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RESEARCH INSIGHT

Quality Time

Understanding Factor Investing

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Foreword, 2023 update

The quality factor aims to capture the performance of companies with healthy fundamentals, such as high profitability, stable earnings and low leverage. When MSCI first published this paper in 2015, quality was a relatively new factor and fewer investors were looking to incorporate it into their allocations compared to more established factors such as value or momentum. However, much has changed since then. Quality has garnered significant attention on the back of consistent performance. The factor has demonstrated strong resilience during periods of market volatility, including the COVID-19 turbulence, when other factors, such as value, yield and size, faltered.

Now well-established, quality is a key consideration for factor allocators seeking to benefit from its return premium and its diversification benefits. Its low correlation with the value and low-size factors made quality a compelling component in factor allocations, particularly given the recent large drawdowns of these factors. Quality indexes tend to exhibit exposure to large-cap and low-leverage stocks and have a moderately defensive bias — attributes typically sought during stressed markets.

The dilution of a risk premium after publication or widespread adoption of a factor is a concern for both researchers and factor investors. Performance analysis of the quality factor over two sub-periods revealed that quality continued to exhibit strong performance even after broader adoption. Republication of this paper and the longer analysis period now available, allowed us to illuminate important characteristics of the quality factor and quality indexes.

First, return-on-equity (ROE) and debt-to-equity (D/E) descriptors have been the best-performing quality descriptors on a long-short basis. However, the performance of the D/E descriptor was largely driven by the poor performance of highly leveraged companies (i.e., the short side). In a long-only setting, ROE has continued to be the most significant driver of quality index returns. Earnings variability (EVAR) descriptors have also demonstrated long-term outperformance, albeit lower compared to profitability and low leverage.

Second, the low correlations between the three quality descriptors (ROE, D/E and EVAR) have persisted over time, resulting in the composite quality factor performing better than each of them individually. More importantly, each descriptor seeks to capture a distinct aspect of quality from a risk perspective. This reaffirms that quality is indeed a multi-dimensional factor, and a composite approach may help to holistically capture its return premium.

Lastly, sector exposures and investability remain important considerations for investors when capturing the quality factor in a long-only index construct. Research has shown that a sector-neutral quality index has been successful in capturing the quality risk premium while minimizing sector impacts on performance.

The past decade's market turbulence, marked by a bear-market episode, rising inflation and fluctuating rates, has emphasized the importance of high-quality firms. The extended history presented here offers robust evidence of quality’s performance and resilience. It also demonstrates its role in navigating risk and return in an ever-changing investment landscape.

Executive summary

The quality factor has demonstrated long-term outperformance against the market but has not received the same attention as the value, size or momentum factors. Benjamin Graham asserted that careful analysis of company fundamentals such as profitability track record, earnings stability and balance-sheet strength is important in determining an investment's "margin of safety" — that is, ensuring that one buys a stock at an adequate discount to its intrinsic value.

The quality of a company can generally be evaluated along five key dimensions. They are profitability, earnings quality, financial leverage, asset growth and corporate governance. Profitability and earnings quality are income-statement-related measures of quality, while financial leverage and asset growth are linked to the balance sheet of the company. Finally, corporate governance goes beyond purely financial measures of quality and considers corporate policies.

Various descriptors can be used to define each dimension. A variety of quality indexes can be replicated with these descriptors, depending on investor objectives and capacity needs:

- A classic approach can be found in the MSCI Quality Index, which is constructed using ROE, D/E and EVAR.
- Investors who are concerned about excessive sector biases may consider a sector-neutral approach, such as the MSCI Sector Neutral Quality Index.
- Investors who require high investment capacity may consider a tilting approach, which historically has tended to display lower exposure to the quality factor compared to the other two approaches.

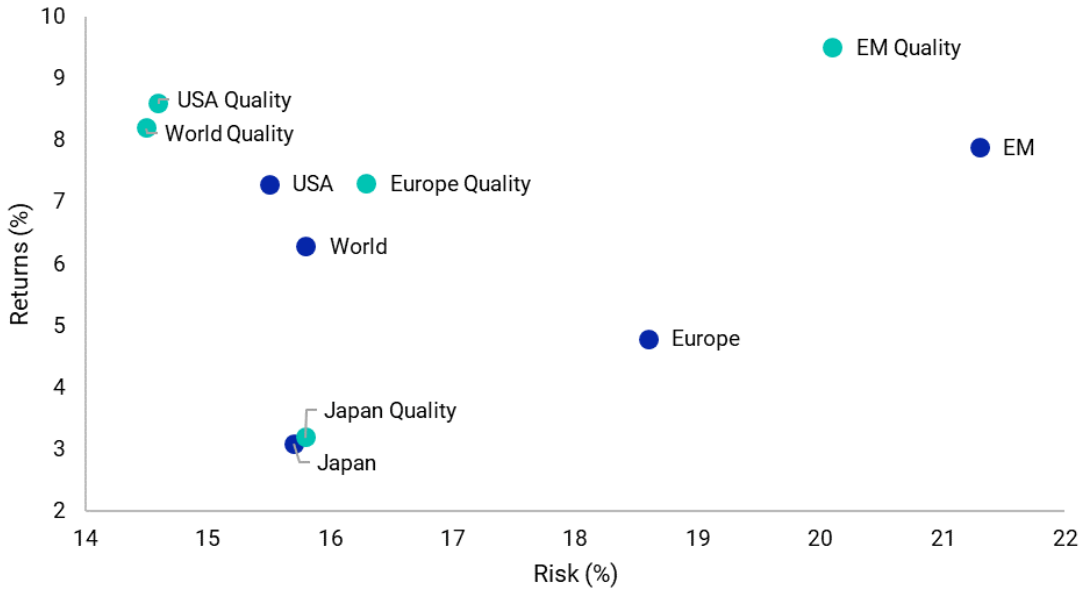
Quality has also been an effective diversifier to other factors historically. Our research shows that quality had low or negative active-return correlations with other systematic factors, especially value and low size. In addition, the MSCI World Quality Index has exhibited a similar defensive characteristic as the MSCI World Minimum Volatility Index. The MSCI World Quality Index tended to have a higher exposure to large-cap stocks and low-leverage stocks, which are generally sought-after attributes when a flight to quality occurs.

Introduction

Benjamin Graham, the founding father of value investing, was among the pioneer investors to recognize the importance of investing in high quality companies (Graham, 1973). Such companies have durable business models and sustainable competitive advantages and generally are better placed to withstand negative business cycles, providing a margin of safety that protects investors from poor decisions and market declines. The concept of "margin of safety" goes beyond simple price valuation. Careful analysis of company fundamentals such as their profitability track record, earnings stability and financial health forms the basis of the evaluation.

The long-term outperformance of the quality factor against the market has been well documented in the financial literature (Sloan, 1996; Novy-Marx, 2013; Asness, et al., 2013). Fama and French (2014) also lent their support to the concept of quality investing by revising the famous "three-factor model" to include two quality measures.[2] Exhibit 1 shows that the long-term outperformance of quality has been high and consistent across regions.

Exhibit 1: Risk/return profile of quality and market cap (across regions)



Period: December 2000 – March 2023. Gross returns annualized in USD.

While few investors would dispute the validity of quality investing, the underlying definitions and descriptors used to define quality companies vary broadly. This paper aims to provide answers to the following questions:

- What is quality investing?
- How have quality descriptors behaved over time?
- How can investors implement a quality strategy?

[2] The two quality factors proposed in the paper are robust profitability (RMW) and conservative investment (CMA).

What is quality investing?

A clear investment belief is the cornerstone of understanding factor investing. Despite the logic of investing in high-quality companies, the concept of quality as a factor is relatively new compared to value, size, yield, momentum and low volatility. We believe one of the main challenges lies in the multi-dimensional aspect of quality investing. In this section, we attempt to bring some clarity to the notion of quality.

Although Benjamin Graham laid out the notion of "margin of safety" in the 1970s, early studies on quality investing tended to treat the style as an alternative strategy to growth investing. The concept began to gain prominence only after the dot-com bubble burst and collapses of high-growth companies such as Enron Corp. and WorldCom due to accounting scandals. Some studies associated quality with the low-volatility premium as quality stocks were found to outperform the market during economic downturns. Quality is being recognized as an independent systematic factor. Key research papers on quality investing are listed in Exhibit 2.

Exhibit 2: Key research papers on quality investing

Authors	Year	Quality aspect	Summary
Benjamin Graham	1973	Profitability, earnings quality (stability)	• Adequate size of enterprise, sufficiently strong financial position, earnings stability, dividend record, earnings growth, moderate P/E and PB ratios
Richard Sloan	1996	Earnings quality	• Accrual anomaly was reported. • Accounting accruals (the non-cash component of earnings) are negatively correlated with future stock returns.
GMO white paper	2004	Profitability, stable earnings, low debt	• High-quality firms are likely to be underpriced due to low volatility.
Robert Novy-Marx	2013	Profitability	• Profitable firms generate significantly higher returns than unprofitable firms, despite having significantly higher valuation ratios.
Max Kozlov and Antti Petajisto	2013	Earnings quality	• Long stocks with high earnings quality and short stocks with low earnings quality (accruals) earned positive risk premia. • Global earnings quality portfolio produced a higher Sharpe ratio against market and value or small-cap strategies. • Quality complements value investing thanks to its negative correlation to value
Clifford S. Asness, Andrea Frazzini, and Lasse H. Pedersen	2019	Profitability, growth, safety, payout	• Quality stocks are defined to be safe, profitable, growing and well managed. • Quality strategy produced information ratio above one in the U.S. and globally (24 countries).
Eugene F. Fama, Kenneth R. French	2014	Quality and profitability	• Size, value, profitability and investment patterns • By adding two new factors, average stock returns performed better than the three-factor model. • Downside: Adding the new factors made value factor less Explanatory.
Jason Hsu, Vitali Kalesnik and Engin Kose	2019	Profitability (ROE)	• Profitability as a factor delivers superior performance on a risk-adjusted basis. • Accounting quality delivers overall superior performance.

Defining the quality factor

The quality of companies can be broadly defined according to the following five dimensions. The first three are generally used to reflect the financial aspect of quality whereas the last two capture additional dimensions of the factor:

1. Profitability
2. Earnings quality
3. Financial leverage
4. Asset growth
5. Corporate governance

Profitability

Profitability refers to the ability of a company to generate profits for its shareholders. ROE is one of the most commonly used metrics for measuring profitability. Other profitability measures (called "descriptors") include return on assets, gross profitability, gross margin and asset turnover. Research has found that profitability displayed explanatory power in predicting cross-sectional returns (Novy-Marx, 2013; Ball, et al., 2014; Ball, et al., 2015). Fama and French revised their influential three-factor model relatively recently by adding two additional factors related to quality: "profitability" and "investing" (Fama and French, 2014). The authors showed that within the dividend discount model, controlling for book-to-market and expected growth in book equity, more profitable firms have higher expected returns. The new model explains between 71% and 94% of the cross-sectional variance of expected returns, an improvement over the three-factor model.

Earnings quality

In accounting, the assessment of quality is typically linked to the persistency and predictability of earnings. Companies that produce consistent earnings in good or bad economic conditions are generally regarded as good-quality companies. Dichev et al. (2006) showed that earnings with low variability had a higher predictive power for up to five years in the future. However, manipulative accounting treatments can often distort the true picture of earnings quality. Researchers have found that understanding accruals accounting can bring complementary insight. For example, Sloan (1996) found that low accruals helped explain excess returns of high-quality companies.[3] This "accrual anomaly" was subsequently reported in different countries and regions (LaFond, 2005; Pincus, et al., 2007). The research results are not surprising as companies with high accruals may potentially overstate their true earning power and demonstrate unsustainable profitability.

Financial leverage

Leverage is another dimension commonly linked to quality. Excessive financial leverage negatively affects earnings and can potentially lead to financial distress. Commonly used metrics for

[3] In accounting, there are two ways of presenting a company's operating performance and measure earnings. Cash accounting is known to be more reliable as it is based on realized cash. Accrual accounting, on the other hand, is more representative of the current state of business but is based on accounting estimations to align revenues and costs in a specific period.

evaluating leverage include market leverage, debt to equity and debt to assets. Contrary to the first two quality dimensions, studies on financial leverage and expected stock returns have been mixed. Most studies on leverage were anchored on Miller and Modigliani's Capital Structure Theorem (1958), which theorizes that the market value of a firm is independent of the way it chooses to finance its investments. Bhandari (1988) found a positive relation between returns and leverage, but Fama and French (1992) found leverage based on book values carries a negative risk premium. Lev (1974) reported that companies with higher operating leverage exhibited higher systematic risk.

Asset growth

Asset growth is another aspect of quality assessment associated with the capital investment of companies. Titman et al. (2004) reported that firms that have substantially increased their capital investments subsequently achieved negative benchmark-adjusted returns.[4] A similar finding from Fama-French's new five-factor model suggests firms that invested conservatively have performed better than firms that invested aggressively. Many of these findings were associated with the phenomenon of "empire building."

Corporate governance

Beyond the financial aspects of quality, some investors also assess the quality of companies through their corporate-governance behavior. Increasingly, investors believe good corporate governance holds the key to a company's ability to achieve sustainable long-term performance. Gompers and Metrick (2003) found that firms with stronger shareholder rights had higher profitability, higher sales growth, lower capital expenditures and made fewer corporate acquisitions. Larcker et al. (2007) found positive signals on 14 different statistical dimensions related to corporate governance in explaining future operating performance of companies. More recently, Gul et al. (2013) show a positive correlation between gender diversity on corporate boards and analysts' earnings forecast accuracy.

A review of quality descriptors

One commonly accepted notion of quality is "high profitability, earning persistency and low leverage." Early studies attributed the concept to a departure from the traditional growth strategy, which focuses mainly on companies that show above-average growth. Blind pursuit of growth strategies has proven vulnerable during past market bubbles, lending credence to Graham's concept of "margin of safety."

The MSCI Quality Index is constructed using ROE, EVAR and D/E descriptors. These descriptors are used to reflect three quality dimensions, namely profitability, earnings stability and leverage. Metrics used to describe these dimensions are tangible and transparent and are readily available in financial statements. Novy-Marx (2014) reported significant alpha from the combination of these descriptors.

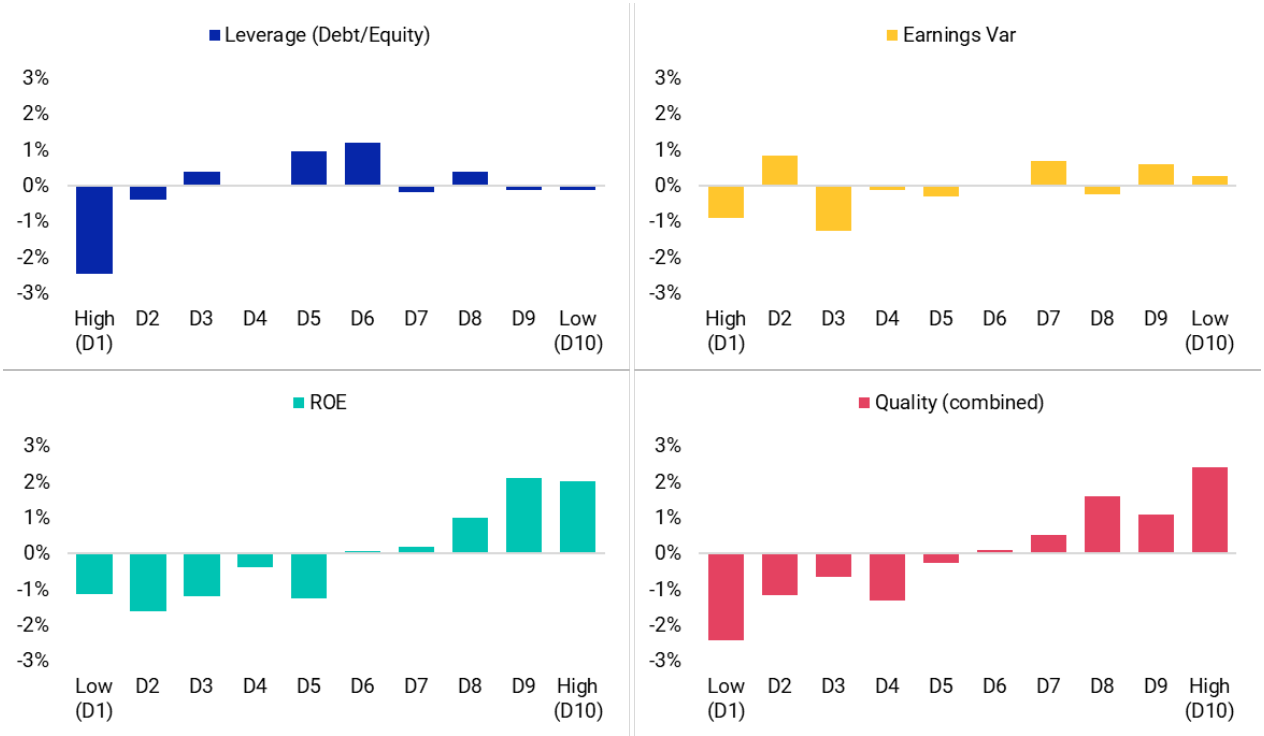
[4] Other descriptors reported to exhibit a strong cross-sectional ability to predict stock returns include Share Issuance, reported by Pontiff, J. and Woodgate in their paper "Share Issuance and Cross-sectional returns," published in The Journal of Finance, 63(2), pp. 921-945, and Asset Growth, reported by Cooper, et al., 2008, in "Asset Growth and the cross- section of stock returns," published in The Journal of Finance, 63(4), pp. 1609-1651.

While each quality descriptor has its own advantages and limitations, it is important to understand how descriptor performance manifests itself through a universe of stocks. It could help us understand if the factor premia were driven by good performance of high quality or poor performance of low-quality stocks. To help understand how differences in risk and return between low- and high-quality stocks appear within descriptors, a decile analysis is performed. We created 10 portfolios with increasing exposure to ROE, D/E and EVAR, as well as a composite portfolio of the three descriptors.

For D/E and EVAR descriptors, D1 corresponded to high exposure and D10 to low exposure, and the opposite was done for ROE. In this way, D1 represented low or negative "quality" and D10 high quality for each of the three descriptors. Each decile was constructed with an equal number of stocks selected from the MSCI World Index and the stocks within deciles were equally weighted.

Exhibit 3 shows that, on average, the top deciles outperformed the bottom deciles for each of the three quality descriptors and the composite quality score. The risk premium was strongest for ROE where decile performance was almost monotonously increased with decile rank. Interestingly, D/E showed better return performance in mid-range deciles as this descriptor displayed a bell-shaped distribution. The stocks that ranked the worst on D/E (i.e., high leverage) showed a significant underperformance indicating that D/E risk premium was captured more efficiently in a long/short construct. The pattern for EVAR was not as strong as other descriptors although deciles D6-D10 (low earnings variability), on average, fared better than deciles D1-D5.

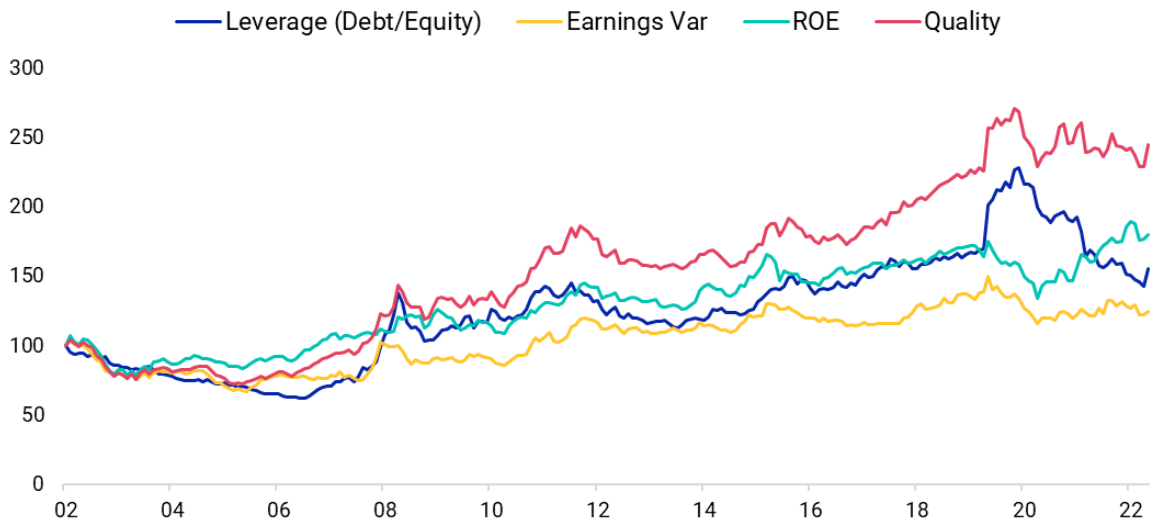
Exhibit 3: Active returns of decile portfolios



Period: November 2002 – March 2023. Gross returns annualized in USD. Deciles are equally sized and equally weighted semiannually. Returns are gross in USD and relative to the MSCI World Equal Weighted Index.

Exhibit 4 shows the time evolution of the cumulative performance of top-minus-bottom-decile portfolios (that approximates the return of the pure factor) for each quality descriptor. The performance of each descriptor has been quite consistent over the period November 2002 – March 2023. Interestingly, the combination of the three descriptors has posted better performance than the individual descriptors over the long run.

Exhibit 4: Performance of top-minus-bottom-decile portfolios



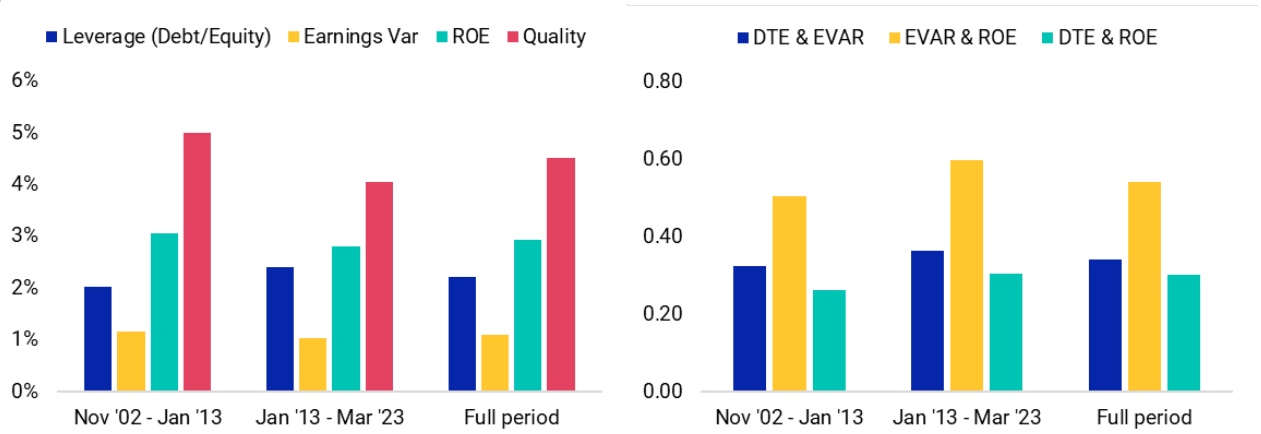
Period: November 2002 – March 2023. Gross returns annualized in USD. Deciles are equally sized and equally weighted semiannually. Returns are gross in USD and relative to the MSCI World Equal Weighted Index.

Since quality is a relative new factor that gained increased attention around 2013, following the published work of Fama-French and Novy-Marx, we performed a sub-period analysis where we split the analysis period into two equal halves. Exhibit 5 shows that the performance of each quality descriptor did not deteriorate in the latter half of the analysis period.

The motivation for combining quality descriptors is further supported by the low correlations between the three descriptors.[5] For example, from March to September 2020, the poor performance of ROE and EVAR was compensated by the sharp rally of D/E; and the reversal that occurred in D/E since then was cancelled out by the rising ROE factor. The analysis shows that quality is multi-dimensional and descriptors of quality capture different aspects of the factor. Using multiple descriptors has provided a more comprehensive definition of quality and helped mitigate the risk arising from the choice of a single factor descriptor.

[5] Correlations are computed between the top-minus-bottom (D10 – D1) portfolios constructed on each quality descriptor.

Exhibit 5: Returns of top-minus-bottom-decile portfolios (left) and pair-wise correlations (right) for sub-periods



Period: November 2002 – March 2023. Gross returns annualized in USD.

Implementing quality strategies in a portfolio

Both single- and multi-variable quality descriptors can be used in constructing a quality index. In this section, we will explore how these descriptors can be applied to address different investment objectives and constraints. For illustrative purposes, we will compare the MSCI Quality, MSCI Sector Neutral Quality and the MSCI Quality Tilt Index.

The objective of any quality index is to gain a certain degree of exposure to quality stocks. A high exposure to quality can be created by selecting stocks based on three financial-quality descriptors and weighting them in proportion to their quality exposure and market capitalization, as is done in the MSCI Quality Index. Industries or sectors tend to have time varying sensitivity to style factors and therefore lead to uncertainty about performance premia (Fama and French, 1997). The MSCI Sector Neutral Quality Index, on the other hand, caters to investors who want to avoid unintended active sector bets in the process of capturing high exposure to quality. This can be done by using sector-relative quality scores for stock selection and applying sector renormalization after stock weighting.

Instead of high exposure, some investors may require very large investment capacity and prefer an approach that does not screen stocks and instead weights all stocks in the investment universe based on their quality scores and market capitalization, such as the MSCI Quality Tilt Index. Since this index includes all assets in the benchmark's universe, it leads to low tracking error and high capacity. Exhibit 6 summarizes the three approaches for quality-index construction.

Exhibit 6: Summary of the MSCI Quality Indexes

Quality indexes	Descriptors	Stock selection	Exposure/capacity	Constraints on other factors	Use cases
MSCI Quality Index	Profitability, earnings quality, leverage	Yes	High exposure	None	High exposure quality strategy with stock selection
MSCI Sector Neutral Quality Index	Profitability, earnings quality, leverage	Yes	Reasonably high exposure within given sector constraint	Limit sector active exposure vs. the parent	High exposure quality without any unintended sector bet
MSCI Quality Tilt Index	Profitability, earnings quality, leverage	No, includes all stocks in the parent index	High capacity	None	High-capacity quality strategy with low turnover

We compare the risk and return characteristics of the three MSCI Quality Indexes between December 2000 and March 2023 in Exhibit 7. All the quality indexes outperformed the parent MSCI World Index with active returns ranging from 0.71%, for the MSCI World Quality Tilt Index to 1.89%, for the MSCI World Quality Index. While there have been periods of relative drawdowns, all three indexes outperformed over the past five- and 10-year horizons as well.

Among the three quality indexes, the MSCI World Quality Index produced the highest returns with the lowest volatility, resulting in a high Sharpe ratio of 0.47 compared to 0.31 for the MSCI World Index. It exhibited a tracking error of 4.24%. The MSCI World Sector Neutral Quality Index also delivered strong outperformance of 96 basis points (bps) with a lower-than-market volatility and low tracking error (2.69%). Such approaches could be attractive to tracking-error-constrained investors who target high exposure to the quality factor. Owing to its tilting-based weighting, the MSCI World Quality Tilt Index produced the lowest tracking error (1.45%), as well as the highest information ratio (0.49), across the three variants.

Exhibit 7: Performance metrics of MSCI World Quality Index variants

	MSCI World	MSCI World Quality	MSCI World Sector Neutral Quality	MSCI World Quality Tilt
Total Return* (%)	6.29	8.17	7.25	7.00
Total Risk (%)	15.78	14.53	15.20	15.21
Return / Risk	0.40	0.56	0.48	0.46
Sharpe Ratio	0.31	0.47	0.39	0.37
Active Return (%)	-	1.89	0.96	0.71
Tracking Error (%)	-	4.24	2.69	1.45
Information Ratio	-	0.44	0.36	0.49
Turnover** (%)	3.4	22.8	32.1	11.0
Sub-period Active Returns (%)				
1-year	-	0.93	0.27	-0.34
5-year	-	3.06	0.48	1.10
10-year	-	2.57	0.62	0.80

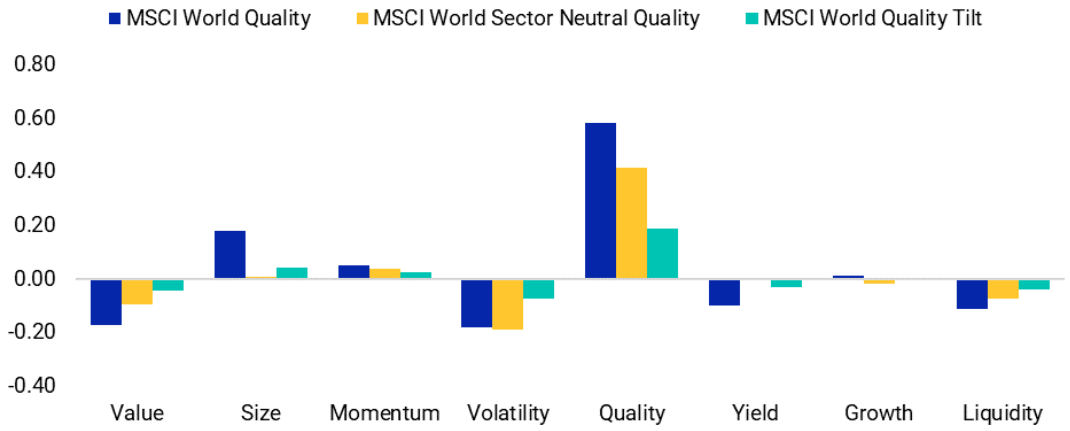
Period: December 2000 – March 2023. Gross returns annualized in USD. Reported turnover is one-way annualized.

Secondary and sector risks in quality indexes

Next, we examined the style-factor exposures of the three indexes using MSCI's Barra Global Equity Model for Long-term Investors (GEMLT). Exhibit 8 shows the active style exposures of the quality indexes over the MSCI World Index benchmark. The MSCI World Quality Index exhibited the strongest active exposure (0.58) to the quality factor, followed by the MSCI World Sector Neutral Quality Index.

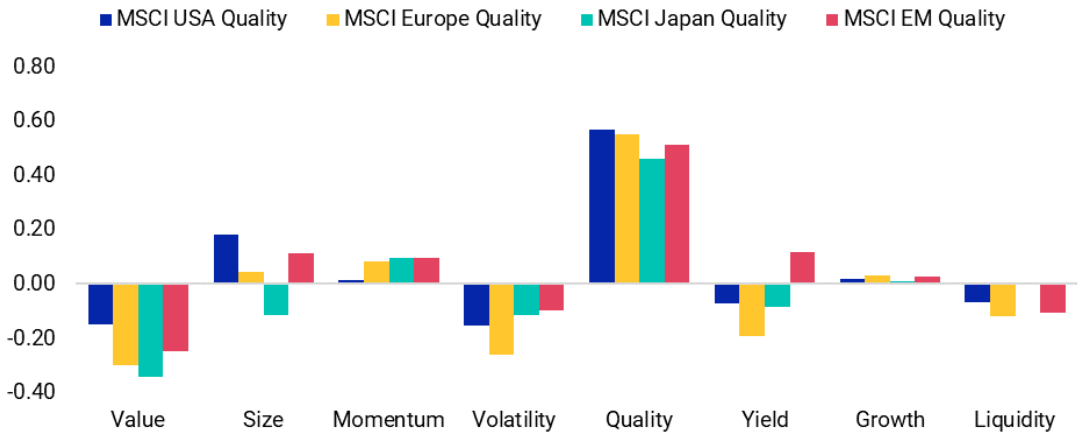
All quality indexes were also exposed to the low-volatility factor, confirming the natural bias of high-quality stocks towards low risk. Lastly, the MSCI World Quality Index also showed significant negative active exposure to the value factor. Interestingly, exposure to the non-target factors were weaker in the sector-neutral version of the index. Exhibit 9 confirms that the factor profile of the MSCI Quality Index was consistent across regions.

Exhibit 8: Active style factor exposures of MSCI Quality Index variants



Period: December 2000 – March 2023. Monthly averages.

Exhibit 9: Active style factor exposures of MSCI Quality Indexes across regions

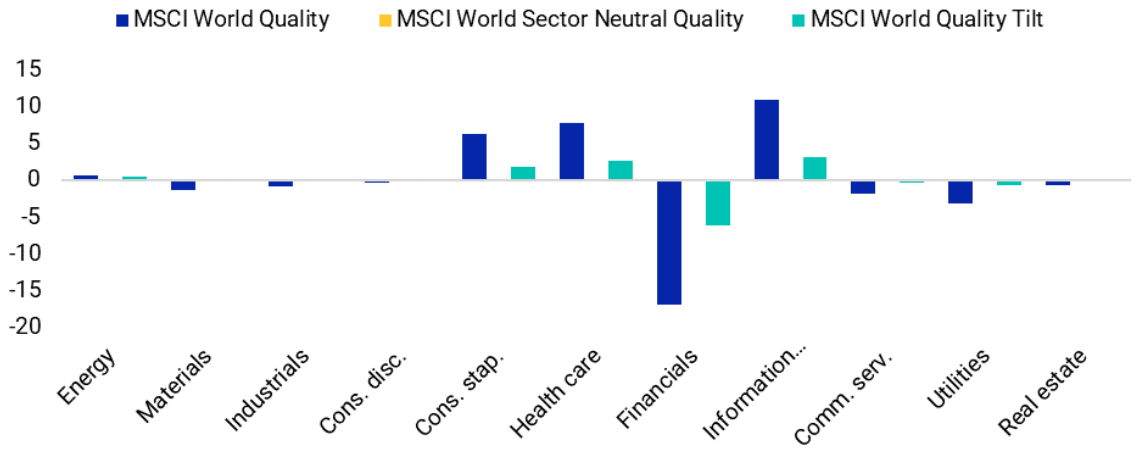


Period: December 2000 – March 2023. Monthly averages.

In terms of active sector exposure, the MSCI World Quality and MSCI World Quality Tilt Indexes exhibited large underweights to financials and significant overweights to the health-care and information-technology sectors. While both index methodologies don't explicitly constrain sector exposures, the sector biases were stronger for the MSCI World Quality Index due to its high exposure nature. When implementing a quality strategy, investors may want to be aware of the associated active sector bets. Investors who seek to avoid active sector bets may opt for the MSCI World Sector Neutral Quality Index, which removes any unintended active sector exposure.

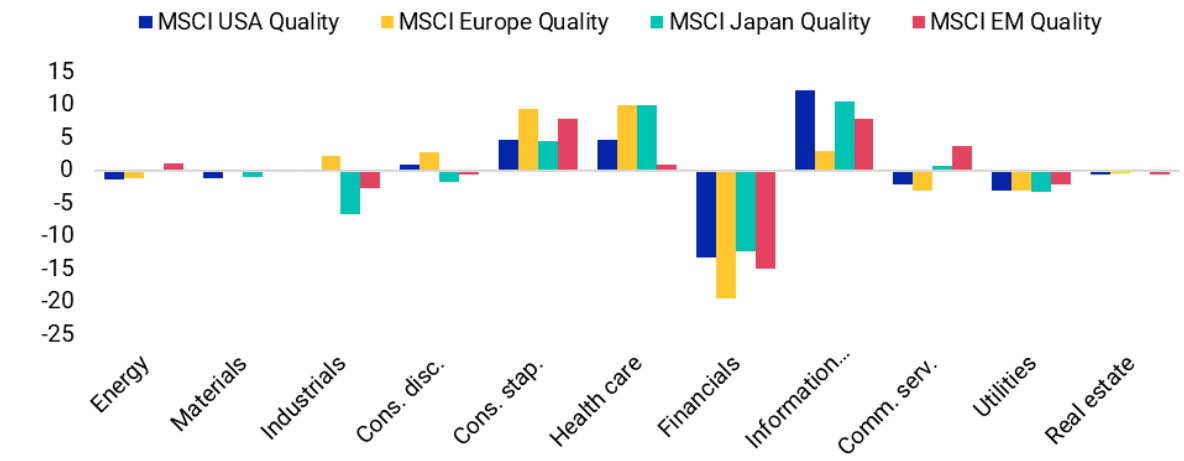
For the MSCI Quality Index, the underweight to financials and the overweight to information technology and consumer staples also were consistent across regions, as can be seen in Exhibit 11. Overall, the bias towards defensive sectors was consistent with the index's exposure to the two defensive factors — quality and low volatility.

Exhibit 10: Active sector exposures (%) of MSCI Quality Index variants



Period: December 2000 – March 2023. Monthly averages.

Exhibit 11: Active sector exposures (%) of MSCI Quality Indexes across regions



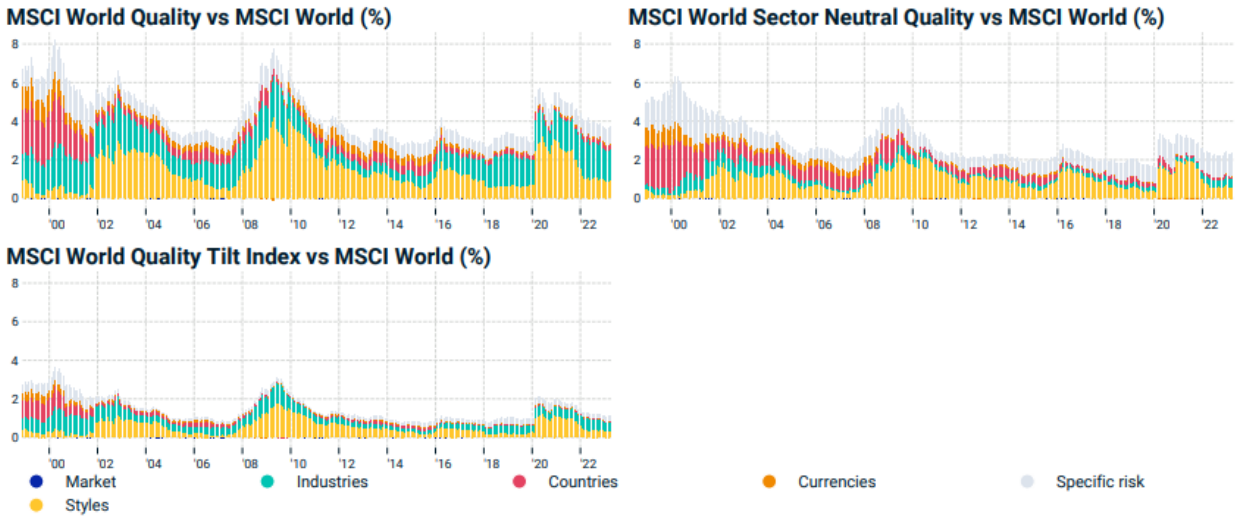
Period: December 2000 – March 2023. Monthly averages.

Attribution of active risk and return for quality indexes

Exhibit 12 shows the contribution of various factors to the ex-ante tracking error (TE) risk using GEMLT. Overall, tracking error remained reasonably stable and close to the long-term average, with peaks during turbulent markets during the 2008 global financial crisis and the COVID-19 sell-off.

As expected, style factors were the highest contributors to the TE of the quality indexes. Industry factors also contributed to the TE of the MSCI World Quality Index, which was in line with the sector biases noted in the previous section. The MSCI World Sector Neutral Quality Index exhibited minimal TE contribution from industry factors. In other words, the exposure to industry and other style factors had a low impact on the variability of performance of the index. Due to its broad nature, the MSCI World Quality Tilt Index had the lowest TE contribution from stock-specific effects.

Exhibit 12: Attribution of tracking-error risk of MSCI Quality Index variants

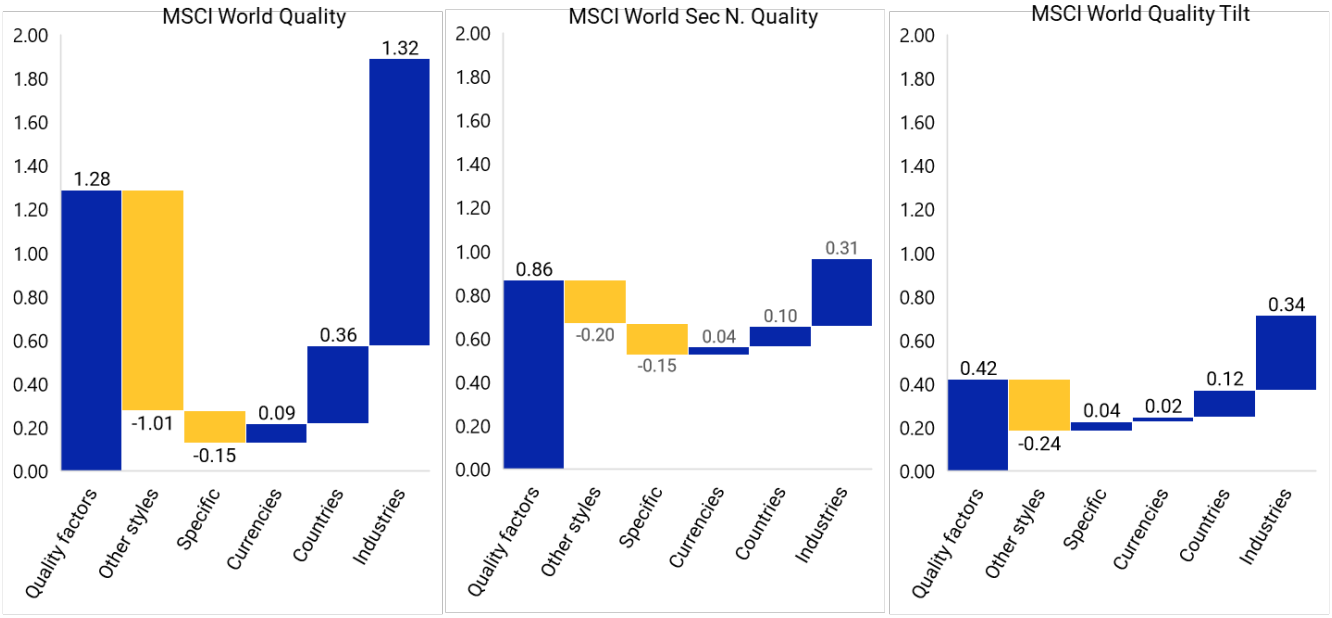


Period: December 2000 – March 2023. Risk model: GEMLT. Benchmark is the MSCI World Index.

The breakdown of active returns in Exhibit 13 shows that exposure to the quality and industry factors have been the principle contributors to the performance of the MSCI Quality Indexes. Exposure to other style factors, on aggregate, detracted from performance, however implicit exposures to country and industry factors offset their impact. Since the MSCI World Quality Index had negative exposure to the value factors, most of the negative return contribution has been derived from the book-to-price factor.

The results also show that imposing sector neutrality reduced the performance impact of both industry and other style factors by a large amount while having only a moderate impact on quality factor return contribution. The overall impact of non-target style and industry factors was -20 bps and 31 bps respectively; much smaller compared to the quality-factor contribution of 86 bps.

Exhibit 13: Attribution of active returns of MSCI Quality Index variants



Period: December 2000 – March 2023. Risk model: GEMLT. Benchmark is the MSCI World Index.

Capacity and investability

We also reviewed the capacity and investability profiles of the three quality index variants (Exhibit 14). As expected, the MSCI Quality Tilt Index had the largest capacity and the highest investability. The index provided more than 98% of the parent-index coverage with an active share of 17%.

Although, the two high exposure quality indexes had relatively lower parent coverage (about 30%) due to their stock-selection step, they nevertheless exhibited sufficiently large capacity and were highly investable. The maximum free-float market-cap ownership, assuming an allocation of USD 10 billion, was 10-25 bps compared to 2 bps of the MSCI World Index that itself has a high capacity.

Exhibit 14: Overview of capacity of MSCI Quality Index variants

	MSCI World	MSCI World Quality	MSCI World Sector Neutral Quality	MSCI World Quality Tilt
Concentration				
Average Number of Constituents	1636	299	298	1602
Effective Number of Constituents	305	64	92	207
Parent Index Coverage (%)	100.0	30.1	28.0	98.3
Top 10 Constituents Weight (%)	12.0	30.7	24.0	15.6
Float Market Cap Ownership				
Average (%)	0.02	0.05	0.07	0.02
95th Percentile (%)	0.02	0.07	0.12	0.03
Maximum (%)	0.02	0.10	0.20	0.04
Degree of Index Tilt				
Active Share (%)	0.0	69.9	72.1	17.0
Average Weight Multiplier	1.0	3.5	4.9	0.9
Maximum Weight Multiplier	1.0	5.1	14.4	2.1
Maximum Weight (%)	2.3	5.2	3.7	3.4

Period: December 2000 – March 2023. Monthly averages. Market cap ownership is computed assuming a fund size of USD 10 billion.

The quality-factor descriptors are based on stock fundamentals that are typically stable and don't fluctuate. Annualized turnover numbers for the three quality indexes could be considered modest compared to other factor indexes. As expected, the MSCI World Quality Tilt Index had the lowest turnover (11%), while the two high exposure index variants had higher turnover.

Exhibit 15: Overview of investability of MSCI Quality Index variants

	MSCI World	MSCI World Quality	MSCI World Sector Neutral Quality	MSCI World Quality Tilt
Days to Trade				
Average	0.0	0.1	0.2	0.0
95th Percentile	0.0	0.4	1.1	0.0
95% of All Trading Volume	0.2	0.6	1.0	0.2
Maximum	0.6	1.2	2.7	0.5
Cost of Replication				
Turnover**** (%)	3.4	22.8	32.1	11.0
Performance Drag at 25 Bps (bps)	1.7	11.4	16.0	5.5
Performance Drag at 75 Bps (bps)	5.2	34.2	48.1	16.5

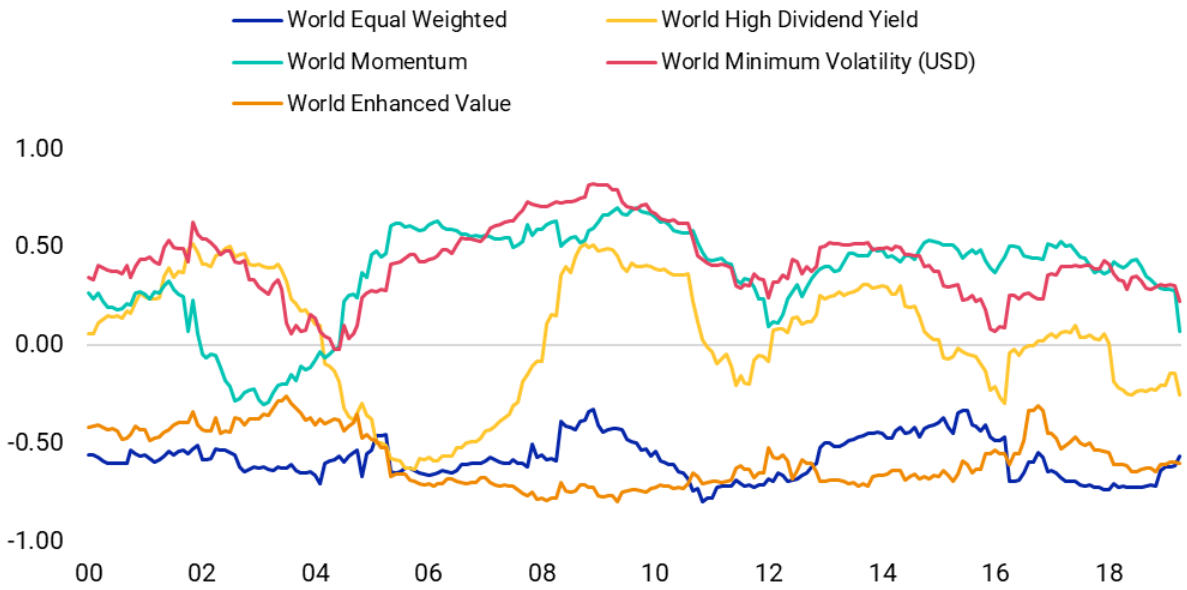
Period: December 2000 – March 2023. Monthly averages. Reported turnover is one-way annualized. Performance drag aims to represent the total two-way annualized index level transaction cost assuming various levels of security-level transaction cost. Days-to-trade metric is based on last four index reviews, assuming a fund size of USD 10 billion and a maximum daily trading limit of 20%.

Quality over the market cycle

The correlation of quality with other factor strategies is an important consideration. Factor indexes historically have generated long-term excess returns in simulations but can be cyclical in nature (Bender, et al., 2013; Alighanbari, et al., 2015). Low correlations across factor indexes could make a case for combining factors to attempt to benefit from factor diversification. Exhibit 16 shows the correlations of active returns (over the MSCI World Index) of the MSCI World Quality Index with other factor indexes.

The MSCI World Quality Index had strong negative correlations with the MSCI World Equal Weighted and MSCI Enhanced Value Indexes for the entire analysis period. The correlations with the momentum and high dividend yield factor indexes have been variable with time. It is important to note that over the past 10 years, quality and momentum have been positively correlated, although the correlation declined during the most-recent period. Minimum volatility has shown a positive correlation, which was expected given the defensive bias of the quality factor noted earlier. The results highlight the potential of the quality factor as a factor diversifier for value- and small-size-factor-tilted allocations.

Exhibit 16: Correlation (active returns) of style-factor indexes with the MSCI World Quality Index

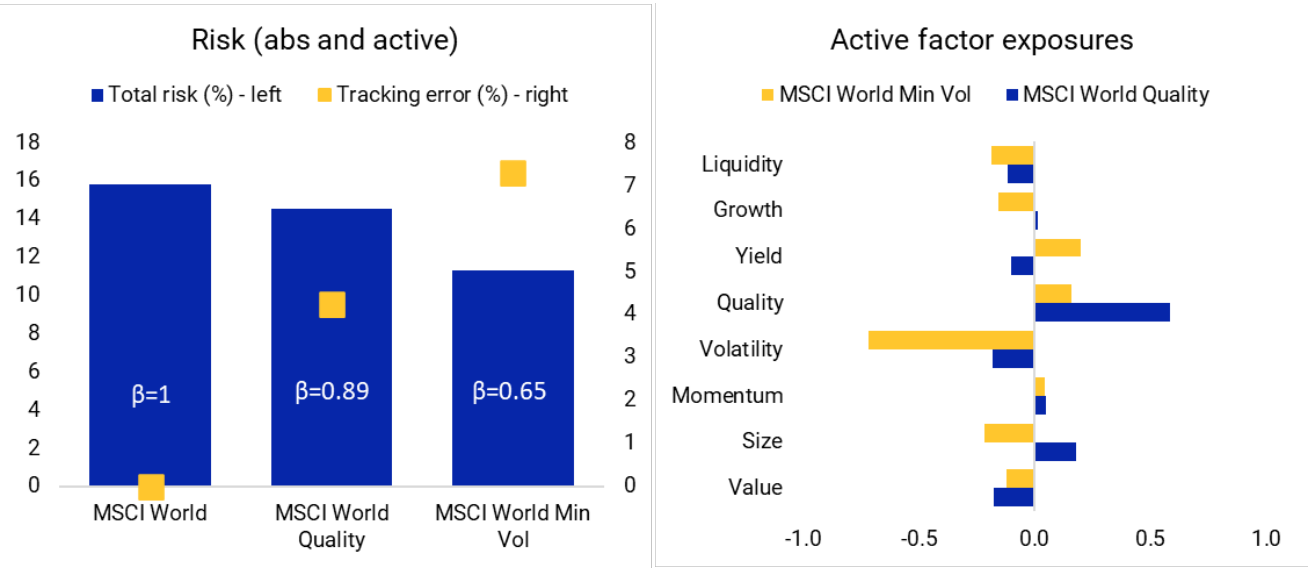


Period: December 2000 – March 2023. 36-month rolling window is used to compute correlations of active returns over the MSCI World Index.

Although among the single-factor indexes, quality and low volatility both are viewed as defensive approaches, there are certain distinctions between the two. In choosing a defensive factor index, investors have considered their tolerance for tracking error and their investment views on other factors, especially size. The MSCI World Quality Index has exhibited a market beta of 0.89 with a tracking error of 4.2%, while the MSCI World Minimum Volatility Index has been more defensive with a beta of 0.65 at a cost of a higher tracking error of 7.3% (Exhibit 17). Also, while the MSCI Quality

Index has historically been exposed to high size, the MSCI Minimum Volatility Index had a tilt towards smaller stocks.

Exhibit 17: Defensive factors: MSCI Quality vs. MSCI Minimum Volatility Indexes



Period: February 2001 – March 2023. Risk and tracking error metrics are annualized.

In addition to providing potential diversification benefits when combined with cyclical factors, quality can also be viewed as a part of defensive mix when combined with minimum volatility. An equal-weighted mix of the MSCI World Quality and MSCI World Minimum Volatility Indexes has delivered moderate risk reduction with a tracking error of 4.9%. More interestingly, due to canceling out of some of unintended exposures upon combination, the active performance of the combination index has been much smoother and has resulted in a maximum relative drawdown smaller than either of the component indexes.

Exhibit 18: Combining the MSCI Quality and MSCI Minimum Volatility Indexes

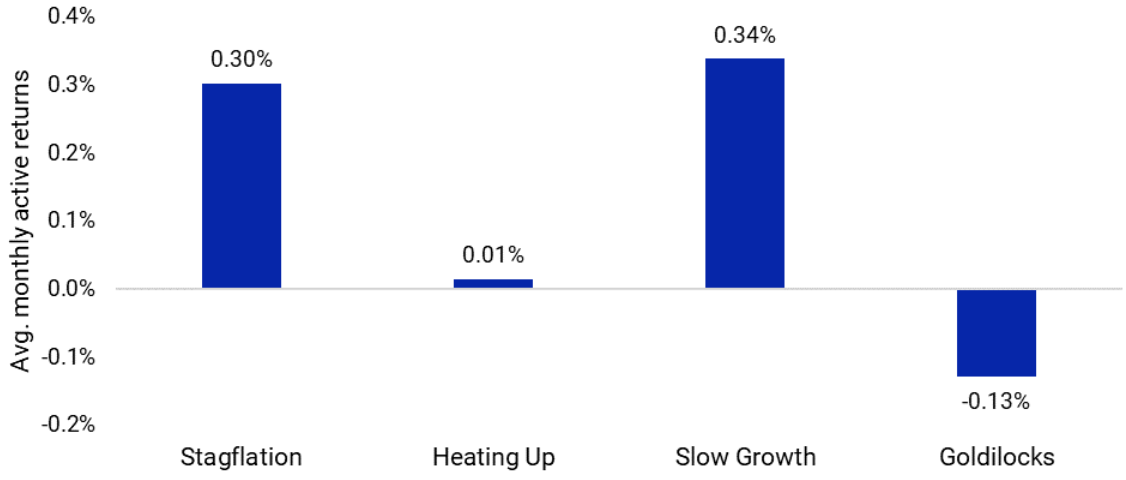
	MSCI World	MSCI World Quality	MSCI World Min Vol	MSCI World Quality Min Vol Mix
Total risk (%)	15.7	14.4	11.3	12.5
Tracking error (%)	-	4.2	7.3	4.9
Market beta	1.00	0.88	0.65	0.77
Maximum rel drawdown (%)	-	-21.9	-28.4	-16.3

Period: February 2001 – March 2023. Quality Min Vol mix is rebalanced quarterly to 50/50 weights.

While factors such as value, low size and divided yield had a bumpy ride, the quality factor has been one of the best-performing factors over past 10 years. The outperformance of the quality factor has coincided with the low-rate environment that spanned from 2009 to 2021. An emerging consensus in the macro-finance academic literature is that macroeconomic risks are persistent shocks to trend growth and inflation. We examined the long-term performance of the MSCI World Quality Index in various macroeconomic regimes characterized by economic growth (CLI indicator) and inflation (CPI indicator).[6]

Exhibit 19 shows that the active returns of the MSCI World Quality Index over the MSCI World Index were highly impacted by the economic growth cycle. Historically, the index performed best in "Stagflation" and "Slow Growth" regimes by about 30 bps per month, an observation that was consistent with the defensive bias of the index. The index did not do well in "Goldilocks" periods, where economic growth picked up, along with a decline in inflation.

Exhibit 19: Active returns in various economic regimes



Period: December 1975 – December 2022

[6] OECD CLI and CPI data are used to characterize regimes as increasing growth and increasing inflation (Heating Up), increasing growth and decreasing inflation (Goldilocks), decreasing growth and increasing inflation (Stagflation) and decreasing growth and decreasing inflation (Slow Growth). Active returns against the MSCI World Index determine each index's sensitivity to a regime.

Conclusion

Quality can be defined by five dimensions: profitability, earnings quality, financial leverage, asset growth and corporate governance. Reviewing common descriptors used for evaluating the quality factor — return-to-equity, debt-to-equity and earnings variability — we found that they each outperformed the MSCI World Equal Weighted Index in our simulation. In addition, combining multiple descriptors better captured various quality dimensions and produced a better historical risk-adjusted return than using single descriptors.

We illustrated that a quality index can be constructed in various ways, depending on investor objectives and constraints:

- A high-quality exposure can be created by selecting stocks based on three financial-quality descriptors and weighting them in proportion to their quality exposure and market capitalization (the MSCI Quality Index).
- Investors who want to avoid unintended active sector bets in the process of capturing high exposure to quality may seek to adopt a sector-neutral approach (the MSCI Sector Neutral Quality Index).
- Very-large investment capacity can be addressed by applying quality tilting on the broad investment universe (the MSCI Quality Tilt Index).

Understanding how quality has performed in different parts of the market cycle may be useful when using quality indexes in portfolio construction. Our analysis shows that the quality factor has historically provided a diversification benefit to other systematic factors. In addition, we found that due to its defensive nature, quality also can be viewed as a complementary or alternative factor to minimum volatility by investors who have a lower active risk tolerance.

Quality is an important and credible factor, with as sound an investment rationale and track record as value, size or momentum. Investors can replicate a variety of quality indexes, depending on their objectives and capacity constraints. When a flight to quality occurs, quality (as well as low volatility) historically has served as an important defensive factor to be used in portfolio construction.

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