAPM Alpha	-0.12	-0.18	-0.55***	-0.68***	-0.63***	-0.89***	-0.65**	-1.16***	-1.51***	-2.46***	2.34***	-0.13	0.00***
	Alpha SE	(0.28)	(0.20)	(0.19)	(0.18)	(0.20)	(0.24)	(0.27)	(0.26)	(0.27)	(0.44)	(0.59)	(0.08)	(0.00)
	CAPM Beta	0.58***	0.58***	0.74***	0.94***	0.99***	1.08***	1.08***	1.40***	1.37***	1.72***	-1.14***	0.92***	1.00***
	Beta SE	(0.07)	(0.07)	(0.04)	(0.08)	(0.05)	(0.05)	(0.07)	(0.05)	(0.05)	(0.07)	(0.11)	(0.02)	(0.00)
	CAPM Adj R-squared	0.46	0.62	0.79	0.85	0.87	0.85	0.83	0.88	0.87	0.80	0.47	0.96	1.00
	Excess Return (%)	-6.87	-0.98	-1.49	-4.00	-4.21	-7.42	-6.30	-14.81	-15.50	-24.15	5.52	7.90	10.43
	Std Deviation (%)	21.72	17.87	20.40	24.36	27.19	27.29	31.82	34.84	39.23	42.70	38.16	22.17	23.53
	Sharpe Ratio	-0.32	-0.05	-0.07	-0.16	-0.15	-0.27	-0.20	-0.42	-0.40	-0.57	0.14	0.36	0.44
	SR t-value vs Avg Universe	-10.13	-9.32	-14.11	-15.15	-14.16	-15.65	-16.00	-16.66	-16.68	-16.90	-2.19	-6.24	
CAPM_BETA	Skewness	-0.77	-0.52	-0.96	-0.95	-1.58	-0.48	-0.67	-0.67	-0.45	0.09	-0.63	-0.33	-0.48
	CAPM Alpha	-0.70**	-0.28	-0.40***	-0.62***	-0.60***	-0.92***	-0.80***	-1.54***	-1.56***	-2.40***	1.71***	-0.13	0.00***
	Alpha SE	(0.35)	(0.20)	(0.14)	(0.18)	(0.23)	(0.21)	(0.21)	(0.26)	(0.28)	(0.35)	(0.58)	(0.08)	(0.00)
	CAPM Beta	0.56***	0.61***	0.82***	0.98***	1.07***	1.09***	1.30***	1.39***	1.57***	1.67***	-1.11***	0.92***	1.00***
	Beta SE	(0.08)	(0.05)	(0.03)	(0.05)	(0.07)	(0.04)	(0.04)	(0.07)	(0.05)	(0.06)	(0.13)	(0.02)	(0.00)
	CAPM Adj R-squared	0.36	0.63	0.89	0.89	0.85	0.87	0.91	0.87	0.88	0.84	0.46	0.96	1.00
	Excess Return (%)	-1.37	-4.61	-9.17	-8.30	-13.73	-19.77	-24.17	-23.30	-32.13	-43.43	50.10	7.90	10.43
	Std Deviation (%)	19.47	25.05	29.34	31.61	33.30	37.17	40.21	45.28	44.61	42.27	32.04	22.17	23.53
	Sharpe Ratio	-0.07	-0.18	-0.31	-0.26	-0.41	-0.53	-0.60	-0.51	-0.72	-1.03	1.56	0.36	0.44
	SR t-value vs Avg Universe	-15.85	-15.90	-17.47	-15.79	-16.02	-16.84	-15.38	-14.91	-16.23	-16.61	7.82	-6.24	
IVOL_36M	Skewness	-1.02	-1.23	-0.79	-0.70	-0.97	-0.80	-1.61	-1.26	0.32	-0.07	0.04	-0.33	-0.48
	CAPM Alpha	-0.39***	-0.67***	-1.08***	-0.97***	-1.43***	-1.98***	-2.21***	-2.03***	-3.19***	-4.59***	4.20***	-0.13	0.00***
	Alpha SE	(0.09)	(0.17)	(0.16)	(0.23)	(0.29)	(0.32)	(0.51)	(0.56)	(0.51)	(0.49)	(0.51)	(0.08)	(0.00)
	CAPM Beta	0.81***	1.02***	1.21***	1.27***	1.30***	1.46***	1.42***	1.61***	1.61***	1.40***	-0.59***	0.92***	1.00***
	Beta SE	(0.03)	(0.05)	(0.03)	(0.04)	(0.07)	(0.05)	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.02)	(0.00)
	CAPM Adj R-squared	0.94	0.91	0.94	0.88	0.83	0.85	0.68	0.69	0.71	0.60	0.18	0.96	1.00

('*' p<.1, '**' p<.05, '***' p<.01)

The table shows the summary statistics of annualised excess returns over risk-free rates, standard deviation, Sharpe Ratio, the t-stats of the test of the difference between the Sharpe ratio of the portfolio against the Sharpe ratio of the Nifty 100 and the skewness for each decile portfolio, D1 - D10, Nifty 100 and the Universe (the market factor, $r_{mkt} - r_f$, from the factor library). In addition, we show the CAPM regression alpha and beta with their SE and significance. We construct a beta-neutral long-short factor and some of the factor's summary statistics for each low-risk metric. For ex-ante beta, we construct two factors, one following Frazzini and Pedersen (2014) and the second following the Fama and French (2015) methodology of double-sorted portfolios.

Table A3: Summary sub-period results of equal-weighted decile portfolios based on different low-risk metrics

Panel A: October 2007 - July 2015

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	3.84	-2.72	-5.49	-7.60	-10.80	-14.78	-14.62	-18.80	-22.70	-32.09	38.69	10.01	-12.85
	Std Deviation (%)	20.70	30.74	33.36	34.43	35.58	37.43	37.28	38.30	39.99	39.91	22.42	24.95	34.43
	Sharpe Ratio	0.19	-0.09	-0.16	-0.22	-0.30	-0.39	-0.39	-0.49	-0.57	-0.80	1.73	0.40	-0.37
	SR t-value vs Avg Universe	11.18	10.60	10.41	9.75	5.63	-2.26	-1.48	-8.19	-9.73	-11.51	8.37	10.22	
	Skewness	-0.86	-0.55	-0.35	-0.45	-0.41	-0.27	-0.04	-0.08	-0.08	0.01	-0.75	-0.25	-0.29
	CAPM Alpha	0.28	-0.15	-0.34	-0.50	-0.76*	-1.10***	-1.09**	-1.48***	-1.83***	-2.88***	3.15***	-0.05	-0.98***
	Alpha SE	(0.21)	(0.32)	(0.35)	(0.39)	(0.42)	(0.41)	(0.46)	(0.45)	(0.46)	(0.51)	(0.45)	(0.12)	(0.37)
	CAPM Beta	0.71***	1.05***	1.13***	1.15***	1.17***	1.25***	1.21***	1.26***	1.31***	1.28***	-0.58***	0.91***	1.15***
	Beta SE	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.02)	(0.05)
	CAPM Adj R-squared	0.90	0.89	0.88	0.85	0.84	0.85	0.81	0.83	0.82	0.80	0.51	0.97	0.86
EX_ANTE_BETA	Excess Return (%)	-8.06	-5.90	-6.34	-5.60	-8.36	-11.11	-12.84	-13.37	-19.96	-29.69	15.47	10.01	-12.09
	Std Deviation (%)	23.85	27.28	31.52	33.32	34.97	35.75	36.87	38.26	40.39	45.18	27.90	24.95	34.22
	Sharpe Ratio	-0.34	-0.22	-0.20	-0.17	-0.24	-0.31	-0.35	-0.35	-0.49	-0.66	0.55	0.40	-0.35
	SR t-value vs Avg Universe	0.36	5.98	8.18	10.09	8.02	3.77	0.51	0.33	-7.78	-9.55	4.39	10.08	
	Skewness	-0.02	-0.52	-0.40	-0.23	-0.29	-0.37	-0.02	-0.22	-0.10	0.04	-0.93	-0.25	-0.27
	CAPM Alpha	-0.67	-0.46	-0.44	-0.35	-0.55	-0.79*	-0.94**	-0.95**	-1.55***	-2.48***	1.81***	-0.05	-0.92**
	Alpha SE	(0.45)	(0.37)	(0.38)	(0.41)	(0.40)	(0.41)	(0.42)	(0.39)	(0.43)	(0.43)	(0.45)	(0.12)	(0.37)
	CAPM Beta	0.68***	0.89***	1.04***	1.10***	1.15***	1.19***	1.22***	1.28***	1.35***	1.53***	-0.85***	0.91***	1.14***
	Beta SE	(0.09)	(0.06)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.09)	(0.02)	(0.05)
	CAPM Adj R-squared	0.62	0.81	0.84	0.84	0.83	0.85	0.85	0.86	0.86	0.88	0.71	0.97	0.86
CAPM_BETA	Excess Return (%)	-3.95	-8.01	-6.53	-4.91	-8.50	-10.02	-11.55	-15.37	-20.43	-30.47	18.21	10.01	-11.88
	Std Deviation (%)	20.32	26.78	30.86	32.76	34.15	35.50	37.30	38.64	41.08	46.96	32.10	24.95	33.84
	Sharpe Ratio	-0.19	-0.30	-0.21	-0.15	-0.25	-0.28	-0.31	-0.40	-0.50	-0.65	0.57	0.40	-0.35
	SR t-value vs Avg Universe	3.39	1.93	6.72	9.71	8.15	6.07	3.68	-3.31	-7.14	-9.10	4.38	10.08	
	Skewness	0.19	-0.48	-0.33	-0.38	-0.26	-0.11	-0.21	-0.08	-0.09	0.00	-0.53	-0.25	-0.25
	CAPM Alpha	-0.34	-0.65	-0.46	-0.29	-0.59	-0.71*	-0.80**	-1.14***	-1.59***	-2.51***	2.17***	-0.05	-0.91**
	Alpha SE	(0.40)	(0.39)	(0.40)	(0.40)	(0.41)	(0.40)	(0.39)	(0.40)	(0.41)	(0.44)	(0.40)	(0.12)	(0.37)
	CAPM Beta	0.56***	0.84***	1.00***	1.08***	1.13***	1.18***	1.24***	1.29***	1.39***	1.60***	-1.04***	0.91***	1.13***
	Beta SE	(0.08)	(0.07)	(0.06)	(0.05)	(0.05)	(0.06)	(0.05)	(0.04)	(0.04)	(0.05)	(0.08)	(0.02)	(0.05)
	CAPM Adj R-squared	0.58	0.75	0.81	0.83	0.84	0.85	0.86	0.86	0.87	0.89	0.80	0.97	0.86
IVOL_36M	Excess Return (%)	3.60	-3.44	-7.04	-6.69	-11.58	-11.96	-13.92	-16.22	-19.59	-29.89	37.72	10.01	-11.86
	Std Deviation (%)	22.85	31.20	33.76	35.33	36.02	36.99	37.35	37.49	34.83	36.48	17.81	24.95	33.84
	Sharpe Ratio	0.16	-0.11	-0.21	-0.19	-0.32	-0.32	-0.37	-0.43	-0.56	-0.82	2.12	0.40	-0.35
	SR t-value vs Avg Universe	11.31	9.97	7.80	10.37	3.04	2.62	-1.87	-5.16	-8.30	-11.15	9.41	10.07	
	Skewness	-0.09	-0.27	-0.27	-0.17	-0.29	-0.11	-0.22	-0.31	-0.18	-0.28	-0.30	-0.25	-0.25
	CAPM Alpha	0.27	-0.21	-0.47	-0.41	-0.83**	-0.85**	-1.02**	-1.23***	-1.62***	-2.68***	2.95***	-0.05	-0.91**
	Alpha SE	(0.24)	(0.29)	(0.33)	(0.37)	(0.42)	(0.42)	(0.45)	(0.45)	(0.47)	(0.49)	(0.40)	(0.12)	(0.37)
	CAPM Beta	0.78***	1.07***	1.15***	1.19***	1.19***	1.22***	1.22***	1.22***	1.10***	1.16***	-0.38***	0.91***	1.13***
	Beta SE	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)	(0.02)	(0.05)
	CAPM Adj R-squared	0.89	0.90	0.89	0.87	0.84	0.84	0.82	0.82	0.77	0.77	0.34	0.97	0.86

Panel B: July 2015 - February 2023

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	1.43	1.55	2.22	-0.18	-1.90	-1.36	-1.37	-4.75	-10.07	-19.72	17.62	5.17	-3.31
	Std Deviation (%)	12.02	19.83	23.63	26.06	27.53	27.93	29.87	30.04	30.51	31.18	22.72	17.45	25.26
	Sharpe Ratio	0.12	0.08	0.09	-0.01	-0.07	-0.05	-0.05	-0.16	-0.33	-0.63	0.78	0.30	-0.13
	SR t-value vs Avg Universe	5.23	6.19	8.37	5.91	4.95	5.87	5.83	-1.70	-7.14	-10.29	4.32	5.35	
	Skewness	-1.66	-2.01	-1.40	-1.40	-0.89	-0.79	-0.65	-0.50	-0.15	-0.04	-0.82	-0.78	-0.85
	CAPM Alpha	-0.33**	-0.52**	-0.52	-0.74*	-0.89**	-0.83*	-0.84	-1.09*	-1.54**	-2.46***	2.13***	-0.23**	-0.98**
	Alpha SE	(0.16)	(0.26)	(0.35)	(0.40)	(0.45)	(0.48)	(0.53)	(0.57)	(0.60)	(0.62)	(0.57)	(0.10)	(0.41)
	CAPM Beta	0.62***	1.01***	1.16***	1.26***	1.30***	1.29***	1.36***	1.32***	1.29***	1.29***	-0.68***	0.95***	1.19***
	Beta SE	(0.03)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)	(0.02)	(0.06)
	CAPM Adj R-squared	0.85	0.84	0.78	0.76	0.71	0.68	0.67	0.61	0.57	0.55	0.28	0.95	0.71
EX_ANTE_BETA	Excess Return (%)	-6.63	-3.73	-1.74	-0.34	-0.15	-0.21	-2.00	-3.65	-5.36	-15.18	-0.94	5.17	-3.55
	Std Deviation (%)	13.85	18.12	21.87	24.84	26.46	28.45	29.89	32.52	34.15	37.04	28.68	17.45	26.08
	Sharpe Ratio	-0.48	-0.21	-0.08	-0.01	-0.01	-0.01	-0.07	-0.11	-0.16	-0.41	-0.03	0.30	-0.14
	SR t-value vs Avg Universe	-4.68	-2.13	2.58	7.02	8.59	8.00	5.25	1.73	-1.28	-9.84	0.51	5.38	
	Skewness	0.49	-0.70	-0.86	-0.92	-0.87	-0.89	-0.92	-0.83	-0.76	-0.59	0.33	-0.78	-0.83
	CAPM Alpha	-0.82*	-0.80**	-0.76*	-0.72*	-0.73*	-0.77*	-0.94**	-1.10**	-1.27**	-2.17***	1.35***	-0.23**	-1.01**
	Alpha SE	(0.42)	(0.39)	(0.39)	(0.41)	(0.42)	(0.44)	(0.46)	(0.50)	(0.52)	(0.58)	(0.40)	(0.10)	(0.43)
	CAPM Beta	0.40***	0.76***	1.01***	1.17***	1.25***	1.35***	1.43***	1.53***	1.63***	1.73***	-1.33***	0.95***	1.23***
	Beta SE	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)	(0.09)	(0.09)	(0.02)	(0.06)
	CAPM Adj R-squared	0.26	0.57	0.68	0.72	0.72	0.72	0.73	0.72	0.73	0.70	0.69	0.95	0.71
CAPM_BETA	Excess Return (%)	-7.63	-3.22	-0.79	-0.08	1.12	-0.87	-1.31	-4.99	-7.37	-13.17	-3.05	5.17	-3.50
	Std Deviation (%)	13.93	18.79	21.61	24.24	26.45	28.34	30.27	32.25	33.84	35.23	26.83	17.45	25.80
	Sharpe Ratio	-0.55	-0.17	-0.04	-0.00	0.04	-0.03	-0.04	-0.15	-0.22	-0.37	-0.11	0.30	-0.14
	SR t-value vs Avg Universe	-5.72	-0.92	3.91	7.22	9.60	7.50	6.65	-1.23	-4.46	-8.53	0.11	5.38	
	Skewness	0.30	-0.50	-1.07	-0.91	-1.02	-0.89	-0.86	-0.67	-0.64	-0.53	0.03	-0.78	-0.83
	CAPM Alpha	-0.93**	-0.74*	-0.67*	-0.68*	-0.62	-0.83*	-0.88*	-1.22**	-1.45***	-1.98***	1.04***	-0.23**	-1.00**
	Alpha SE	(0.40)	(0.43)	(0.40)	(0.41)	(0.43)	(0.45)	(0.47)	(0.48)	(0.50)	(0.53)	(0.39)	(0.10)	(0.42)
	CAPM Beta	0.43***	0.75***	0.98***	1.13***	1.25***	1.35***	1.43***	1.53***	1.61***	1.65***	-1.22***	0.95***	1.21***
	Beta SE	(0.05)	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.02)	(0.06)
	CAPM Adj R-squared	0.30	0.51	0.66	0.70	0.72	0.73	0.72	0.72	0.73	0.71	0.66	0.95	0.71
IVOL_36M	Excess Return (%)	1.67	1.31	1.24	-0.01	-2.90	-2.58	-2.12	-3.58	-9.55	-19.02	20.11	5.17	-3.50
	Std Deviation (%)	15.60	23.50	25.95	28.32	29.24	30.01	28.98	28.40	26.96	27.51	17.31	17.45	25.84
	Sharpe Ratio	0.11	0.06	0.05	-0.00	-0.10	-0.09	-0.07	-0.13	-0.35	-0.69	1.16	0.30	-0.14
	SR t-value vs Avg Universe	5.85	6.62	7.89	7.02	2.73	4.00	3.91	0.56	-6.94	-10.14	6.14	5.38	
	Skewness	-1.66	-1.48	-1.09	-1.12	-0.89	-0.84	-0.52	-0.50	-0.22	0.03	-1.37	-0.78	-0.83
	CAPM Alpha	-0.42**	-0.62**	-0.65*	-0.77*	-1.01**	-0.95*	-0.86	-0.97*	-1.42**	-2.34***	1.91***	-0.23**	-1.00**
	Alpha SE	(0.17)	(0.30)	(0.36)	(0.42)	(0.46)	(0.52)	(0.54)	(0.55)	(0.58)	(0.60)	(0.52)	(0.10)	(0.42)
	CAPM Beta	0.81***	1.19***	1.29***	1.37***	1.39***	1.38***	1.27***	1.24***	1.10***	1.12***	-0.30***	0.95***	1.21***
	Beta SE	(0.04)	(0.06)	(0.05)	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.08)	(0.08)	(0.02)	(0.06)
	CAPM Adj R-squared	0.87	0.82	0.79	0.75	0.73	0.68	0.62	0.61	0.53	0.53	0.09	0.95	0.71

('*' $p<.1$, '**' $p<.05$, '***' $p<.01$)

The table shows the summary statistics of annualised excess returns over risk-free rates, standard deviation, Sharpe Ratio, the t-stats of the test of the difference between the Sharpe ratio of the portfolio against the Sharpe ratio of the Nifty 100 and the skewness for each decile portfolio, D1 - D10, Nifty 100 and the Universe (the market factor, $r_{mkt} - r_f$, from the factor library). In addition, we show the CAPM regression alpha and beta with their SE and significance.

Table A4: Summary sub-period results of market-weighted decile portfolios based on different low-risk metrics

Panel A: October 2007 - July 2015

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	-2.53	-12.83	-14.20	-15.52	-23.19	-27.33	-20.35	-39.14	-32.39	-44.63	47.38	10.01	12.05
	Std Deviation (%)	20.20	30.61	34.18	40.32	40.33	43.39	42.22	48.38	51.15	47.08	34.21	24.95	26.76
	Sharpe Ratio	-0.13	-0.42	-0.42	-0.38	-0.58	-0.63	-0.48	-0.81	-0.63	-0.95	1.38	0.40	0.45
	SR t-value vs Avg Universe	-10.87	-12.86	-12.43	-12.30	-12.62	-12.68	-11.92	-12.63	-12.29	-12.46	4.56	-2.92	
	Skewness	-1.33	-0.77	-0.58	-0.76	-0.35	-0.40	0.27	-0.04	0.58	0.47	-1.34	-0.25	-0.37
	CAPM Alpha	-0.25	-1.06***	-1.12***	-1.07***	-1.88***	-2.22***	-1.57***	-3.50***	-2.63***	-4.31***	4.06***	-0.05	-0.00
	Alpha SE	(0.18)	(0.19)	(0.31)	(0.35)	(0.42)	(0.43)	(0.52)	(0.55)	(0.58)	(0.53)	(0.63)	(0.12)	(0.00)
	CAPM Beta	0.69***	1.07***	1.18***	1.39***	1.38***	1.48***	1.41***	1.60***	1.70***	1.49***	-0.80***	0.91***	1.00***
	Beta SE	(0.05)	(0.04)	(0.05)	(0.07)	(0.05)	(0.05)	(0.06)	(0.07)	(0.10)	(0.09)	(0.13)	(0.02)	(0.00)
	CAPM Adj R-squared	0.90	0.95	0.92	0.91	0.90	0.89	0.85	0.84	0.85	0.77	0.41	0.97	1.00
EX_ANTE_BETA	Excess Return (%)	-1.05	-0.02	-8.80	-10.75	-6.28	-16.89	-6.97	-17.04	-19.59	-31.09	20.86	10.01	12.05
	Std Deviation (%)	21.10	19.57	22.94	27.33	28.11	31.28	29.81	39.29	38.23	47.83	36.56	24.95	26.76
	Sharpe Ratio	-0.05	-0.00	-0.38	-0.39	-0.22	-0.54	-0.23	-0.43	-0.51	-0.65	0.57	0.40	0.45
	SR t-value vs Avg Universe	-6.67	-5.99	-11.09	-11.36	-11.27	-12.04	-10.28	-12.20	-12.63	-12.60	0.61	-2.92	
	Skewness	-1.08	-1.37	-0.47	-1.15	-0.54	-0.71	-0.09	-0.13	-0.04	0.18	-0.85	-0.25	-0.37
	CAPM Alpha	-0.08	-0.01	-0.77***	-0.89***	-0.50*	-1.42***	-0.53	-1.29***	-1.58***	-2.58***	2.49***	-0.05	-0.00
	Alpha SE	(0.37)	(0.32)	(0.29)	(0.31)	(0.30)	(0.40)	(0.41)	(0.37)	(0.34)	(0.50)	(0.71)	(0.12)	(0.00)
	CAPM Beta	0.61***	0.56***	0.75***	0.90***	0.96***	1.04***	0.97***	1.34***	1.32***	1.62***	-1.01***	0.91***	1.00***
	Beta SE	(0.09)	(0.09)	(0.04)	(0.09)	(0.05)	(0.05)	(0.06)	(0.04)	(0.04)	(0.07)	(0.13)	(0.02)	(0.00)
	CAPM Adj R-squared	0.63	0.62	0.81	0.83	0.89	0.85	0.82	0.89	0.91	0.88	0.59	0.97	1.00
CAPM_BETA	Excess Return (%)	0.56	-2.94	-3.19	-8.96	-7.15	-10.79	-12.12	-18.46	-19.69	-28.89	15.80	10.01	12.05
	Std Deviation (%)	22.65	20.57	24.43	27.24	30.72	29.97	37.19	38.11	42.62	48.74	42.36	24.95	26.76
	Sharpe Ratio	0.02	-0.14	-0.13	-0.33	-0.23	-0.36	-0.33	-0.48	-0.46	-0.59	0.37	0.40	0.45
	SR t-value vs Avg Universe	-4.81	-7.73	-10.69	-12.01	-10.94	-11.88	-12.40	-12.45	-12.60	-12.44	-0.40	-2.92	
	Skewness	-1.09	-0.52	-0.88	-0.54	-0.92	-0.16	-0.31	-0.10	-0.25	0.47	-1.25	-0.25	-0.37
	CAPM Alpha	0.10	-0.26	-0.27	-0.75***	-0.51*	-0.88***	-0.87***	-1.47***	-1.45***	-2.31***	2.41***	-0.05	-0.00
	Alpha SE	(0.48)	(0.33)	(0.23)	(0.27)	(0.30)	(0.29)	(0.30)	(0.33)	(0.36)	(0.49)	(0.89)	(0.12)	(0.00)
	CAPM Beta	0.56***	0.60***	0.83***	0.94***	1.03***	1.02***	1.29***	1.31***	1.48***	1.65***	-1.09***	0.91***	1.00***
	Beta SE	(0.11)	(0.06)	(0.04)	(0.04)	(0.07)	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)	(0.17)	(0.02)	(0.00)
	CAPM Adj R-squared	0.46	0.65	0.89	0.91	0.87	0.89	0.93	0.90	0.92	0.88	0.50	0.97	1.00
IVOL_36M	Excess Return (%)	-5.20	-5.96	-14.03	-11.59	-17.99	-22.09	-25.23	-25.77	-40.07	-43.37	43.45	10.01	12.05
	Std Deviation (%)	22.47	28.51	33.10	35.41	36.12	41.35	39.36	43.55	52.09	45.17	32.72	24.95	26.76
	Sharpe Ratio	-0.23	-0.21	-0.42	-0.33	-0.50	-0.53	-0.64	-0.59	-0.77	-0.96	1.33	0.40	0.45
	SR t-value vs Avg Universe	-12.28	-11.68	-13.01	-12.34	-11.98	-12.59	-12.33	-12.36	-11.83	-11.92	4.51	-2.92	
	Skewness	-0.86	-0.68	-0.54	-0.70	-0.80	-0.43	-0.76	-0.90	0.71	0.80	-1.57	-0.25	-0.37
	CAPM Alpha	-0.47***	-0.47*	-1.13***	-0.84***	-1.42***	-1.72***	-2.08***	-1.99***	-3.52***	-4.18***	3.71***	-0.05	-0.00
	Alpha SE	(0.15)	(0.26)	(0.20)	(0.28)	(0.45)	(0.37)	(0.49)	(0.49)	(0.78)	(0.66)	(0.70)	(0.12)	(0.00)
	CAPM Beta	0.79***	0.98***	1.17***	1.23***	1.20***	1.42***	1.31***	1.46***	1.60***	1.32***	-0.53***	0.91***	1.00***
	Beta SE	(0.04)	(0.04)	(0.03)	(0.05)	(0.08)	(0.06)	(0.08)	(0.07)	(0.14)	(0.11)	(0.14)	(0.02)	(0.00)
	CAPM Adj R-squared	0.94	0.92	0.96	0.93	0.85	0.91	0.85	0.87	0.73	0.65	0.19	0.97	1.00

Panel B: July 2015 - February 2023

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	2.10	-0.06	-1.33	-12.11	-13.06	-14.03	-10.08	-25.87	-36.89	-34.66	36.23	5.17	8.48
	Std Deviation (%)	15.18	21.88	25.60	31.03	32.69	33.31	38.82	43.56	47.18	40.05	33.04	17.45	17.96
	Sharpe Ratio	0.14	-0.00	-0.05	-0.39	-0.40	-0.42	-0.26	-0.59	-0.78	-0.87	1.10	0.30	0.47
	SR t-value vs Avg Universe	-8.26	-10.53	-9.92	-12.08	-10.93	-10.88	-8.99	-10.43	-10.94	-11.04	3.31	-6.57	
	Skewness	-1.07	-2.02	-1.33	-1.51	-1.52	-1.12	-1.01	-1.71	-2.66	-0.39	0.51	-0.78	-1.10
	CAPM Alpha	-0.39***	-0.75***	-0.91***	-1.95***	-1.98***	-2.07***	-1.64***	-2.99***	-3.86***	-4.09***	3.70***	-0.23**	-0.00
	Alpha SE	(0.11)	(0.20)	(0.26)	(0.30)	(0.44)	(0.50)	(0.63)	(0.95)	(1.05)	(0.82)	(0.86)	(0.10)	(0.00)
	CAPM Beta	0.81***	1.17***	1.34***	1.64***	1.61***	1.63***	1.77***	1.88***	1.97***	1.61***	-0.81***	0.95***	1.00***
	Beta SE	(0.03)	(0.07)	(0.05)	(0.07)	(0.08)	(0.09)	(0.09)	(0.15)	(0.18)	(0.14)	(0.15)	(0.02)	(0.00)
	CAPM Adj R-squared	0.91	0.93	0.88	0.89	0.78	0.77	0.67	0.60	0.55	0.52	0.18	0.95	1.00
EX_ANTE_BETA	Excess Return (%)	1.51	0.73	2.31	1.94	-2.41	4.36	-2.04	-3.27	-8.02	-18.83	5.89	5.17	8.48
	Std Deviation (%)	18.44	14.88	14.63	19.75	20.96	22.65	25.29	29.92	30.28	41.76	40.73	17.45	17.96
	Sharpe Ratio	0.08	0.05	0.16	0.10	-0.11	0.19	-0.08	-0.11	-0.26	-0.45	0.14	0.30	0.47
	SR t-value vs Avg Universe	-3.54	-5.68	-5.27	-8.28	-9.77	-6.32	-10.22	-10.06	-10.31	-10.46	-1.72	-6.57	
	Skewness	1.08	-0.56	-0.08	-1.60	-1.72	-1.04	-1.76	-1.60	-1.19	-1.39	1.01	-0.78	-1.10
	CAPM Alpha	-0.15	-0.38	-0.30	-0.51***	-0.88***	-0.38	-0.96***	-1.12***	-1.51***	-2.46***	2.31***	-0.23**	-0.00
	Alpha SE	(0.41)	(0.25)	(0.24)	(0.20)	(0.27)	(0.25)	(0.27)	(0.36)	(0.41)	(0.72)	(0.88)	(0.10)	(0.00)
	CAPM Beta	0.50***	0.66***	0.71***	1.04***	1.07***	1.18***	1.32***	1.55***	1.51***	1.95***	-1.45***	0.95***	1.00***
	Beta SE	(0.08)	(0.04)	(0.07)	(0.09)	(0.08)	(0.05)	(0.07)	(0.08)	(0.08)	(0.12)	(0.17)	(0.02)	(0.00)
	CAPM Adj R-squared	0.23	0.62	0.75	0.89	0.84	0.87	0.88	0.86	0.80	0.70	0.40	0.95	1.00
CAPM_BETA	Excess Return (%)	-13.44	1.28	0.52	1.60	-1.01	-3.00	-0.40	-10.41	-10.49	-18.53	-3.95	5.17	8.48
	Std Deviation (%)	20.52	14.63	15.30	20.97	23.06	24.38	25.23	31.20	35.47	35.56	33.03	17.45	17.96
	Sharpe Ratio	-0.65	0.09	0.03	0.08	-0.04	-0.12	-0.02	-0.33	-0.30	-0.52	-0.12	0.30	0.47
	SR t-value vs Avg Universe	-8.85	-5.06	-8.86	-8.13	-8.87	-10.02	-8.85	-11.11	-10.94	-11.31	-3.07	-6.57	
	Skewness	-0.48	-0.41	-0.97	-1.71	-3.02	-1.03	-1.51	-1.68	-0.76	-0.85	0.51	-0.78	-1.10
	CAPM Alpha	-1.50***	-0.32	-0.51***	-0.56**	-0.78**	-1.02***	-0.80***	-1.74***	-1.83***	-2.54***	1.05	-0.23**	-0.00
	Alpha SE	(0.49)	(0.23)	(0.17)	(0.24)	(0.37)	(0.29)	(0.31)	(0.38)	(0.40)	(0.49)	(0.72)	(0.10)	(0.00)
	CAPM Beta	0.59***	0.63***	0.80***	1.09***	1.17***	1.25***	1.29***	1.59***	1.81***	1.74***	-1.15***	0.95***	1.00***
	Beta SE	(0.09)	(0.04)	(0.03)	(0.10)	(0.15)	(0.06)	(0.07)	(0.10)	(0.09)	(0.10)	(0.15)	(0.02)	(0.00)
	CAPM Adj R-squared	0.26	0.60	0.87	0.87	0.83	0.85	0.84	0.83	0.84	0.77	0.38	0.95	1.00
IVOL_36M	Excess Return (%)	2.79	-2.87	-3.72	-4.11	-8.08	-16.75	-21.85	-19.48	-22.20	-42.99	56.22	5.17	8.48
	Std Deviation (%)	15.80	21.00	24.91	27.30	30.31	32.44	41.24	47.09	35.37	39.18	31.35	17.45	17.96
	Sharpe Ratio	0.18	-0.14	-0.15	-0.15	-0.27	-0.52	-0.53	-0.41	-0.63	-1.10	1.79	0.30	0.47
	SR t-value vs Avg Universe	-8.33	-10.94	-11.22	-9.43	-10.62	-11.15	-9.79	-9.23	-10.98	-11.74	6.27	-6.57	
	Skewness	-1.16	-2.51	-1.23	-0.63	-1.23	-1.53	-2.39	-1.59	-0.75	-1.42	1.93	-0.78	-1.10
	CAPM Alpha	-0.36***	-0.94***	-1.12***	-1.14***	-1.53***	-2.30***	-2.45***	-2.23**	-2.81***	-5.12***	4.76***	-0.23**	-0.00
	Alpha SE	(0.11)	(0.23)	(0.23)	(0.37)	(0.34)	(0.51)	(0.92)	(1.04)	(0.62)	(0.71)	(0.75)	(0.10)	(0.00)
	CAPM Beta	0.85***	1.11***	1.32***	1.36***	1.53***	1.57***	1.70***	1.97***	1.61***	1.60***	-0.75***	0.95***	1.00***
	Beta SE	(0.03)	(0.09)	(0.04)	(0.09)	(0.07)	(0.10)	(0.14)	(0.19)	(0.12)	(0.14)	(0.14)	(0.02)	(0.00)
	CAPM Adj R-squared	0.93	0.90	0.91	0.79	0.82	0.75	0.54	0.56	0.66	0.53	0.18	0.95	1.00

('*' p<.1, '**' p<.05, '***' p<.01)

The table shows the summary statistics of annualised excess returns over risk-free rates, standard deviation, Sharpe Ratio, the t-stats of the test of the difference between the Sharpe ratio of the portfolio against the Sharpe ratio of the Nifty 100 and the skewness for each decile portfolio, D1 - D10, Nifty 100 and the Universe (the market factor, $r_{mkt} - r_f$, from the factor library). In addition, we show the CAPM regression alpha and beta with their SE and significance.

Table A5: Summary sub-period results of decile portfolios based on different low-risk metrics: August 2018 - February 2023

Panel A: Equal Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	-0.99	-0.21	-0.65	-3.11	-3.23	-4.74	-3.95	-5.44	-11.24	-19.74	13.10	4.38	-5.14
	Std Deviation (%)	13.46	22.44	26.12	28.98	29.66	30.27	32.48	32.27	33.01	34.65	25.39	19.83	27.64
	Sharpe Ratio	-0.07	-0.01	-0.02	-0.11	-0.11	-0.16	-0.12	-0.17	-0.34	-0.57	0.52	0.22	-0.19
	SR t-value vs Avg Universe	1.87	4.02	5.22	2.90	4.48	1.82	3.61	0.87	-4.16	-6.70	2.62	4.13	
	Skewness	-1.81	-2.24	-1.56	-1.56	-1.01	-0.84	-0.66	-0.45	0.04	0.06	-0.96	-0.90	-0.90
	CAPM Alpha	-0.50**	-0.62*	-0.68	-0.90*	-0.91	-1.02	-0.97	-1.06	-1.53*	-2.36***	1.86**	-0.26*	-1.06*
	Alpha SE	(0.25)	(0.37)	(0.46)	(0.54)	(0.59)	(0.63)	(0.68)	(0.73)	(0.82)	(0.84)	(0.78)	(0.14)	(0.55)
	CAPM Beta	0.61***	1.02***	1.15***	1.26***	1.26***	1.25***	1.34***	1.27***	1.22***	1.29***	-0.68***	0.96***	1.17***
	Beta SE	(0.04)	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)	(0.09)	(0.10)	(0.11)	(0.11)	(0.02)	(0.07)
	CAPM Adj R-squared	0.85	0.85	0.80	0.77	0.74	0.69	0.70	0.63	0.56	0.56	0.28	0.96	0.73
EX_ANTE_BETA	Excess Return (%)	-4.38	-4.13	-3.44	-2.88	-2.45	-2.33	-4.07	-6.25	-9.16	-20.74	6.13	4.38	-5.59
	Std Deviation (%)	15.23	19.63	23.93	27.35	28.56	31.17	32.86	35.25	37.11	40.46	31.59	19.83	28.44
	Sharpe Ratio	-0.29	-0.21	-0.14	-0.11	-0.09	-0.07	-0.12	-0.18	-0.25	-0.51	0.19	0.22	-0.20
	SR t-value vs Avg Universe	-0.98	-0.32	1.80	4.40	6.22	6.16	4.48	1.05	-2.28	-7.96	1.46	4.20	
	Skewness	0.76	-0.69	-0.94	-1.03	-0.99	-0.98	-0.96	-0.87	-0.77	-0.55	0.22	-0.90	-0.87
	CAPM Alpha	-0.60	-0.80	-0.85	-0.86	-0.83	-0.85	-1.00	-1.20*	-1.47**	-2.55***	1.95***	-0.26*	-1.10*
	Alpha SE	(0.59)	(0.52)	(0.54)	(0.55)	(0.56)	(0.60)	(0.62)	(0.61)	(0.66)	(0.76)	(0.57)	(0.14)	(0.57)
	CAPM Beta	0.39***	0.75***	0.99***	1.17***	1.21***	1.33***	1.39***	1.50***	1.58***	1.68***	-1.28***	0.96***	1.20***
	Beta SE	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)	(0.09)	(0.09)	(0.10)	(0.09)	(0.11)	(0.12)	(0.02)	(0.07)
	CAPM Adj R-squared	0.26	0.59	0.70	0.74	0.73	0.74	0.74	0.74	0.74	0.70	0.67	0.96	0.73
CAPM_BETA	Excess Return (%)	-5.37	-1.24	-3.27	-2.81	-3.14	-4.12	-5.53	-7.51	-10.14	-16.20	0.60	4.38	-5.50
	Std Deviation (%)	15.08	19.95	23.52	26.06	28.90	31.11	33.23	35.61	37.33	38.77	30.28	19.83	28.17
	Sharpe Ratio	-0.36	-0.06	-0.14	-0.11	-0.11	-0.13	-0.17	-0.21	-0.27	-0.42	0.02	0.22	-0.20
	SR t-value vs Avg Universe	-1.78	2.49	1.69	4.37	4.76	3.84	2.01	-0.78	-3.15	-6.02	0.82	4.19	
	Skewness	0.53	-0.44	-1.25	-1.09	-1.09	-0.95	-0.87	-0.66	-0.63	-0.48	-0.09	-0.90	-0.87
	CAPM Alpha	-0.70	-0.53	-0.82	-0.84	-0.89	-1.01*	-1.13*	-1.32**	-1.56**	-2.11***	1.40**	-0.26*	-1.09*
	Alpha SE	(0.57)	(0.58)	(0.53)	(0.52)	(0.56)	(0.58)	(0.62)	(0.64)	(0.67)	(0.71)	(0.58)	(0.14)	(0.56)
	CAPM Beta	0.42***	0.72***	0.97***	1.10***	1.23***	1.33***	1.40***	1.51***	1.58***	1.61***	-1.19***	0.96***	1.19***
	Beta SE	(0.05)	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)	(0.11)	(0.11)	(0.02)	(0.07)
	CAPM Adj R-squared	0.30	0.53	0.69	0.73	0.74	0.75	0.73	0.74	0.73	0.70	0.63	0.96	0.73
IVOL_36M	Excess Return (%)	-0.06	-1.91	-1.21	-3.04	-6.02	-7.72	-4.27	-6.17	-9.16	-17.21	14.08	4.38	-5.52
	Std Deviation (%)	17.53	26.43	28.19	31.33	31.29	32.23	30.91	30.39	28.94	31.55	19.94	19.83	28.22
	Sharpe Ratio	-0.00	-0.07	-0.04	-0.10	-0.19	-0.24	-0.14	-0.20	-0.32	-0.55	0.71	0.22	-0.20
	SR t-value vs Avg Universe	3.65	3.59	5.28	4.04	0.19	-2.91	2.77	-0.32	-3.14	-6.25	3.43	4.20	
	Skewness	-1.83	-1.62	-1.25	-1.19	-0.97	-0.91	-0.49	-0.43	-0.09	0.06	-1.44	-0.90	-0.87
	CAPM Alpha	-0.53**	-0.81**	-0.77*	-0.93*	-1.17**	-1.29*	-0.94	-1.10	-1.31*	-2.08**	1.56**	-0.26*	-1.09*
	Alpha SE	(0.26)	(0.41)	(0.46)	(0.56)	(0.58)	(0.68)	(0.71)	(0.72)	(0.78)	(0.83)	(0.73)	(0.14)	(0.56)
	CAPM Beta	0.81***	1.19***	1.25***	1.36***	1.33***	1.33***	1.21***	1.19***	1.05***	1.15***	-0.35***	0.96***	1.19***
	Beta SE	(0.05)	(0.08)	(0.07)	(0.08)	(0.08)	(0.09)	(0.09)	(0.08)	(0.08)	(0.10)	(0.10)	(0.02)	(0.07)
	CAPM Adj R-squared	0.87	0.83	0.81	0.78	0.74	0.70	0.63	0.62	0.54	0.54	0.11	0.96	0.73

Panel B: Market Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
VOL_36M	Excess Return (%)	0.61	-0.10	-3.22	-17.10	-17.43	-23.82	-13.03	-36.16	-48.85	-25.07	17.47	4.38	7.92
	Std Deviation (%)	17.22	24.84	28.21	35.23	37.79	38.10	45.66	51.40	55.82	41.78	33.85	19.83	20.29
	Sharpe Ratio	0.04	-0.00	-0.11	-0.49	-0.46	-0.63	-0.29	-0.70	-0.88	-0.60	0.52	0.22	0.39
	SR t-value vs Avg Universe	-6.39	-7.20	-7.58	-9.35	-8.25	-8.76	-6.50	-8.02	-8.40	-7.45	0.54	-5.29	
	Skewness	-1.18	-2.40	-1.62	-1.69	-1.55	-1.11	-0.96	-1.63	-2.53	-0.11	0.35	-0.90	-1.26
	CAPM Alpha	-0.48***	-0.67**	-0.98***	-2.29***	-2.24***	-2.91***	-1.68*	-3.80***	-4.88***	-2.87***	2.40**	-0.26*	0.00***
	Alpha SE	(0.17)	(0.30)	(0.34)	(0.40)	(0.63)	(0.67)	(0.92)	(1.45)	(1.61)	(0.99)	(1.03)	(0.14)	(0.00)
	CAPM Beta	0.81***	1.17***	1.31***	1.65***	1.64***	1.66***	1.83***	1.95***	2.06***	1.53***	-0.72***	0.96***	1.00***
	Beta SE	(0.03)	(0.09)	(0.06)	(0.08)	(0.09)	(0.11)	(0.12)	(0.21)	(0.21)	(0.13)	(0.15)	(0.02)	(0.00)
	CAPM Adj R-squared	0.90	0.92	0.89	0.90	0.78	0.77	0.65	0.58	0.55	0.54	0.17	0.96	1.00
EX_ANTE_BETA	Excess Return (%)	4.46	-0.90	0.51	1.26	-5.16	2.35	-2.89	-3.52	-15.23	-29.26	16.35	4.38	7.92
	Std Deviation (%)	20.69	16.20	15.23	23.17	23.98	25.02	29.21	33.59	34.59	49.19	48.12	19.83	20.29
	Sharpe Ratio	0.22	-0.06	0.03	0.05	-0.22	0.09	-0.10	-0.10	-0.44	-0.59	0.34	0.22	0.39
	SR t-value vs Avg Universe	-1.22	-4.58	-4.48	-5.96	-7.69	-5.11	-7.39	-6.90	-8.24	-8.04	-0.20	-5.29	
	Skewness	1.16	-0.75	0.11	-1.66	-1.89	-1.34	-1.98	-1.88	-1.18	-1.32	0.88	-0.90	-1.26
	CAPM Alpha	0.14	-0.48	-0.39	-0.53*	-1.06***	-0.47	-0.95**	-0.99*	-2.05***	-3.24***	3.38***	-0.26*	0.00***
	Alpha SE	(0.57)	(0.34)	(0.30)	(0.29)	(0.38)	(0.36)	(0.39)	(0.54)	(0.61)	(1.14)	(1.31)	(0.14)	(0.00)
	CAPM Beta	0.48***	0.63***	0.65***	1.08***	1.09***	1.15***	1.35***	1.52***	1.52***	1.98***	-1.50***	0.96***	1.00***
	Beta SE	(0.10)	(0.05)	(0.08)	(0.10)	(0.09)	(0.07)	(0.08)	(0.11)	(0.10)	(0.17)	(0.22)	(0.02)	(0.00)
	CAPM Adj R-squared	0.21	0.62	0.74	0.89	0.85	0.87	0.88	0.85	0.79	0.66	0.39	0.96	1.00
CAPM_BETA	Excess Return (%)	-6.44	1.18	-1.55	0.16	-5.81	-3.99	0.75	-15.12	-14.45	-29.38	15.00	4.38	7.92
	Std Deviation (%)	19.74	16.21	17.08	24.15	27.43	28.05	28.99	35.98	41.66	40.43	36.76	19.83	20.29
	Sharpe Ratio	-0.33	0.07	-0.09	0.01	-0.21	-0.14	0.03	-0.42	-0.35	-0.73	0.41	0.22	0.39
	SR t-value vs Avg Universe	-5.13	-3.38	-7.43	-6.03	-7.52	-7.31	-5.76	-8.53	-8.15	-8.87	0.07	-5.29	
	Skewness	0.72	-0.51	-1.14	-1.84	-3.01	-1.11	-1.82	-1.81	-0.76	-0.78	0.28	-0.90	-1.26
	CAPM Alpha	-0.86	-0.31	-0.65***	-0.62*	-1.13**	-1.03**	-0.62	-2.04***	-2.02***	-3.51***	2.66***	-0.26*	0.00***
	Alpha SE	(0.54)	(0.30)	(0.22)	(0.37)	(0.52)	(0.41)	(0.42)	(0.52)	(0.63)	(0.71)	(0.94)	(0.14)	(0.00)
	CAPM Beta	0.56***	0.63***	0.79***	1.10***	1.24***	1.28***	1.32***	1.62***	1.87***	1.73***	-1.16***	0.96***	1.00***
	Beta SE	(0.10)	(0.04)	(0.04)	(0.13)	(0.17)	(0.08)	(0.08)	(0.12)	(0.12)	(0.13)	(0.19)	(0.02)	(0.00)
	CAPM Adj R-squared	0.32	0.62	0.89	0.86	0.83	0.85	0.85	0.83	0.82	0.75	0.40	0.96	1.00
IVOL_36M	Excess Return (%)	1.59	-4.67	-5.36	-7.36	-14.03	-26.77	-29.68	-26.80	-17.95	-44.68	55.34	4.38	7.92
	Std Deviation (%)	17.74	24.31	27.79	31.00	33.96	37.15	49.62	57.63	40.12	43.03	34.05	19.83	20.29
	Sharpe Ratio	0.09	-0.19	-0.19	-0.24	-0.41	-0.72	-0.60	-0.47	-0.45	-1.04	1.63	0.22	0.39
	SR t-value vs Avg Universe	-6.45	-8.15	-8.59	-7.16	-8.46	-8.97	-7.38	-6.82	-7.85	-8.71	4.61	-5.29	
	Skewness	-1.35	-2.77	-1.51	-0.57	-1.36	-1.50	-2.28	-1.42	-0.76	-1.32	1.90	-0.90	-1.26
	CAPM Alpha	-0.42***	-1.04***	-1.18***	-1.32**	-1.95***	-3.21***	-2.88**	-2.49	-2.28***	-5.16***	4.74***	-0.26*	0.00***
	Alpha SE	(0.15)	(0.34)	(0.32)	(0.52)	(0.47)	(0.68)	(1.44)	(1.65)	(0.78)	(0.99)	(1.02)	(0.14)	(0.00)
	CAPM Beta	0.84***	1.13***	1.31***	1.35***	1.52***	1.61***	1.79***	2.10***	1.69***	1.56***	-0.72***	0.96***	1.00***
	Beta SE	(0.04)	(0.11)	(0.06)	(0.12)	(0.09)	(0.10)	(0.18)	(0.27)	(0.12)	(0.17)	(0.16)	(0.02)	(0.00)
	CAPM Adj R-squared	0.93	0.89	0.92	0.78	0.83	0.77	0.53	0.54	0.73	0.54	0.17	0.96	1.00

('*' p<.1, '**' p<.05, '***' p<.01)

The table shows the summary statistics of annualised excess returns over risk-free rates, standard deviation, Sharpe Ratio, the t-stats of the test of the difference between the Sharpe ratio of the portfolio against the Sharpe ratio of the Nifty 100 and the skewness for each decile portfolio, D1 - D10, Nifty 100 and the Universe (the market factor, $r_{mkt} - r_f$, from the factor library). In addition, we show the CAPM regression alpha and beta with their SE and significance.

Table A6: Summary results of 6-factor regressions for portfolios based on different low-risk metrics: October 2007 - February 2023

Panel A: Equal Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
	alpha	-0.32***	-0.71***	-0.84***	-1.07***	-1.37***	-1.50***	-1.54***	-1.88***	-2.27***	-3.10***	2.78***	-0.04	-1.46***
	alpha SE	(0.11)	(0.13)	(0.11)	(0.12)	(0.13)	(0.16)	(0.18)	(0.19)	(0.23)	(0.27)	(0.28)	(0.08)	(0.13)
	MF	0.66***	0.90***	0.93***	0.94***	0.96***	1.00***	0.96***	0.98***	1.01***	0.96***	-0.30***	0.97***	0.93***
	MF SE	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.04)	(0.06)	(0.05)	(0.05)	(0.02)	(0.04)
	SMB5	0.31***	0.63***	0.81***	0.93***	1.02***	1.03***	1.12***	1.15***	1.15***	1.07***	-0.76***	-0.20***	0.92***
	SMB5 SE	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)	(0.06)	(0.08)	(0.09)	(0.10)	(0.02)	(0.04)
	HML	-0.08	0.04	0.12*	0.14***	0.13**	0.17**	0.27***	0.20**	0.13	0.16	-0.24*	0.01	0.13**
VOL_36M	HML SE	(0.05)	(0.07)	(0.06)	(0.05)	(0.06)	(0.07)	(0.08)	(0.08)	(0.10)	(0.13)	(0.13)	(0.04)	(0.06)
	RMW	0.01	-0.06	-0.13***	-0.16***	-0.18***	-0.18***	-0.16***	-0.19***	-0.29***	-0.35***	0.36***	0.08***	-0.17***
	RMW SE	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.07)	(0.09)	(0.10)	(0.11)	(0.02)	(0.04)
	CMA	0.13*	0.01	0.00	-0.04	0.07	0.04	0.07	0.04	0.13	-0.02	0.14	0.01	0.04
	CMA SE	(0.07)	(0.07)	(0.07)	(0.07)	(0.10)	(0.11)	(0.12)	(0.14)	(0.19)	(0.17)	(0.17)	(0.05)	(0.09)
	WML	0.03	0.03	0.02	0.05*	0.05	0.04	0.04	0.04	0.03	-0.00	0.03	-0.02	0.03
	WML SE	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)	(0.07)	(0.07)	(0.08)	(0.02)	(0.03)
	Adj R-squared	0.92	0.96	0.97	0.97	0.96	0.96	0.94	0.93	0.91	0.87	0.65	0.98	0.96
	alpha	-1.16***	-1.17***	-1.17***	-1.06***	-1.21***	-1.27***	-1.43***	-1.58***	-1.88***	-2.70***	1.54***	-0.04	-1.46***
	alpha SE	(0.27)	(0.17)	(0.15)	(0.14)	(0.14)	(0.14)	(0.13)	(0.16)	(0.16)	(0.21)	(0.32)	(0.08)	(0.13)
	MF	0.48***	0.73***	0.87***	0.92***	0.96***	0.98***	1.00***	1.07***	1.10***	1.22***	-0.74***	0.97***	0.93***
	MF SE	(0.08)	(0.04)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.08)	(0.02)	(0.04)
	SMB5	0.60***	0.75***	0.85***	0.92***	1.01***	0.99***	1.05***	1.11***	1.10***	1.09***	-0.49***	-0.20***	0.95***
	SMB5 SE	(0.09)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.11)	(0.02)	(0.04)
	HML	0.09	-0.06	-0.01	0.08	0.07	0.21***	0.25***	0.21***	0.33***	0.33***	-0.24	0.01	0.15***
EX_ANTE_BETA	HML SE	(0.13)	(0.09)	(0.08)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)	(0.08)	(0.12)	(0.21)	(0.04)	(0.06)
	RMW	-0.18**	-0.13**	-0.11**	-0.14***	-0.16***	-0.18***	-0.14***	-0.14**	-0.16**	-0.23***	0.05	0.08***	-0.16***
	RMW SE	(0.08)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.08)	(0.12)	(0.02)	(0.04)
	CMA	0.00	0.07	0.06	0.06	0.07	0.06	0.07	0.16*	0.10	0.15	-0.15	0.01	0.08
	CMA SE	(0.18)	(0.12)	(0.10)	(0.09)	(0.10)	(0.08)	(0.08)	(0.09)	(0.10)	(0.12)	(0.18)	(0.05)	(0.09)
	WML	0.16***	0.12***	0.08**	0.07**	0.06	0.04	-0.00	-0.03	-0.06	-0.15***	0.32***	-0.02	0.03
	WML SE	(0.06)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.07)	(0.02)	(0.03)
	Adj R-squared	0.67	0.89	0.93	0.95	0.96	0.96	0.97	0.96	0.96	0.95	0.77	0.98	0.97
	alpha	-1.04***	-1.35***	-1.17***	-1.07***	-1.15***	-1.33***	-1.33***	-1.64***	-1.90***	-2.46***	1.42***	-0.04	-1.44***
	alpha SE	(0.23)	(0.19)	(0.17)	(0.15)	(0.13)	(0.14)	(0.15)	(0.14)	(0.15)	(0.19)	(0.26)	(0.08)	(0.12)
	MF	0.41***	0.72***	0.86***	0.90***	0.94***	1.00***	1.02***	1.05***	1.10***	1.22***	-0.80***	0.97***	0.92***
	MF SE	(0.07)	(0.05)	(0.05)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.07)	(0.02)	(0.03)
	SMB5	0.58***	0.80***	0.84***	0.92***	0.98***	1.02***	1.06***	1.09***	1.07***	0.99***	-0.42***	-0.20***	0.94***
	SMB5 SE	(0.08)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.10)	(0.02)	(0.04)
	HML	0.13	-0.06	0.02	0.09	0.13**	0.08	0.19***	0.22***	0.32***	0.35***	-0.22	0.01	0.15***
CAPM_BETA	HML SE	(0.12)	(0.10)	(0.08)	(0.08)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.10)	(0.18)	(0.04)	(0.05)
	RMW	-0.11	-0.11*	-0.09*	-0.08	-0.16***	-0.16***	-0.17***	-0.16**	-0.19***	-0.30***	0.18	0.08***	-0.15***
	RMW SE	(0.07)	(0.06)	(0.05)	(0.05)	(0.04)	(0.05)	(0.06)	(0.07)	(0.07)	(0.09)	(0.12)	(0.02)	(0.04)
	CMA	0.09	0.18	0.11	0.05	0.04	0.15*	0.04	0.10	0.02	-0.01	0.10	0.01	0.08
	CMA SE	(0.14)	(0.13)	(0.10)	(0.09)	(0.08)	(0.09)	(0.10)	(0.09)	(0.09)	(0.12)	(0.14)	(0.05)	(0.09)
	WML	0.12**	0.16***	0.11***	0.07**	0.09***	0.01	0.01	-0.07*	-0.09**	-0.17***	0.29***	-0.02	0.02
	WML SE	(0.05)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.06)	(0.07)	(0.02)	(0.03)
	Adj R-squared	0.68	0.86	0.92	0.94	0.96	0.96	0.96	0.96	0.97	0.95	0.83	0.98	0.97
	alpha	-0.30***	-0.77***	-1.03***	-1.07***	-1.43***	-1.49***	-1.58***	-1.71***	-2.12***	-2.96***	2.66***	-0.04	-1.45***
	alpha SE	(0.11)	(0.10)	(0.10)	(0.11)	(0.12)	(0.16)	(0.18)	(0.19)	(0.23)	(0.28)	(0.30)	(0.08)	(0.12)
	MF	0.69***	0.92***	0.99***	0.99***	0.98***	0.99***	0.97***	0.96***	0.85***	0.88***	-0.19***	0.97***	0.92***
	MF SE	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.02)	(0.03)
	SMB5	0.41***	0.71***	0.86***	0.97***	1.06***	1.11***	1.11***	1.11***	1.06***	0.99***	-0.59***	-0.20***	0.94***
	SMB5 SE	(0.03)	(0.03)	(0.02)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)	(0.08)	(0.09)	(0.10)	(0.02)	(0.04)
	HML	0.07	0.11**	0.12**	0.19***	0.19***	0.21***	0.21***	0.13	0.19**	0.07	0.00	0.01	0.15***
IVOL_36M	HML SE	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)	(0.08)	(0.09)	(0.10)	(0.12)	(0.13)	(0.04)	(0.05)
	RMW	0.01	-0.08***	-0.06*	-0.10**	-0.17***	-0.13**	-0.19***	-0.24***	-0.23***	-0.33***	0.34***	0.08***	-0.15***
	RMW SE	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.06)	(0.06)	(0.07)	(0.08)	(0.09)	(0.10)	(0.02)	(0.04)
	CMA	0.12**	0.09	0.17***	0.08	0.08	0.10	0.16	0.04	0.04	-0.10	0.21	0.01	0.08
	CMA SE	(0.06)	(0.06)	(0.07)	(0.07)	(0.09)	(0.10)	(0.13)	(0.15)	(0.16)	(0.17)	(0.18)	(0.05)	(0.09)
	WML	-0.06***	-0.02	-0.05**	-0.01	0.02	0.03	0.05	0.09	0.12*	0.09	-0.15**	-0.02	0.03
	WML SE	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.06)	(0.06)	(0.07)	(0.08)	(0.02)	(0.03)
	Adj R-squared	0.95	0.98	0.98	0.98	0.97	0.95	0.94	0.93	0.88	0.84	0.44	0.98	0.97

Panel B: Market Weight Portfolios

		D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_10	D_1_less_D_10	NIFTY100	Avg_Univ
	alpha	-0.47***	-0.80***	-1.11***	-1.45***	-1.90***	-2.03***	-1.46***	-3.14***	-3.04***	-4.36***	3.90***	-0.04	0.00**
	alpha SE	(0.10)	(0.13)	(0.18)	(0.24)	(0.27)	(0.36)	(0.37)	(0.47)	(0.58)	(0.54)	(0.58)	(0.08)	(0.00)
	MF	0.85***	1.05***	1.11***	1.31***	1.28***	1.28***	1.20***	1.41***	1.56***	1.25***	-0.40***	0.97***	1.00***
	MF SE	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.08)	(0.07)	(0.10)	(0.11)	(0.10)	(0.11)	(0.02)	(0.00)
	SMB5	-0.09***	0.03	0.30***	0.28***	0.36***	0.42***	0.46***	0.37***	0.41**	0.84***	-0.93***	-0.20***	0.00***
	SMB5 SE	(0.03)	(0.04)	(0.05)	(0.08)	(0.07)	(0.09)	(0.15)	(0.12)	(0.16)	(0.18)	(0.19)	(0.02)	(0.00)
	HML	-0.11**	0.15**	0.23***	0.27**	0.31***	0.13	0.62***	0.73***	-0.04	-0.32	0.21	0.01	0.00***
VOL_36M	HML SE	(0.04)	(0.07)	(0.09)	(0.11)	(0.10)	(0.21)	(0.21)	(0.27)	(0.20)	(0.23)	(0.25)	(0.04)	(0.00)
	RMW	0.14***	-0.13**	-0.07	-0.16**	-0.29***	-0.32***	-0.11	-0.04	-0.49***	-0.41**	0.55***	0.08***	0.00***
	RMW SE	(0.04)	(0.05)	(0.06)	(0.08)	(0.08)	(0.11)	(0.13)	(0.14)	(0.17)	(0.20)	(0.21)	(0.02)	(0.00)
	CMA	0.17**	-0.17	0.13	-0.12	0.03	-0.27	-0.40	-0.45	-0.42	0.07	0.09	0.01	-0.00
	CMA SE	(0.07)	(0.11)	(0.10)	(0.13)	(0.17)	(0.20)	(0.26)	(0.39)	(0.46)	(0.32)	(0.36)	(0.05)	(0.00)
	WML	0.09*	0.11***	-0.03	0.03	0.06	-0.05	-0.02	0.07	0.08	-0.23	0.32*	-0.02	-0.00*
	WML SE	(0.05)	(0.04)	(0.06)	(0.07)	(0.09)	(0.07)	(0.11)	(0.22)	(0.27)	(0.16)	(0.18)	(0.02)	(0.00)
	Adj R-squared	0.94	0.95	0.93	0.92	0.90	0.88	0.81	0.76	0.73	0.48	0.48	0.98	1.00
	alpha	-0.54*	-0.72***	-0.87***	-0.67***	-0.63***	-0.87***	-0.57**	-1.03***	-1.29***	-2.20***	1.66***	-0.04	0.00**
	alpha SE	(0.29)	(0.19)	(0.18)	(0.19)	(0.22)	(0.24)	(0.28)	(0.26)	(0.24)	(0.42)	(0.54)	(0.08)	(0.00)
	MF	0.82***	0.83***	0.83***	0.93***	0.94***	1.04***	0.98***	1.24***	1.24***	1.48***	-0.65***	0.97***	1.00***
	MF SE	(0.06)	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.06)	(0.05)	(0.05)	(0.08)	(0.12)	(0.02)	(0.00)
	SMB5	-0.11	0.06	0.07	0.04	0.07	0.05	0.04	0.16*	0.04	0.25***	-0.36**	-0.20***	0.00***
	SMB5 SE	(0.08)	(0.05)	(0.05)	(0.06)	(0.08)	(0.06)	(0.08)	(0.09)	(0.08)	(0.09)	(0.15)	(0.02)	(0.00)
	HML	-0.23	-0.37***	-0.06	-0.03	0.25**	0.10	0.37***	0.31**	0.29**	0.32	-0.56*	0.01	0.00***
EX_ANTE_BETA	HML SE	(0.15)	(0.08)	(0.08)	(0.10)	(0.10)	(0.11)	(0.12)	(0.14)	(0.14)	(0.21)	(0.30)	(0.04)	(0.00)
	RMW	0.30**	0.17***	0.29***	-0.10	0.04	-0.12	-0.05	-0.11	-0.21**	-0.45***	0.75***	0.08***	0.00***
	RMW SE	(0.13)	(0.06)	(0.06)	(0.08)	(0.07)	(0.09)	(0.08)	(0.09)	(0.09)	(0.12)	(0.20)	(0.02)	(0.00)
	CMA	0.37**	0.47***	0.27**	-0.25*	-0.16	0.12	0.07	-0.07	-0.03	-0.11	0.47	0.01	-0.00
	CMA SE	(0.16)	(0.12)	(0.12)	(0.14)	(0.12)	(0.15)	(0.19)	(0.14)	(0.22)	(0.31)	(0.37)	(0.05)	(0.00)
	WML	0.16**	0.21***	-0.02	0.14	0.07	-0.00	-0.02	-0.09	-0.05	-0.03	0.19	-0.02	-0.00*
	WML SE	(0.08)	(0.06)	(0.04)	(0.11)	(0.07)	(0.06)	(0.07)	(0.06)	(0.10)	(0.18)	(0.20)	(0.02)	(0.00)
	Adj R-squared	0.56	0.76	0.83	0.86	0.88	0.86	0.85	0.90	0.89	0.83	0.62	0.98	1.00
	alpha	-1.42***	-0.71***	-0.58***	-0.45**	-0.55**	-0.78***	-0.61***	-1.44***	-1.43***	-2.07***	0.65	-0.04	0.00**
	alpha SE	(0.40)	(0.20)	(0.13)	(0.21)	(0.22)	(0.23)	(0.22)	(0.26)	(0.28)	(0.36)	(0.60)	(0.08)	(0.00)
	MF	0.80***	0.78***	0.93***	0.94***	1.01***	0.98***	1.15***	1.17***	1.40***	1.46***	-0.66***	0.97***	1.00***
	MF SE	(0.08)	(0.04)	(0.02)	(0.04)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.08)	(0.14)	(0.02)	(0.00)
	SMB5	0.20**	0.07	0.03	-0.10	0.08	0.08	0.11	0.29***	0.24***	0.17*	0.03	-0.20***	0.00***
	SMB5 SE	(0.10)	(0.06)	(0.04)	(0.06)	(0.08)	(0.07)	(0.07)	(0.09)	(0.08)	(0.10)	(0.15)	(0.02)	(0.00)
	HML	-0.33*	-0.26***	-0.31***	0.09	0.09	0.15	0.21**	0.36***	0.17	0.02	-0.35	0.01	0.00***
CAPM_BETA	HML SE	(0.17)	(0.09)	(0.07)	(0.10)	(0.10)	(0.11)	(0.10)	(0.11)	(0.13)	(0.20)	(0.32)	(0.04)	(0.00)
	RMW	0.37***	0.24***	-0.05	0.00	-0.11	-0.13*	-0.13*	-0.10	-0.26***	-0.42***	0.79***	0.08***	0.00***
	RMW SE	(0.14)	(0.07)	(0.04)	(0.07)	(0.09)	(0.07)	(0.08)	(0.09)	(0.08)	(0.12)	(0.20)	(0.02)	(0.00)
	CMA	0.56***	0.27**	0.11	-0.20	-0.20	-0.16	-0.21**	-0.08	-0.01	-0.04	0.60*	0.01	-0.00
	CMA SE	(0.21)	(0.13)	(0.07)	(0.14)	(0.20)	(0.15)	(0.10)	(0.17)	(0.18)	(0.24)	(0.34)	(0.05)	(0.00)
	WML	0.14	0.11**	0.12***	-0.03	0.08	-0.01	-0.07*	-0.14*	-0.09	-0.20	0.34**	-0.02	-0.00*
	WML SE	(0.09)	(0.06)	(0.03)	(0.05)	(0.07)	(0.07)	(0.04)	(0.08)	(0.09)	(0.13)	(0.18)	(0.02)	(0.00)
	Adj R-squared	0.47	0.71	0.91	0.89	0.85	0.88	0.92	0.90	0.90	0.87	0.59	0.98	1.00
	alpha	-0.43***	-0.73***	-1.21***	-1.05***	-1.65***	-2.04***	-2.21***	-2.16***	-3.07***	-4.87***	4.45***	-0.04	0.00**
	alpha SE	(0.10)	(0.17)	(0.16)	(0.23)	(0.23)	(0.28)	(0.50)	(0.50)	(0.50)	(0.59)	(0.63)	(0.08)	(0.00)
	MF	0.89***	0.99***	1.21***	1.14***	1.10***	1.25***	1.23***	1.37***	1.30***	1.24***	-0.36***	0.97***	1.00***
	MF SE	(0.02)	(0.04)	(0.03)	(0.05)	(0.05)	(0.04)	(0.09)	(0.09)	(0.11)	(0.11)	(0.12)	(0.02)	(0.00)
	SMB5	-0.15***	0.12**	0.14***	0.31***	0.63***	0.57***	0.47***	0.57***	0.61***	0.82***	-0.97***	-0.20***	0.00***
	SMB5 SE	(0.03)	(0.06)	(0.05)	(0.06)	(0.06)	(0.08)	(0.11)	(0.18)	(0.11)	(0.19)	(0.19)	(0.02)	(0.00)
	HML	-0.01	0.08	0.01	0.24**	0.24**	0.00	0.14	0.58**	-0.07	-0.83***	0.82***	0.01	0.00***
IVOL_36M	HML SE	(0.04)	(0.07)	(0.07)	(0.10)	(0.10)	(0.12)	(0.25)	(0.25)	(0.27)	(0.25)	(0.26)	(0.04)	(0.00)
	RMW	0.10***	-0.04	-0.00	-0.11	-0.26***	-0.37***	-0.37**	-0.06	-0.48**	-0.44**	0.54**	0.08***	0.00***
	RMW SE	(0.04)	(0.06)	(0.06)	(0.08)	(0.07)	(0.08)	(0.14)	(0.19)	(0.19)	(0.20)	(0.21)	(0.02)	(0.00)
	CMA	0.10	-0.08	0.06	-0.04	0.07	-0.21	-0.51	-0.67	-0.04	0.33	-0.24	0.01	-0.00
	CMA SE	(0.07)	(0.16)	(0.10)	(0.16)	(0.14)	(0.18)	(0.37)	(0.43)	(0.26)	(0.32)	(0.34)	(0.05)	(0.00)
	WML	0.03	0.07	0.04	0.03	0.05	0.04	0.22	0.27	-0.23	-0.29	0.32	-0.02	-0.00*
	WML SE	(0.04)	(0.05)	(0.04)	(0.07)	(0.07)	(0.07)	(0.22)	(0.23)	(0.14)	(0.18)	(0.20)	(0.02)	(0.00)
	Adj R-squared	0.95	0.91	0.94	0.90	0.92	0.89	0.72	0.73	0.76	0.66	0.34	0.98	1.00

('*' p<.1, '**' p<.05, '***' p<.01)

The table shows the summary statistics of the 6 Factor regressions. We construct a beta-neutral long-short factor and some of the factor's summary statistics for each low-risk metric. For ex-ante beta, we construct two factors, one following Frazzini and Pedersen (2014) and the second following the Fama and French (2015) methodology of double-sorted portfolios.

Table A7: Annual median number of firms in size-low-risk metric for VOL, BAB$_{FP}$, BAB$_{FF}$, BAB$_{CAPM}$ and IVOL factors: October 2007 - February 2023

	VOL						BAB$_{FP}$				BAB$_{FF}$						BAB$_{CAPM}$						IVOL					
	Lovol		Neutral		Hivol		Low Beta		Hi Beta		Low Beta		Neutral		Hi Beta		Low Beta		Neutral		Hi Beta		Lovol		Neutral		Hivol	
	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small	Big	Small
2007-12-31	65	84	86	276	65	1,264	78	646	104	620	55	496	72	430	55	359	55	512	72	378	55	398	55	84	72	214	55	1,002
2008-12-31	65	98	86	285	65	1,269	86	706	86	697	55	452	73	543	55	410	55	382	73	569	55	524	55	111	73	226	55	1,040
2009-12-31	60	190	78	546	60	1,080	71	821	106	787	53	642	70	684	53	271	53	422	70	658	53	532	53	176	69	355	53	1,094
2010-12-31	61	164	82	532	61	1,124	132	815	76	885	58	370	76	530	58	824	58	416	76	804	58	490	57	171	76	388	57	1,142
2011-12-31	79	102	104	490	79	1,223	138	868	102	887	74	472	98	598	74	683	74	436	98	706	74	620	74	139	97	408	74	1,220
2012-12-31	73	76	98	284	73	1,618	129	890	99	922	69	462	90	710	69	633	69	506	90	626	69	730	69	128	90	300	69	1,406
2013-12-31	73	118	96	308	73	1,678	128	948	101	970	70	572	92	640	70	724	70	613	92	796	70	551	70	158	92	300	70	1,496
2014-12-31	60	93	80	290	60	1,734	112	986	91	1,008	60	536	78	816	60	594	60	603	78	862	60	528	60	150	78	264	60	1,583
2015-12-31	83	86	109	226	83	1,748	160	952	116	992	81	560	108	554	81	789	82	662	107	754	82	550	82	109	107	228	82	1,597
2016-12-31	86	87	115	228	86	1,754	164	928	129	976	86	587	114	590	86	724	86	644	114	680	86	602	86	101	114	224	86	1,606
2017-12-31	94	100	123	208	94	1,808	158	931	146	943	91	628	119	610	91	634	91	603	120	500	91	786	91	80	120	228	91	1,586
2018-12-31	108	98	142	233	108	1,856	174	941	140	976	97	608	127	584	97	734	97	552	128	502	97	911	97	99	128	227	97	1,614
2019-12-31	98	142	131	230	98	1,950	140	990	144	1,002	87	671	114	685	87	630	87	554	114	466	87	994	87	106	114	302	87	1,592
2020-12-31	85	153	111	317	85	1,816	143	1,016	120	1,036	78	676	103	570	78	794	78	596	103	520	78	961	78	123	103	322	78	1,618
2021-12-31	86	122	114	319	86	1,812	179	1,020	104	1,096	82	576	108	582	82	942	82	634	108	554	82	982	82	142	108	325	82	1,654
2022-12-31	100	82	132	309	100	1,844	192	1,027	118	1,105	94	596	124	526	94	940	94	704	124	618	94	819	94	104	124	308	94	1,730
2023-02-28	106	82	140	324	105	1,836	161	1,062	153	1,070	94	760	126	580	94	792	94	719	126	620	94	801	94	91	126	310	94	1,736

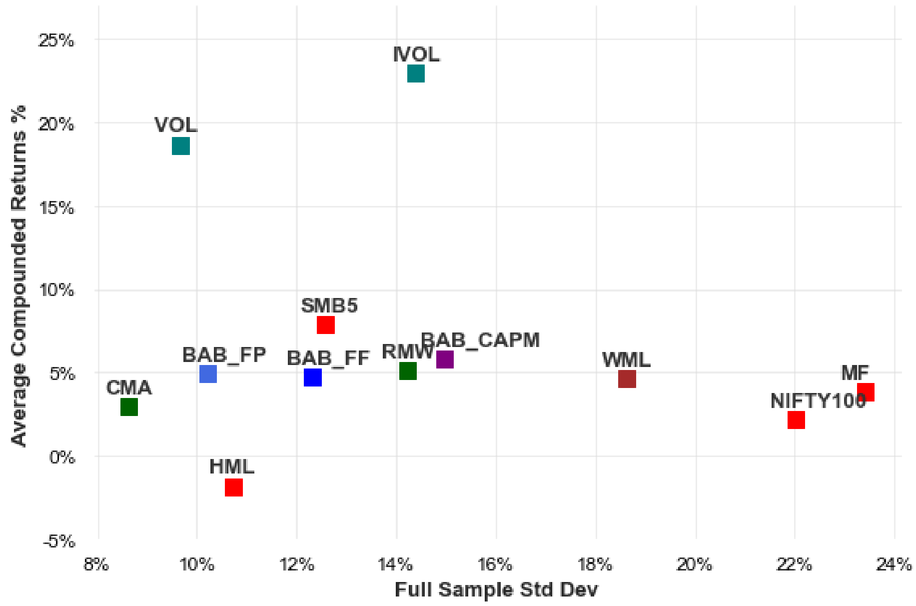
The table shows the annual median of firms in each size-low-risk double-sorted portfolio that makes up a factor. The breakpoints for Size follow Fama and French (2015) and defined *Big* stocks are those in India's top 90% of September market cap, and small stocks are those in the bottom 10%. The low-risk breakpoints are the 30th and 70th percentiles of respective ratios for the *Big* stocks. The median for 2007 is from September 2007 and for 2023 till February 2023.

Table A8: Summary statistics for Long and Short and Small, Big portfolios forming the sub-portfolios for VOL, BAB$_{FP}$, BAB$_{FF}$, BAB$_{CAPM}$ and IVOL factors: October 2007 - February 2023

		Excess Return (%)	Std Deviation (%)	t-Statistic	CAPM Alpha	Alpha SE	CAPM Beta	Beta SE	CAPM Adj R-squared
VOL	Long	11.67	18.34	3.01	0.28**	(0.12)	0.74***	(0.04)	0.90
	Short	-6.10	35.39	0.06	-1.49***	(0.20)	1.44***	(0.04)	0.91
	L-S	10.85	20.02	2.65	1.78***	(0.21)	-0.70***	(0.04)	0.67
	Big	11.16	25.10	2.36	2.00***	(0.32)	-0.80***	(0.06)	0.55
	Small	9.86	17.21	2.72	1.55***	(0.19)	-0.60***	(0.03)	0.68
	B-S	1.67	15.79	0.79	0.45	(0.30)	-0.19***	(0.05)	0.08
BAB$_{FP}$	Long	1.24	23.12	0.74	-0.53**	(0.26)	0.81***	(0.06)	0.68
	Short	-9.26	36.44	-0.31	-1.68***	(0.31)	1.37***	(0.07)	0.78
	L-S	5.33	16.94	1.68	1.14***	(0.21)	-0.55***	(0.05)	0.59
BAB$_{FF}$	Long	0.14	19.25	0.46	-0.64***	(0.14)	0.76***	(0.04)	0.86
	Short	-9.02	35.17	-0.33	-1.75***	(0.20)	1.43***	(0.05)	0.91
	L-S	2.87	19.72	1.05	1.11***	(0.23)	-0.66***	(0.04)	0.63
	Big	6.24	24.52	1.59	1.56***	(0.34)	-0.75***	(0.06)	0.51
	Small	-0.99	17.33	0.13	0.66***	(0.19)	-0.58***	(0.04)	0.62
	B-S	7.61	15.74	2.33	0.89***	(0.32)	-0.17***	(0.06)	0.06
BAB$_{CAPM}$	Long	1.20	19.38	0.70	-0.55***	(0.15)	0.76***	(0.04)	0.85
	Short	-9.80	35.24	-0.44	-1.82***	(0.20)	1.42***	(0.05)	0.90
	L-S	4.67	20.64	1.41	1.27***	(0.25)	-0.66***	(0.06)	0.56
	Big	8.03	25.24	1.88	1.71***	(0.34)	-0.74***	(0.08)	0.47
	Small	0.86	17.89	0.59	0.83***	(0.22)	-0.58***	(0.05)	0.59
	B-S	7.82	14.50	2.54	0.88***	(0.26)	-0.15***	(0.05)	0.06
IVOL	Long	5.99	20.28	1.54	0.20*	(0.11)	0.84***	(0.03)	0.94
	Short	-11.39	33.95	-0.67	-1.25***	(0.20)	1.39***	(0.03)	0.91
	L-S	10.84	15.13	3.25	1.45***	(0.21)	-0.46***	(0.04)	0.51
	Big	13.49	22.15	2.68	1.62***	(0.33)	-0.64***	(0.06)	0.45
	Small	12.07	13.74	3.53	1.28***	(0.19)	-0.46***	(0.03)	0.60
	B-S	1.22	14.96	0.66	0.36	(0.29)	-0.15***	(0.06)	0.05

('*' p<.1, '**' p<.05, '***' p<.01)
The table shows the summary statistics of annualised excess returns over risk-free rates, standard deviation, t-Statistic, the CAPM regression alpha and beta with their SE and significance and CAPM Adj R-squared.

Fig. A4: Annualised returns and standard deviations of factors in India: October 2007 - February 2023



Source: "Data Library: Fama French 3 and 5 Factors and Momentum Factor for the Indian Market" and Author's calculations

Table A9: Summary statistics for beta-neutral long-short VOL, BAB_{FP}, BAB_{FF}, BAB_{CAPM} and IVOL factors: October 2007 - February 2023

		VOL	BAB_{FP}	BAB_{FF}	BAB_{CAPM}	IVOL	NIFTY100
	Return (%)	17.36	7.25	4.57	6.39	22.88	7.90
	Std Deviation (%)	10.06	9.90	11.83	14.19	14.40	22.17
	t-Statistic	7.09	3.24	1.87	2.18	5.92	1.96
	Sharpe Ratio	1.73	0.73	0.39	0.45	1.59	0.36
	SR t-value vs NIFTY100	11.20	3.63	0.33	0.94	11.16	
	Alpha	1.43***	0.65***	0.50**	0.73***	1.85***	-0.14*
	Alpha SE	(0.19)	(0.20)	(0.21)	(0.27)	(0.32)	(0.08)
CAPM	Beta	-0.05	-0.03	-0.06	-0.12*	-0.06	0.93***
	Beta SE	(0.04)	(0.04)	(0.04)	(0.06)	(0.08)	(0.02)
	Adj R-squared	0.01	-0.00	0.01	0.03	0.00	0.96
	alpha	1.19***	0.30*	-0.03	0.13	1.56***	-0.06
	alpha SE	(0.19)	(0.17)	(0.21)	(0.29)	(0.33)	(0.07)
	MF	0.08	-0.02	0.10**	0.07	-0.02	0.96***
	MF SE	(0.05)	(0.03)	(0.04)	(0.06)	(0.09)	(0.02)
	SMB5	0.02	0.28***	0.20***	0.17**	0.06	-0.17***
	SMB5 SE	(0.07)	(0.06)	(0.07)	(0.08)	(0.10)	(0.03)
	HML	-0.21**	0.00	-0.26**	-0.25**	0.28*	0.04
FF5+WML	HML SE	(0.10)	(0.09)	(0.11)	(0.12)	(0.16)	(0.04)
	RMW	0.29***	-0.03	0.35***	0.33***	0.33***	0.11***
	RMW SE	(0.07)	(0.06)	(0.07)	(0.09)	(0.11)	(0.03)
	CMA	0.33***	0.04	0.33***	0.35**	0.43**	-0.00
	CMA SE	(0.09)	(0.07)	(0.10)	(0.14)	(0.20)	(0.03)
	WML	-0.05	0.20***	0.10	0.20***	-0.06	-0.04
	WML SE	(0.06)	(0.03)	(0.06)	(0.07)	(0.10)	(0.03)
	Adj R-squared	0.19	0.20	0.28	0.27	0.08	0.98

('*' p<.1, '**' p<.05, '***' p<.01)
The table shows the summary statistics of the beta-neutral long-short low-risk factors and Nifty100 total excess returns over risk-free: annualised returns, standard deviation, t-Statistic, Sharpe ratio, the t-value of the difference in the Sharpe ratio versus Nifty 100, the CAPM and FF5+WML regressions.

Table A10: Full period correlation between monthly returns of factors and Nifty100: October 2007 - February 2023

	MF	SMB5	HML	RMW	CMA	WML	VOL	BAB_{FP}	BAB_{FF}	BAB_{CAPM}	IVOL
SMB5	0.25										
HML	0.40	0.38									
RMW	-0.37	-0.18	-0.61								
CMA	-0.27	-0.20	0.18	-0.23							
WML	-0.34	-0.20	-0.29	0.30	0.28						
VOL	-0.11	-0.12	-0.30	0.38	0.09	0.12					
BAB_{FP}	-0.06	0.29	0.05	0.01	0.09	0.30	0.26				
BAB_{FF}	-0.12	0.03	-0.32	0.43	0.06	0.30	0.70	0.49			
BAB_{CAPM}	-0.19	-0.03	-0.31	0.39	0.12	0.39	0.68	0.44	0.87		
IVOL	-0.10	0.02	0.09	0.10	0.21	0.06	0.66	0.26	0.46	0.54	
NIFTY100	0.98	0.16	0.36	-0.31	-0.28	-0.34	-0.03	-0.10	-0.08	-0.15	-0.05

The table shows the correlations between the monthly returns of factors and the Nifty100 excess returns.

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