RESEARCH

Factor Risk Premia in the Indian Market

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INTRODUCTION

The existence of factor risk premia is well established in the global market. A factor can be thought of as an element that helps to explain the source of risk/return characteristics of a portfolio. The broadly recognized factors are size, dividend, volatility, momentum, quality, and value. Active portfolio managers have long used factors to achieve diversification. More recently, factors have been incorporated into passive portfolio strategies as well. They are offered through factor-based exchange-traded products and funds (ETPs and ETFs) and have become increasingly popular. These factor-based ETPs and ETFs are colloquially known by many different terms such as alternate beta, smart beta, strategic beta, etc. According to Morningstar's "A Global Guide to Strategic-Beta Exchange Traded Products," September 2016 edition, there were 1,123 such products, with approximately USD 550.5 billion in assets under management as of June 2016. The growth of these products and funds has been exponential in global markets and India is also jumping on the bandwagon. While a large amount of research exists on global markets, it would be interesting to see how these factors behave in the Indian market. In this paper, we examine four factors: low volatility, momentum, quality, and value.

A factor can be thought of as an element that helps to explain the source of risk/return characteristics of a portfolio.

METHODOLOGY

For this research paper, we used the S&P BSE LargeMidCap as the underlying universe for the back-testing between Sept. 30, 2005, and April 30, 2016. The S&P BSE LargeMidCap is a float-market-cap-weighted index and consists of large- and mid-cap companies in India,[1] with 126 and 149 companies as of Sept. 30, 2005, and April 30, 2016, respectively. In our study on different factors, we divided the index universe into five quintile portfolios according to their ranks of each examined factor, and they were equally weighted and rebalanced semi-annually, in March and September.[2]

We tracked the return characteristics, portfolio turnover, performance in different market cycles, and sector composition for the top and bottom

[1] The S&P BSE LargeMidCap represents approximately 85% of the S&P BSE AllCap by total market capitalization. Small-cap companies, which represent the bottom 15% of the S&P BSE AllCap by total market capitalization, were not included in the study in order to avoid the small-cap bias.

[2] The universe and the hypothetical back-tested factor portfolios were rebalanced after the close of the third Friday of March and September, with reference dates of the last business day of February and August each year.

quintile portfolios for each factor. In our study on the low volatility factor, we measured volatility as historical annualized volatility over trailing 12-month, 6-month, and 3-month periods. Similarly, for the momentum factor, we measured momentum as historical risk-adjusted momentum[3] over trailing 12-month, 6-month, and 3-month periods, excluding the most recent month. For the quality factor, we measured quality using return on equity,[4] balance sheet accruals ratio,[5] and financial leverage ratio.[6] For the value factor, we measured value using the book-value-to-price ratio, earnings-to-price ratio, and sales-to-price ratio of a company.

Additionally, we examined the top and bottom quintile portfolios of the individual underlying fundamental factors in the same manner as the overall factor. We also included the performance of the equal-weighted S&P BSE LargeMidCap for a consistent comparison with the equal-weighted factor quintile portfolios.

The low volatility anomaly directly challenges the CAPM, which posits a linear relationship between risk and return.

LOW VOLATILITY

The low volatility anomaly may be one of the most intriguing anomalies, according to which, portfolios with lower volatility stocks tend to produce higher risk-adjusted returns than the portfolios with higher volatility stocks. It directly challenges the capital asset pricing model (CAPM), which posits a linear relationship between risk and return. The anomaly was identified as far back as 1972.[7] Since then, many empirical studies have been written across the global markets. Evidence of the persistence of the low volatility anomaly in the short to medium term has also been documented.[8]

Low volatility portfolios can be constructed using various methods, such as minimum variance with an optimization model or simple heuristics based on rank by volatility.[9] In this paper, we have constructed hypothetical low volatility quintile portfolios based on historical annualized volatility over trailing 12-, 6-, and 3-month periods. The top quintile (Q1) consists of stocks with the lowest volatility and the bottom quintile (Q5) consists of stocks with the highest volatility. Volatility was measured as the standard deviation of the daily local currency price return over the measurement period.

[3] The risk-adjusted momentum was calculated as the annualized price return divided by the annualized standard deviation of daily price return over the respective measurement period.

[4] Return on equity is calculated as a company's trailing 12-month earnings per share divided by its latest book value per share.

[5] The balance sheet accruals ratio is computed using the change of a company's net operating assets over the last year divided by its average net operating assets over the last two years.

[6] The financial leverage ratio is calculated as a company's latest total debt divided by its book value.

[7] Jensen, Michael C., Fischer Black, and Myron S. Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," Studies in the theory of Capital Markets, Praeger Publishers Inc., 1972.

[8] Chan, Fei Mei and Craig J. Lazzara, "Is the Low Volatility Anomaly Universal?" S&P Dow Jones Indices, April 2015.

[9] Tzee-man, Chow, Jason C. Hsu, Li-lan Kuo, and Feifei Li, "A Study of Low Volatility Portfolio Construction Methods," The Journal of Portfolio Management, 2014.

The Q1 volatility portfolios delivered a higher risk-adjusted return and information ratios and had lower drawdowns than the benchmark indices and the corresponding Q5 portfolios.

We observed that from Sept. 30, 2005, to April 30, 2016, the Q1 portfolios delivered a higher risk-adjusted return and information ratios and had lower drawdowns than the benchmark indices and the corresponding Q5 portfolios for back-tests using different volatility measurement periods (see Exhibit 1). This shows the existence of low volatility anomaly in the Indian market.

Exhibit 1: Risk/Return Profiles of Low Volatility Portfolios

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED LOW VOLATILITY PORTFOLIOS					
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	12-MONTH Q1	12-MONTH Q5	6-MONTH Q1	6-MONTH Q5	3-MONTH Q1	3-MONTH Q5
Annualized Return (%)	12.90	13.13	22.45	7.73	21.94	8.48	18.99	4.73
Annualized Risk (%)	25.03	29.47	19.34	42.15	19.62	40.50	19.87	40.06
Risk-Adjusted Return	0.52	0.45	1.16	0.18	1.12	0.21	0.96	0.12
Sharpe Ratio	0.25	0.22	0.82	0.03	0.78	0.05	0.62	-0.05
Excess Return (%)	N/A	0.23	9.55	-5.17	9.04	-4.42	6.09	-8.17
Tracking Error (%)	N/A	8.17	12.89	20.74	12.75	19.25	12.76	20.00
Information Ratio	N/A	0.03	0.74	-0.25	0.71	-0.23	0.48	-0.41
12-Month Maximum Drawdown (%)	-57.92	-62.40	-42.16	-75.45	-40.42	-74.85	-44.20	-75.83

Equal-weighted low volatility portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Sharpe ratio is calculated using volume-weighted average Collateralized Borrowing and Lending Obligation (CBLO) Rate published by The Clearing Corporation of India Ltd. Excess return, tracking error, and information ratio have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark.

Exhibit 2 shows characteristics of the Q1 portfolios constructed with different volatility measurement periods, including portfolio turnover, average monthly excess returns, and beta. From Sept. 30, 2005, to April 30, 2016, the Q1 portfolios using 12- and 6-month volatility delivered significant excess return and had beta less than one against the float-market-cap-weighted S&P BSE LargeMidCap at a 5% significance level. However, the excess return and the beta less than one were not significant for the Q1 portfolio using three-month volatility. This implied that capturing low volatility stocks using a shorter volatility measurement period did not yield more pronounced or significant excess returns than using longer volatility measurement periods. Moreover, the portfolio turnovers had an inverse relationship with the volatility measurement periods. Portfolios with longer volatility measurement periods implied lower replication costs, which is an important factor for passive portfolio management.

Exhibit 2: Characteristics of Q1 Low Volatility Portfolios

STATISTICS	EQUAL-WEIGHTED LOW VOLATILITY PORTFOLIOS		
	12-MONTH Q1	6-MONTH Q1	3-MONTH Q1
Average Annual Turnover (%)	67.08	97.95	115.49
Average Monthly Excess Return (%)	0.58	0.55	0.35
T-Statistic (Excess Return)	1.7649*	1.6877*	1.0660
Beta	0.6673	0.6787	0.6859
T-Statistic (Beta)	-9.5510*	-9.1569*	-8.8151*

Equal-weighted low volatility portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Average annual turnover is one-way turnover by portfolio weight. Average monthly excess return and beta have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

During the down months, the low volatility portfolio outperformed the market more than 80% of the time, with significant average monthly excess return at a 5% significance level.

Exhibit 3 indicates how the Q1 portfolio based on 12-month volatility performed in different market cycles. We divided the examined period into up and down months, based on the monthly return of the float-market-cap-weighted S&P BSE LargeMidCap. During the down months, the low volatility portfolio outperformed the market more than 80% of the time, with significant average monthly excess return at a 5% significance level. During the up months, the low volatility portfolio underperformed the market more than half of the time, though the underperformance was not significant. This led us to conclude that the low volatility portfolio could provide protection during down months in the Indian market.

Exhibit 3: Performance of Equal-Weighted Low Volatility 12-Month Q1 Portfolio

STATISTICS	% OF MONTHS OUTPERFORMED THE MARKET	AVERAGE MONTHLY EXCESS RETURNS (%)	T-STATISTIC
Up Months	46.15	-0.57	-1.3038
Down months	81.63	2.41	6.2524*
All months	59.84	0.58	1.7649*

Equal-weighted low volatility 12-month Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Up months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had positive returns. Down months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had negative returns. Percentage of months outperformed the market and average monthly excess return have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

From Sept. 30, 2005, to April 30, 2016, the Q1 portfolio using 12-month volatility had higher exposure to large-cap stocks but lower sector diversification, on average, compared with the equal-weighted S&P BSE LargeMidCap. Historically, the fast moving consumer goods (FMCG) and healthcare sectors had the highest average sector weights (see Exhibit 4), showing that the low volatility portfolio had a higher allocation to defensive sectors in the Indian market.

Exhibit 4: Size and Sector Exposure

STATISTICS	S&P BSE LARGEMIDCAP INDEX		EQUAL-WEIGHTED LOW VOLATILITY 12-MONTH Q1 PORTFOLIO
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	
AVERAGE SIZE EXPOSURE (%)			
Large Cap	82.96	43.62	55.21
Mid Cap	17.04	56.38	44.79
AVERAGE SECTOR EXPOSURE (%)			
Basic Materials	8.40	11.94	6.24
CDGS^	7.76	12.04	12.78
Energy	12.71	7.63	8.78
Finance	23.93	19.29	8.48
FMCG	9.17	7.62	20.18
Healthcare	5.50	9.03	19.59
Industrials	11.16	13.50	7.18
IT	12.32	6.21	6.79
Telecom	3.87	3.48	0.48
Utilities	5.18	9.25	9.50
SECTOR CONCENTRATION (HIGHER NUMBERS IMPLY HIGHER CONCENTRATION)			
Average Sector HHI*	0.1337	0.1193	0.1531

Equal-weighted low volatility 12-month Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes. CDGS^: Consumer Discretionary Goods and Services. *Note: The Herfindahl-Hirshman Index (HHI) is calculated as the sum of the square of the 10 sectors' weighting. A higher number implies lower diversification (higher concentration) and vice versa.

The underlying hypothesis of the momentum effect is the existence of persistence in the relative performance of stocks; i.e., the winners continue to win and losers continue to lose.

MOMENTUM

The momentum effect was documented in academic literature in the early 1990s.[10] The underlying hypothesis is the existence of persistence in the relative performance of stocks; i.e., the winners continue to win and losers continue to lose. The momentum effect has been studied across different markets and asset classes.[11] Studies have also been conducted to demonstrate that momentum returns are not irregular and that the strategy can work for long-only market participants as well.[12] Empirical studies on the Indian stock market have suggested that there is no calendar effect on momentum strategies and it can be implemented throughout the year.[13]

Traditionally, momentum has been measured as price return over the previous 3 to 12 months, excluding the most recent month in order to avoid the one-month reversal effect.[14] Critics have argued that returns generated

[10] Jegadeesh, Narasimhan and Sheridan Titman, "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency," Journal of Finance 48, 65-91, 1993.

[11] Asness, Clifford S., Tobias J. Moskowitz, and Lasse Heje Pedersen, "Value and Momentum Everywhere," Chicago Booth Research Paper No. 12-53, June 2012.

[12] Asness, Clifford S., Andrea Frazzini, Ronen Israel and Tobias J. Moskowitz, "Fact, Fiction and Momentum Investing", Journal of Portfolio Management, 2014

[13] Maheshwari, Supriya and Raj S. Dhankar, "Seasonality in Momentum Profits: Evidence from the Indian Stock Market," Journal of Commerce and Accounting Research, 4(3&4), pp. 8-18, July 2015.

[14] Zeng, Liyu, "Examining Factor Strategies in China's A-Share Market," S&P Dow Jones Indices, November 2015.

by such measures can be eliminated during a crisis. This has led researchers to discover new methods of measuring momentum, such as the risk-adjusted momentum, which can yield more consistent performance.[15] For this paper, we have constructed hypothetical momentum portfolios based on historical risk-adjusted momentum over trailing 12-, 6-, and 3-month periods, excluding the most recent month. Q1 consists of stocks with the highest risk-adjusted momentum and Q5 consists of stocks with the lowest risk-adjusted momentum. The risk-adjusted momentum was calculated as the annualized price return divided by the annualized standard deviation of daily price return over the respective measurement period.

The Q1 risk-adjusted momentum portfolios had higher a risk-adjusted return and information ratio than the benchmark indices and the corresponding Q5 portfolios for back-tests using different risk-adjusted momentum measurement periods.

We observed that from Sept. 30, 2005, to April 30, 2016, the Q1 risk-adjusted momentum portfolios had a higher risk-adjusted return and information ratio than the benchmark indices and the corresponding Q5 portfolios for back-tests using different risk-adjusted momentum measurement periods (see Exhibit 5). However, the drawdown was higher than the float-market-cap-weighted S&P BSE LargeMidCap for all the Q1 portfolios. This demonstrates the existence of the momentum effect in the Indian market as well.

Exhibit 5: Risk/Return Profiles of Risk Adjusted Momentum Portfolios

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED, RISK-ADJUSTED MOMENTUM PORTFOLIOS					
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	12-MONTH Q1	12-MONTH Q5	6-MONTH Q1	6-MONTH Q5	3-MONTH Q1	3-MONTH Q5
Annualized Return (%)	12.90	13.13	18.58	12.57	21.60	11.20	17.87	14.68
Annualized Risk (%)	25.03	29.47	26.69	33.42	28.21	32.55	28.12	32.17
Risk Adjusted Return	0.52	0.45	0.70	0.38	0.77	0.34	0.64	0.46
Sharpe Ratio	0.25	0.22	0.45	0.18	0.53	0.14	0.40	0.25
Excess Return (%)	N/A	0.23	5.68	-0.33	8.70	-1.70	4.97	1.78
Tracking Error (%)	N/A	8.17	14.79	16.86	13.99	15.72	13.52	14.56
Information Ratio	N/A	0.03	0.38	-0.02	0.62	-0.11	0.37	0.12
12-Month Maximum Draw Down (%)	-57.92	-62.40	-63.47	-57.95	-60.79	-60.59	-60.85	-66.43

Equal-weighted, risk-adjusted momentum portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Sharpe ratio is calculated using the volume-weighted average CBLO Rate published by The Clearing Corporation of India Ltd. Excess return, tracking error, and information ratio have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark.

Exhibit 6 displays characteristics of the Q1 portfolios constructed using risk-adjusted momentum measured over different periods, including portfolio turnover, average monthly excess returns, and beta. From Sept. 30, 2005, to April 30, 2016, the Q1 portfolio using six-month, risk-adjusted momentum

[15] Soe, Aye M., "Momentum: Does Adjusting by risk mater?", S&P Dow Jones Indices, 2015

Harvesting momentum by measuring risk-adjusted momentum over very short or very long measurement periods in the Indian market did not yield significant excess return.

delivered significant excess return over the float-market-cap-weighted S&P BSE LargeMidCap at a 5% significance level. However, the excess return was not significant for the other Q1 portfolios. This shows that harvesting momentum by measuring risk-adjusted momentum over very short or very long measurement periods in the Indian market did not yield significant excess return. The Q1 portfolio using 12-month, risk-adjusted momentum had beta significantly less than one against the float-market-cap-weighted S&P BSE LargeMidCap at a 5% significance level. Therefore, a longer measurement period lowered the risk of the portfolio. Moreover, the average annual turnover ratio was also much lower for the portfolio based on 12-month risk adjusted momentum in comparison with other portfolios. Consequently, there is a tradeoff among a slightly longer measurement period used in portfolio construction, risk exposure, and transaction cost of the momentum strategy.

Exhibit 6: Characteristics of Q1 Momentum Portfolios

STATISTICS	EQUAL-WEIGHTED, RISK-ADJUSTED MOMENTUM PORTFOLIOS		
	12-MONTH Q1	6-MONTH Q1	3-MONTH Q1
Average Annual Turnover (%)	110.40	152.28	156.93
Average Monthly Excess Return (%)	0.45	0.69	0.43
T-Statistic (Excess Return)	1.1890	1.9364*	1.2306
Beta	0.8941	0.9788	0.9852
T-Statistic (Beta)	-2.0466*	-0.4273	-0.3085

Equal-weighted, risk-adjusted momentum portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Average annual turnover is one-way turnover by portfolio weight. Average monthly excess return and beta have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

Exhibit 7 shows how the Q1 portfolio based on 12-month, risk-adjusted momentum performed in different market cycles. We divided the examined period into up and down months based on the monthly return of the float-market-cap-weighted S&P BSE LargeMidCap. During the down months, the momentum portfolio outperformed the market more than 65% of the time and had significant excess return, at a 5% significance level. During the up months, it outperformed the market more than half of the time. This led us to conclude that while the momentum portfolio constructed using risk-adjusted momentum had upside potential, it also provided protection in down markets.

Exhibit 7: Performance of Equal-Weighted Momentum 12-Month Q1 Portfolio

STATISTICS	% OF MONTHS OUTPERFORMED MARKET	AVERAGE MONTHLY EXCESS RETURNS (%)	T-STATISTIC
Up Months	53.85	0.21	0.3850
Down months	65.31	0.83	1.8828*
All months	58.27	0.45	1.1890

Equal-weighted momentum 12-month Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Up months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a positive return. Down months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a negative return. Percentage of months outperformed the market and average monthly excess return have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at 5% level.

On average, the Q1 portfolio using 12-month, risk-adjusted momentum had higher exposure to mid-cap stocks and lower sector diversification in comparison with the equal-weighted S&P BSE LargeMidCap.

On average, the Q1 portfolio using 12-month, risk-adjusted momentum had higher exposure to mid-cap stocks and lower sector diversification in comparison with the equal-weighted S&P BSE LargeMidCap. Historically, the finance and industrials sectors had the highest average sector weights (see Exhibit 8), showing that the risk-adjusted momentum portfolio had higher allocation to cyclical sectors in the Indian market.

Exhibit 8: Size and Sector Exposure

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED, RISK-ADJUSTED, 12-MONTH MOMENTUM Q1 PORTFOLIO
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	
AVERAGE SIZE EXPOSURE (%)			
Large Cap	82.96	43.62	40.60
Mid Cap	17.04	56.38	59.40
AVERAGE SECTOR EXPOSURE (%)			
Basic Materials	8.40	11.94	11.67
CDGS^	7.76	12.04	12.91
Energy	12.71	7.63	5.26
Finance	23.93	19.29	16.46
FMCG	9.17	7.62	12.06
Healthcare	5.50	9.03	13.61
Industrials	11.16	13.50	13.92
IT	12.32	6.21	7.11
Telecom	3.87	3.48	2.55
Utilities	5.18	9.25	4.46
SECTOR CONCENTRATION (HIGHER NUMBERS IMPLY HIGHER CONCENTRATION)			
Average Sector HHI*	0.1337	0.1193	0.1768

Equal-weighted, risk-adjusted, 12-month momentum Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes. CDGS^: Consumer Discretionary Goods and Services. *Note: The HHI is calculated as the sum of the square of the 10 sectors' weighting. A higher number implies lower diversification (higher concentration) and vice versa.

QUALITY

Quality as a concept is not new for financial analysts. In the debt market, ratings are used as a measure of the quality of the debt issued by a company. For equities, quality has been associated with a measure of profitability of the firm.[16] A great deal of work exists on the use of profitability as a measure of a firm's success. More recently, professors Fama and French extended the three-factor model to a five-factor model, incorporating profitability as one of the factors.[17] There have been various attempts to define quality as a factor, and a number of practitioners go beyond profitability to define what constitutes quality. S&P Quality Indices employ return on equity as a measure of profitability, the balance sheet accruals ratio as a measure of a company's earnings quality, and financial leverage ratio as a measure of the financial robustness of the company to define quality.[18] Higher return on equity indicates better chances of surviving the competition and remaining profitable in the future. A lower balance sheet accruals ratio indicates that the reported financial information is more reliable. A lower financial leverage ratio indicates more resilience during times of financial distress.

In the debt market, ratings are used as a measure of the quality of the debt issued by a company. For equities, quality has been associated with a measure of profitability of the firm.

In this paper, we have constructed hypothetical quality portfolios based on quality score, which is the average of the normalized fundamental factors: return on equity,[19] balance sheet accruals ratio,[20] and financial leverage ratio.[21] We have also constructed individual hypothetical portfolios for each fundamental factor. The Q1 portfolios consist of stocks with a high quality score, high return on equity, low balance sheet accruals ratio, and low financial leverage ratio. The Q5 portfolios consist of stocks with a low quality score, low return on equity, high balance sheet accruals ratio, and high financial leverage ratio.

Exhibit 9 shows that the Q1 quality score portfolio had a higher risk-adjusted return, higher information ratio, and lower drawdown than the benchmark indices and the corresponding Q5 quality portfolio. This implies that quality as a factor also has significance in the Indian market.

For the period studied, we also observed that the Q1 portfolios using individual fundamental factors had similar annualized excess return over the float-market-cap-weighted S&P BSE LargeMidCap. However, the return spread between the Q1 and Q5 portfolios for these underlying

[16] Hunstad, Michael, "Insights on Quality Investing," Northern Trust.

[17] Fama, Eugene F. and Kenneth R. French, "A Five-Factor Asset Pricing Model," Fama-Miller Working Paper, September 2014.

[18] Ung, Daniel and Priscilla Luk, "Quality: A distinct equity factor?" S&P Dow Jones Indices, 2014.

[19] Return on equity is calculated as a company's trailing 12-month earnings per share divided by its latest book value per share.

[20] The balance sheet accruals ratio is computed using the change of a company's net operating assets over the last year divided by its average net operating assets over the last two years.

[21] The financial leverage ratio is calculated as a company's latest total debt divided by its book value.

fundamental factors was most significant for return on equity, followed by balance sheet accruals ratio and financial leverage ratio. Therefore, the return spread contribution between the Q1 and Q5 quality portfolios can be attributed most to the return on equity.

Exhibit 9: Risk/Return Profiles of Portfolios

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED PORTFOLIOS							
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	QUALITY Q1	QUALITY Q5	RETURN ON EQUITY Q1	RETURN ON EQUITY Q5	BALANCE SHEET ACCRUALS RATIO Q1	BALANCE SHEET ACCRUALS RATIO Q5	FINANCIAL LEVERAGE RATIO Q1	FINANCIAL LEVERAGE RATIO Q5
Annualized Return (%)	12.90	13.13	22.03	5.56	17.00	8.14	17.32	10.32	17.31	15.81
Annualized Risk (%)	25.03	29.47	21.68	39.42	22.11	34.89	23.39	32.61	21.99	37.02
Risk Adjusted Return	0.52	0.45	1.02	0.14	0.77	0.23	0.74	0.32	0.79	0.43
Sharpe Ratio	0.25	0.22	0.71	-0.03	0.47	0.04	0.46	0.11	0.49	0.25
Excess Return (%)	N/A	0.23	9.13	-7.34	4.10	-4.76	4.42	-2.58	4.41	2.91
Tracking Error (%)	N/A	8.17	9.32	18.44	11.39	14.87	11.28	13.56	12.36	15.10
Information Ratio	N/A	0.03	0.98	-0.40	0.36	-0.32	0.39	-0.19	0.36	0.19
12-Month Max Drawdown (%)	-57.92	-62.40	-43.79	-76.83	-53.02	-71.56	-48.88	-76.35	-51.23	-71.73

Equal-weighted portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Sharpe ratio is calculated using the volume-weighted average CBLO Rate published by The Clearing Corporation of India Ltd. Excess return, tracking error, and information ratio have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark.

The fundamental factors used for constructing the quality portfolio lowered the risk.

Exhibit 10 presents the characteristics of the Q1 portfolios constructed using quality score, return on equity, balance sheet accruals ratio, and financial leverage ratio, including portfolio turnover, average monthly excess returns, and beta. From Sept. 30, 2005, to April 30, 2016, all the Q1 portfolios had a beta significantly less than one against the float-market-cap-weighted S&P BSE LargeMidCap at a 5% significance level. Hence, the fundamental factors used for constructing the quality portfolio lowered the risk. The Q1 quality score portfolios had significant excess return, at a 5% significance level. However, the Q1 portfolios that based on individual fundamental factors had non-significant excess returns. Therefore, even though in isolation the parameters did not yield significant excess returns, when combined in the quality score, the excess return was significant. The turnover of the Q1 portfolio using balance sheet accruals ratio was highest among the individual fundamental factors. Hence, it contributed the most to the turnover of the Q1 quality portfolio.

Exhibit 10: Characteristics of Q1 Portfolios

STATISTICS	EQUAL-WEIGHTED PORTFOLIOS			
	QUALITY Q1	RETURN ON EQUITY Q1	BALANCE SHEET ACCRUALS RATIO Q1	FINANCIAL LEVERAGE RATIO Q1
Average Annual Turnover (%)	66.76	54.31	75.96	33.33
Average Monthly Excess Returns (%)	0.59	0.25	0.30	0.27
T-Statistic (Excess Return)	2.4859*	0.8473	1.0215	0.8425
Beta	0.8077	0.7887	0.8358	0.7666
T-Statistic (Beta)	-6.7898*	-5.9017*	-4.3977*	-6.0377*

Equal-weighted portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Average annual turnover is one-way turnover by portfolio weight. Average monthly excess return and beta have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

Exhibit 11 illustrates how the Q1 quality score portfolio performed in different market cycles. We divided the examined period into up and down months, based on the monthly return of the float-market-cap-weighted S&P BSE LargeMidCap. During the down markets, the quality portfolio outperformed the market more than 75% of the time, with significant excess returns at a 5% significance level. During the up markets, the quality portfolio underperformed the market more than half of the time, though the underperformance was not significant. This indicates that the quality portfolio had defensive characteristics that provided protection in the down months in the Indian market.

During the up markets, the quality portfolio underperformed the market more than half of the time, though the underperformance was not significant.

Exhibit 11: Performance of Equal-Weighted Quality Q1 Portfolio

STATISTICS	% OF MONTHS OUTPERFORMED MARKET	AVERAGE MONTHLY EXCESS RETURN (%)	T-STATISTIC
Up Months	46.15	-0.20	-0.6774
Down months	77.55	1.85	5.4584*
All months	58.27	0.59	2.4858*

Equal-weighted quality Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Up months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a positive return. Down months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a negative return. Percentage of months outperformed the market and average monthly excess return have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

During the period studied, the Q1 quality score portfolio had similar exposure to the large- and mid-cap segments as the equal-weighted S&P BSE LargeMidCap, but lower sector diversification, on average (see Exhibit 12). Among all of the Q1 individual factor portfolios, the average sector weights of the Q1 quality portfolio were most similar to the return on equity factor. We also observed that the return on equity and financial leverage

ratio factors lowered the sector diversification of the quality portfolio, while the balance sheet accrual ratio increased the sector diversification. Historically, the FMCG sector had the highest average sector weight and the finance and telecom sectors had the lowest average sector weight in the Q1 portfolio by quality. Overall, the total allocation to defensive sectors was slightly less than 50% in the Q1 portfolio by quality.

Historically, the FMCG sector had the highest average sector weight and the finance and telecom sectors had the lowest average sector weight in the Q1 portfolio by quality.

Exhibit 12: Size and Sector Exposure

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL- WEIGHTED QUALITY Q1 PORTFOLIO			
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	QUALITY Q1	RETURN ON EQUITY Q1	BALANCE SHEET ACCRUALS RATIO Q1	FINANCIAL LEVERAGE RATIO Q1
AVERAGE SIZE EXPOSURE (%)						
Large Cap	82.96	43.62	44.08	44.34	36.84	45.88
Mid Cap	17.04	56.38	55.92	55.66	63.16	54.12
AVERAGE SECTOR EXPOSURE (%)						
Basic Materials	8.40	11.94	11.29	10.93	11.95	12.44
CDGS^	7.76	12.04	14.62	16.39	10.87	10.38
Energy	12.71	7.63	9.91	6.96	9.49	7.15
Finance	23.93	19.29	2.97	2.48	13.96	3.80
FMCG	9.17	7.62	21.97	24.56	16.78	14.75
Healthcare	5.50	9.03	11.54	11.61	8.12	10.04
Industrials	11.16	13.50	11.62	10.84	9.30	19.77
IT	12.32	6.21	12.04	12.18	5.36	19.03
Telecom	3.87	3.48	2.57	2.93	8.36	2.33
Utilities	5.18	9.25	1.48	1.11	5.80	0.31
SECTOR CONCENTRATION (HIGHER NUMBERS IMPLY HIGHER CONCENTRATION)						
Average Sector HHI*	0.1337	0.1193	0.1544	0.1642	0.1336	0.1600

Equal-weighted quality Q1 portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes. CDGS^: Consumer Discretionary Goods and Services. *Note: The HHI is calculated as the sum of the square of the 10 sectors' weighting. A higher number implies lower diversification (higher concentration) and vice versa.

VALUE

The groundwork of value as a concept was laid in the 1930s by Graham and Dodd in their text "Security Analysis."[22] The idea behind value investing is to buy stocks that are priced lower than their intrinsic value. Damodaran classifies value market participants into three different types.[23] The first type is passive and uses valuation multiples, such as price to book multiple, price to earnings multiple, etc., as screens and invests in stocks with low multiples. The second type is contrarians that invest in companies that have performed poorly. The third and final type is those who take a

[22] Graham, Benjamin and David Dodd, "Security Analysis," New York, McGraw-Hill, 1934.

[23] Damodaran, Aswath, "Value Investing: Investing for Grown Ups?" April 2012.

large position in poorly managed companies and then turn them around by actively playing a role in their management. S&P DJI's Enhanced Value Indices can be categorized as the first type. They use the classic valuation ratios (book-value-to-price, earnings-to-price, and sales-to-price ratios) for screening stocks. Higher ratios imply an attractive valuation.

For this paper, we have constructed hypothetical value portfolios based on value score, which is the average of the normalized fundamental factors: book-value-to-price, earnings-to-price, and sales-to-price ratio scores. We have also constructed individual hypothetical portfolios for each fundamental factor. The Q1 portfolios consist of stocks with a high value score, book-value-to-price ratio, earnings-to-price ratio, and sales-to-price ratio. The Q5 portfolios consist of stocks with a low value score, book-value-to-price ratio, earnings-to-price ratio, and sales-to-price ratio.

Q1 value score portfolios had a lower risk-adjusted return and information ratio than the benchmark indices and the corresponding Q5 portfolio.

Exhibit 13 affirms that the Q1 value score portfolios had a lower risk-adjusted return and information ratio than the benchmark indices and the corresponding Q5 portfolio. This shows that a screen using classic ratios for identifying value did not yield a premium in the Indian market during the period from Sept. 30, 2005, to April 30, 2016.

For the same time period, we also observed that the Q1 book-value-to-price portfolios had the lowest annualized excess return over the float-market-cap-weighted S&P BSE LargeMidCap, and it underperformed the respective Q5 portfolio. The Q1 earnings-to-price and sales-to-price portfolios outperformed their respective Q5 portfolios during the same period. Hence, the book-value-to-price ratio contributed the most to lowering the excess returns of the Q1 value portfolio. It is also noteworthy that for all of the valuation metrics, the Q1 portfolios had higher volatility than their respective Q5 portfolios. Therefore, all of the valuation metrics contributed to the higher volatility of the Q1 value portfolio.

Exhibit 13: Risk/Return Profiles of Portfolios

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED PORTFOLIOS							
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	VALUE Q1	VALUE Q5	BOOK TO PRICE Q1	BOOK TO PRICE Q5	EARNINGS TO PRICE Q1	EARNINGS TO PRICE Q5	SALES TO PRICE Q1	SALES TO PRICE Q5
Annualized Return (%)	12.90	13.13	8.20	13.45	7.39	15.43	12.35	10.10	13.17	12.19
Annualized Risk (%)	25.03	29.47	37.70	23.70	37.19	23.16	33.28	27.43	35.30	24.40
Risk-Adjusted Return	0.52	0.45	0.22	0.57	0.20	0.67	0.37	0.37	0.37	0.50
Sharpe Ratio	0.25	0.22	0.04	0.29	0.02	0.38	0.17	0.13	0.19	0.23
Excess Return (%)	N/A	0.23	-4.70	0.55	-5.51	2.53	-0.55	-2.80	0.28	-0.71
Tracking Error (%)	N/A	8.17	20.06	9.72	19.30	12.10	15.22	12.63	16.30	11.70
Information Ratio	N/A	0.03	-0.23	0.06	-0.29	0.21	-0.04	-0.22	0.02	-0.06
12-Month Maximum Drawdown (%)	-57.92	-62.40	-60.24	-64.21	-60.73	-60.99	-59.79	-71.84	-65.52	-63.18

Equal-weighted portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Sharpe ratio is calculated using the volume-weighted average CBLO Rate published by The Clearing Corporation of India Ltd. Excess return, tracking error, and information ratio have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark.

The portfolio constructed using classic valuation ratios had higher risk than the market and the factor premium was not realized for the period under consideration.

Exhibit 14 depicts the characteristics of the Q1 portfolios constructed using value score, book-value-to-price ratio, earnings-to-price ratio, and sales-to-price ratio, including portfolio turnover, average monthly excess returns, and beta. From Sept. 30, 2005, to April 30, 2016, all the Q1 portfolios had a beta significantly greater than one against the float-market-cap-weighted S&P BSE LargeMidCap at a 5% significance level, implying that these portfolios had higher risk than the market. The average monthly excess return was not significant at a 5% significance level for all the Q1 portfolios. Hence, the portfolio constructed using classic valuation ratios had higher risk than the market and the factor premium was not realized for the period under consideration.

Exhibit 14: Characteristics of Q1 Portfolios

STATISTICS	EQUAL-WEIGHTED PORTFOLIOS			
	VALUE Q1	BOOK TO PRICE Q1	EARNINGS TO PRICE Q1	SALES TO PRICE Q1
Average Annual Turnover (%)	54.10	56.19	64.77	46.50
Average Monthly Excess Returns (%)	-0.06	-0.14	0.14	0.26
T-Statistic (Excess Return)	-0.1109	-0.2816	0.3494	0.6150
Beta	1.3119	1.3059	1.1988	1.2809
T-Statistic (Beta)	4.7497*	4.8610*	3.8901*	5.3783*

Equal-weighted portfolios are hypothetical portfolios.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Average annual turnover is the one-way turnover by portfolio weight. Average monthly excess return and beta have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

Exhibit 15 portrays how the Q1 value score portfolio performed in different market environments. We divided the examined period into up and down months, based on the monthly return of the float-market-cap-weighted S&P BSE LargeMidCap. During the up months, the value portfolio outperformed the market slightly more than 55% of the time, with a positive excess return at a 5% significance level. However, during down months, it underperformed the market more than 70% of the time, with a negative excess return at a 5% significance level. This shows that the value portfolio was highly procyclical and tended to outperform during up markets, but it was prone to larger losses during down markets.

During the up months, the value portfolio outperformed the market slightly more than 55% of the time, with a positive excess return at a 5% significance level.

Exhibit 15: Performance of Equal-Weighted Value Q1 Portfolio

STATISTICS	% OF MONTHS OUTPERFORMED MARKET	AVERAGE MONTHLY EXCESS RETURN (%)	T-STATISTIC
Up Months	56.41	1.46	2.0908*
Down months	28.57	-2.48	-4.2236*
All months	45.67	-0.06	-0.1109

Equal-weighted Value Q1 Portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Performance data is based on total return in INR. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance. Up months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a positive return. Down months are those months when the float-market-cap-weighted S&P BSE LargeMidCap had a negative return. Percentage of months outperformed the market and average monthly excess return have been calculated using the float-cap-weighted S&P BSE LargeMidCap as the benchmark. *Implies significance at a 5% level.

During the period studied, the Q1 value score portfolio had a higher allocation to the mid-cap segment in comparison with the equal-weighted S&P BSE LargeMidCap and much lower sector diversification, on average (see Exhibit 16). Moreover, we observed that the sector diversification of the value portfolio was similar to the book-value-to-price portfolio. The earnings-to-price ratio reduced the sector diversification, while the sales-to-price ratio contributed to an increase in the sector diversification. The finance sector had the highest weight in all the Q1 portfolios. Overall, the total allocation to cyclical sectors was high.

Exhibit 16: Size and Sector Exposure

STATISTICS	S&P BSE LARGEMIDCAP		EQUAL-WEIGHTED VALUE Q1 PORTFOLIO			
	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	VALUE Q1	BOOK TO PRICE Q1	EARNINGS TO PRICE Q1	SALES TO PRICE Q1
AVERAGE SIZE EXPOSURE (%)						
Large Cap	82.96	43.62	33.07	29.02	38.42	28.71
Mid Cap	17.04	56.38	66.93	70.98	61.58	71.29
AVERAGE SECTOR EXPOSURE (%)						
Basic Materials	8.40	11.94	11.87	10.62	17.48	13.49
CDGS^	7.76	12.04	5.84	8.85	3.83	6.84
Energy	12.71	7.63	16.93	8.40	9.48	19.36
Finance	23.93	19.29	44.19	44.04	47.86	34.64
FMCG	9.17	7.62	1.09	1.27	1.13	1.10
Healthcare	5.50	9.03	0.93	0.91	1.86	0.31
Industrials	11.16	13.50	10.17	9.30	8.45	14.21
IT	12.32	6.21	1.72	1.73	2.14	2.10
Telecom	3.87	3.48	3.50	4.44	0.96	2.78
Utilities	5.18	9.25	3.76	10.44	6.82	5.18
SECTOR CONCENTRATION (HIGHER NUMBERS IMPLY HIGHER CONCENTRATION)						
Average Sector HHI*	0.1337	0.1193	0.2696	0.2671	0.3098	0.2173

Equal-weighted Value Q1 Portfolio is a hypothetical portfolio.
Source: S&P Dow Jones Indices LLC. Data from Sept. 30, 2005, to April 30, 2016. Past performance is no guarantee of future results. Table is provided for illustrative purposes. CDGS^: Consumer Discretionary Goods and Services. *Note: The HHI is calculated as the sum of the square of the 10 sectors' weighting. A higher number implies lower diversification (higher concentration) and vice versa.

Overall, the most significant positive excess return in the up markets was delivered by the value factor and in the down markets by the low volatility factor over the period studied in the Indian market.

CONCLUSION

We examined four factors—low volatility, momentum, quality, and value—in the Indian market for the period from Sept. 30, 2005, to April 30, 2016. We found that the portfolios constructed using factors also have different risk/return characteristics in the Indian market.

The low volatility anomaly exists in the Indian market, and it provided significant excess returns in down markets and the overall market. We also found that for portfolio construction, it may not be advisable to measure volatility over a short period.

The momentum factor portfolio was constructed using risk-adjusted momentum, and we observed that during the down markets, it provided significant excess returns. However, in the overall market, the excess returns were not significant. There is a tradeoff among measuring risk-adjusted momentum over a slightly longer period for portfolio construction, risk exposure, and transaction cost of the momentum strategy.

The quality factor was constructed using return on equity, the balance sheet accruals ratio, and the financial leverage ratio. This factor provided significant excess return in the down market and the overall market. The

portfolios constructed using individual components of the quality factor did not have significant excess returns in the overall market. Therefore, even though the individual components of the quality factor did not yield significant excess return in isolation, when combined in the quality score, the excess return was significant.

The value factor was constructed using the book-value-to-price, earnings-to-price, and sales-to-price ratios. The value factor did not yield a premium in the Indian market over the period studied. Moreover, the individual components as well as the value factor had significantly higher risk than the market. We also discovered that the value factor was highly procyclical and tended to outperform during up markets, but it was prone to larger losses during down markets.

Overall, the most significant positive excess return in the up markets was delivered by the value factor and in the down markets by the low volatility factor over the period studied in the Indian market. Over the entire period, the most risky factor was value, with a beta significantly greater than one, at a 5% significance level. All the other factors studied in this paper had a beta significantly lower than one, at a 5% significance level.

Because the individual factors generally exhibit low correlation with each other, they can provide valuable insights about the Indian market and help with portfolio construction as well as benchmarking.

Because the individual factors generally exhibit low correlation with each other, they can provide valuable insights about the Indian market and help with portfolio construction as well as benchmarking.

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