Morningstar Risk Model Quarterly
Q2 2023

Morningstar Quantitative Research
4 Aug 2023
Version 1.0

Contents

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Risk Model Introduction

The Morningstar Risk Model is a holdings-based model that helps "identify and assess the risk in one's investments. By measuring exposure to as many as 36 factors, including six Morningstar Proprietary Factors, one can see how market conditions affect your portfolio."[1] The factors used are a result of new factors proposed by academics and practitioners, which have driven an increase in factor-based investment strategies. As factor-based offerings have increased over the years, investors have learned that their portfolio returns can be explained by a certain combination of factors. This highlights the model's value to pinpoint the underlying drivers to find a stock's true sources of returns.

This document serves to report on the performance of these factors for the second quarter of 2023.

Risk Model Methodology

This report focuses on returns (for the quarter to date) to measure factor performance. Within our Global Multi-Asset Model, we will look at assets' exposure to the following factors:

▶ Industry Standard Style: Size, liquidity, volatility, quality, momentum, yield, and value-growth

▶ Sector: Basic materials, consumer cyclical, consumer defensive, energy, financial services, healthcare, industrials, real estate, technology, communication services, and utilities

▶ Region: Developed Asia Pacific, Developed Europe, Developed North America, Emerging Asia Pacific, Emerging Europe, Emerging Latin America, and Emerging Middle East and Africa

▶ Interest-Rate Sensitivity: EUR—Convexity, EUR—Duration, USD—Convexity, USD—Duration, GBP—Convexity, GBP—Duration, CHF—Convexity, CHF—Duration, CAD—Convexity, and CAD—Duration

Factor Selection

The Risk Model contains the factors above because their components meet a variety of criteria: having an economic basis for predicting future asset-return distributions and being interpretable, parsimonious, and practical to calculate. Furthermore, focusing on these key factors reduces the dimensionality of the model and drives down noise, thus improving the model's estimates for future comovement.

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[1] Morningstar. 2021. "Risk Model Methodology."
https://mswiki.morningstar.com/pages/viewpage.action?spaceKey=QR&title=Publications&preview=/203474864/410783918/Risk%20Model%20Methodology%20April%202021.pdf

Factor Calculations

An asset's exposure to a factor is based on the characteristics of its underlying securities. First, Morningstar calculates a standardized score of stocks' factor characteristics within an asset class and region to compare them with relevant peers. Stock-level factor scores are then aggregated into the fund based on their weight within the portfolio's holdings. This score is analogous to a fund's factor exposure. This factor exposure is then multiplied by the factor's premium. The premium is the quantified influence a factor had on asset returns for a particular period. The premium is calculated as follows: "Given a collection of factor exposures for a set of n stocks at time t, we perform a cross-sectional regression of those exposures on total returns from t to $t+1$ to estimate the factor premium." For more details, please see the Risk Model Methodology document.

The product of an asset's factor exposure and premium is a number signifying what percentage of an asset's return can be attributed to a factor.

Q2 Premium Returns

Each table below presents the cumulative return premium of each factor in the second quarter of 2023.

Exhibit 1 Second-Quarter Style Factors Cumulative Return (%)

Factors	YTD	QTD
Momentum	-0.79	0.3
Liquidity	1.55	0.11
Quality	1.18	-0.05
Yield	0.26	-0.17
Size	-0.47	-0.21
Value-Growth	-0.77	-0.24
Volatility	-2.83	-0.71

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

Exhibit 2 Second-Quarter Sector Factors Cumulative Return (%)

Factors	YTD	QTD
Industrials	10.67	7.13
Technology	20.29	6.49
Consumer Cyclical	9.31	4.69
Financial Services	-2.92	4.34
Telecommunications	2.78	-0.16
Real Estate	-9.5	-3.81
Healthcare	-11.31	-3.9
Energy	-11.24	-5.21
Utilities	-8.65	-5.52
Basic Materials	-4	-6.36
Consumer Defensive	-9.49	-7.87

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

Exhibit 3 Second-Quarter Region Factors Cumulative Return (%)

Factors	YTD	QTD
Emerging Latin America	13.89	11.9
Emerging Middle East & Africa	4.64	8.3
Emerging Europe	-6.88	4.98
Developed North America	1.51	2.79
Developed Asia Pacific	-1.03	-1.87
Developed Europe	0.64	-3.75
Emerging Asia Pacific	-10.02	-9.81

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

**Exhibit 4** Second-Quarter Interest-Rate Sensitivity Factors Premium (%)

Factors	YTD	QTD
CHF - Duration	0.55	0.2
CAD - Convexity	0.4	0.16
USD - Convexity	0.44	0.16
GBP - Convexity	0.39	0.15
EUR - Convexity	0.4	0.11
CHF - Convexity	0.29	0.08
EUR - Duration	0.06	-0.11
USD - Duration	-0.11	-0.39
CAD - Duration	-0.25	-0.57
GBP - Duration	-0.82	-1.07

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

Q2 Factor Performance

Volatility Continues to Fall as Momentum Makes a Comeback
As seen in Exhibit 5, following a similar trend as last quarter, the volatility factor underperformed, ending June with a negative 0.71% return. It should be noted that by the end of May, the return of the volatility factor had dropped to as low as negative 1.5%. The negative premium on volatility suggests that investors who avoided volatile securities benefited from their decision. The market conditions fostered a cautious attitude toward risk, leading investors to favor less-volatile stocks as their preferred option.

The momentum factor has experienced a significant reversal compared with the previous quarter, transforming from one of the weakest performers into the strongest, with 0.3% return, among all factors. It indicates that investors and traders are attracted to assets with recent positive price movements, leading to increased demand and further price appreciation. However, the big swing of the momentum factor also indicates higher risk for investors. Liquidity is another favorable factor in Q2 2023. The presence of a favorable liquidity premium suggests that investors who favored highly liquid securities were compensated for their choice.

**Exhibit 5** Style Second-Quarter 2023 Performance
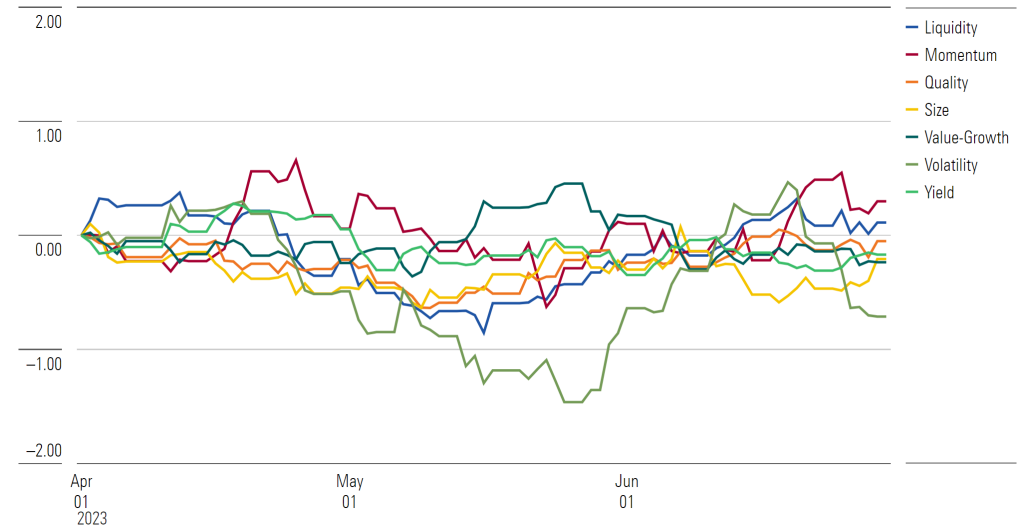
Source: Morningstar Direct. Data as of Jun 30, 2023.

Industrials and Technology Lead the Way While Consumer Defensive Tumbles

In contrast to the relatively neutral performance of style factors during the quarter, the sector factors exhibited substantial variation, as indicated by the nearly 16% range. The industrials and technology sectors led the way, closing at 7.13% and 6.49%, respectively, on the quarter. In the technology sector, Nvidia was a standout security again this quarter per the Observer: "The technology sector posted its second-consecutive quarter with double-digit gains, led by Nvidia's astounding 190% return through the first six months of 2023." [2] The industrials and financial services sectors experienced modest growth in the second quarter owing to increasing optimism about a gradual and controlled economic slowdown.

The consumer defensive and basic materials sectors tumbled down, closing at negative 7.87% and 6.36% respectively, on the quarter. Strong economic data prompted investors to shift to sectors poised to benefit from better-than-anticipated economic growth. Meanwhile, the energy sector recorded a negative return in the second quarter stemming from the impact of declining oil prices: "Brent Crude was down 35% in the year ended June 2023."

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[2] Markets Observer Q2 2023 Report.

Exhibit 6 Sector Second-Quarter 2023 Performance
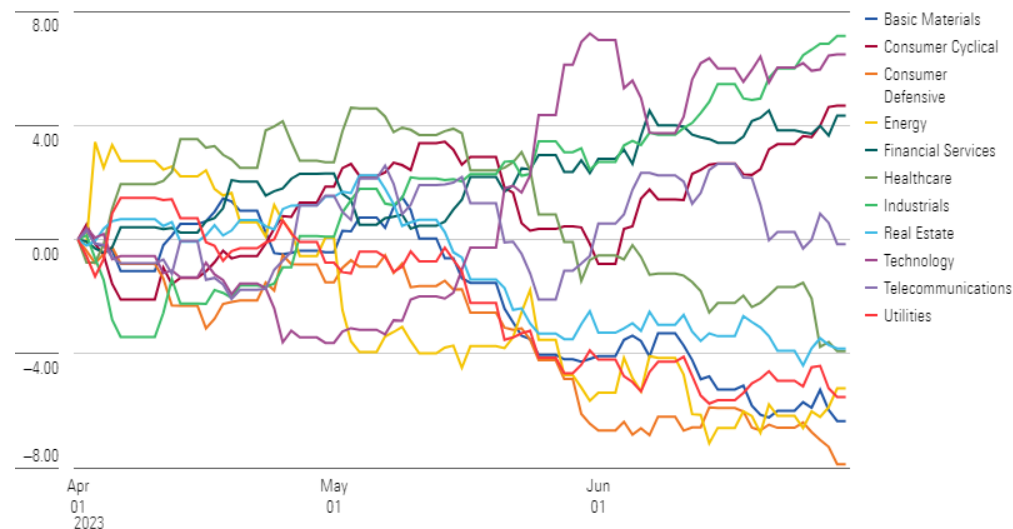
Source: Morningstar Direct. Data as of Jun 30, 2023.

Emerging Latin America on the Rise as Emerging Asia-Pacific Slumps

After a rather middling finish in Q1, Emerging Latin America paced all regions in the second quarter. The surging farm sector in Brazil and booming manufacturing sector in Mexico are two big contributors to Latin America's economic success this quarter. For Brazil, soybeans could not have more momentum, with sales expected to reach record numbers in 2023: "Brazil's soybean crushing is estimated to reach a record high 53.5 million mt in 2023 from the previous month's estimate of 53.2 million mt, driven by a greater demand for soybean oil and meal, according to the latest release from the Brazilian Association of Vegetable Oil Industries, or Above, on July 20."[3] For Mexico, we see growth in all tiers of the economy led by the services sector: "Growth was distributed among all sectors of the Mexican economy, with services expanding by 1% from 1.5% in the previous quarter, while both manufacturing and primary industries grew by 0.8% from 0.6% and negative 2.8%, respectively."[4]

Across the Pacific Ocean, however, we see a much different story, with Emerging Asia Pacific trailing all regions by a significant margin. China, a big player in the world economy and therefore a massive player in the Emerging Asia Pacific economy, has continued to face a number of challenges. One of these challenges is that consumers are hesitant to spend: "Monday's data showed that retail sales increased 3.1% in June, significantly lower than May's 12.7%. It marked the slowest growth since December, when Beijing scrapped most of its Covid-19 restrictions."[5] This compounded with the continued plunge of the housing market: "Investment in the property industry plunged 7.9% in the first six months of this year. Demand is also weak, with sales down 5.3% in terms of floor area." The effects of the global

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[3] Pandey, S. 2023. "Brazil's 2023 soybean crushing set for record highs driven by oil, meal demand."
https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/agriculture/072123-brazils-2023-soybean-crushing-set-for-record-highs-driven-by-oil-meal-demand

[4] "Mexico GDP Growth Rate." 2023. https://tradingeconomics.com/mexico/gdp-growth

[5] He, L. 2023. "More stimulus 'desperately' needed as China's economic recovery slows further." CNN.
https://www.cnn.com/2023/07/16/economy/china-economy-q2-gdp-intl-hnk/index.html

economy also had an impact: "According to customs figures released last week, exports fell 12.4% in June, the fastest pace in three years. Imports declined 6.8%, worse than markets had expected." China has a number of hurdles to overcome to get back on track. There is hope, however, as the tech sector has started to gain momentum on the back of AI: "seven government agencies jointly published long-awaited rules regulating the country's generative AI industry…Some restrictions included in an earlier draft were loosened…Chinese tech stocks rallied last week after the good news. The Hang Seng Tech Index was up more than 8%, the best weekly performance since December 2022"

Exhibit 7 Region Second-Quarter Performance
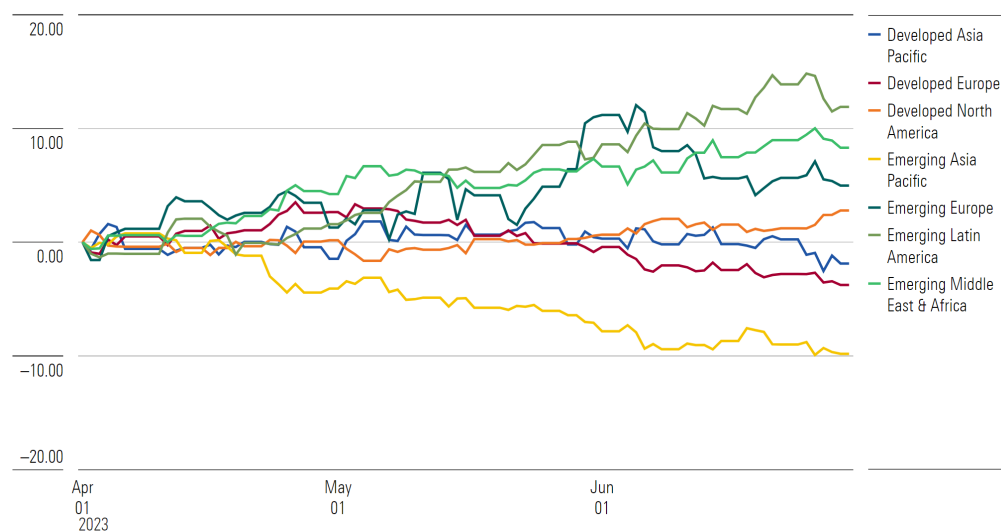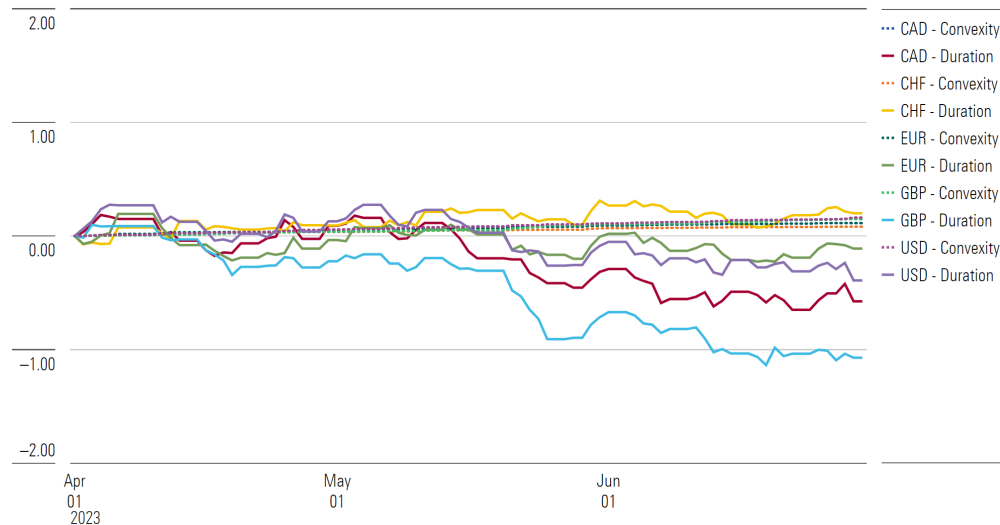

Source: Morningstar Direct. Data as of Jun 30, 2023.

The Pound in Free-Fall as Most Markets Tumble
Interest-rate sensitivity decreased for almost all markets, with the British pound leading the way at negative 1.07%. The lone exception was the Swiss franc checking in at 0.2%. We see a continued downward trend across the board continuing from 2022 after a slight bounceback last quarter.

Exhibit 8 Interest-Rate Sensitivity Second-Quarter Performance

Source: Morningstar Direct. Data as of Jun 30, 2023.

Factor Correlations

Exhibits 9 and 10 highlight a variety of strong and weak correlations within style and sector factors. Below are notable standouts.

Among the style factors, the most significant positive correlation, at 0.16, was observed between yield and volatility. This suggests occasional simultaneous increases or decreases in yield and volatility. On the other hand, the lowest negative correlation, at -0.32, was found between volatility and value-growth, indicating frequent opposite movements between these two factors.

In terms of sector factors, the most substantial positive correlation observed is 0.46, between the real estate and utilities sectors. This suggests that these sectors had a moderate positive relationship last quarter, with premiums in real estate often increasing alongside utilities premiums, or vice versa. Conversely, the lowest negative correlation, at -0.48, was found between the technology and energy sectors during the same period.

Exhibit 9 Premium Correlations—Style Factors

Correlations	Size	Value-Growth	Yield	Volatility	Momentum	Quality
Size	1					
Value-Growth	0.1	1				
Yield	0.01	-0.09	1			
Volatility	-0.04	-0.32	0.16	1		
Momentum	-0.22	-0.09	-0.29	-0.14	1	
Quality	0.11	-0.13	0.05	0	0.1	1

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

Exhibit 10 Premium Correlations—Sector Factors

Correlations	Basic Materials	Telecom	Consumer Cyclical	Consumer Defensive	Healthcare	Industrials	Real Estate	Technology	Energy	Financial Services	Utilities
Basic Materials	1										
Telecommunic	0.13	1									
Consumer Cyclical	0.19	0.15	1								
Consumer Defensive	0.14	0.1	0.2	1							
Healthcare	-0.01	-0.09	-0.21	0.38	1						
Industrials	0.17	-0.01	0.39	-0.07	-0.3	1					
Real Estate	0.03	0.19	-0.09	-0.02	-0.01	-0.02	1				
Technology	-0.25	-0.23	-0.22	-0.46	-0.33	0.11	-0.29	1			
Energy	-0.13	-0.16	-0.19	-0.15	-0.01	-0.29	-0.01	-0.48	1		
Financial Services	-0.2	-0.18	0.02	-0.12	-0.34	-0.08	-0.05	-0.28	0.28	1	
Utilities	0.01	0.12	-0.3	0.22	0.32	-0.22	0.46	-0.47	0.06	0.01	1

Source: Morningstar Quantitative Research. Data as of June 30, 2023.

Exhibit 11 Style Factor Correlation Pairs Time Series
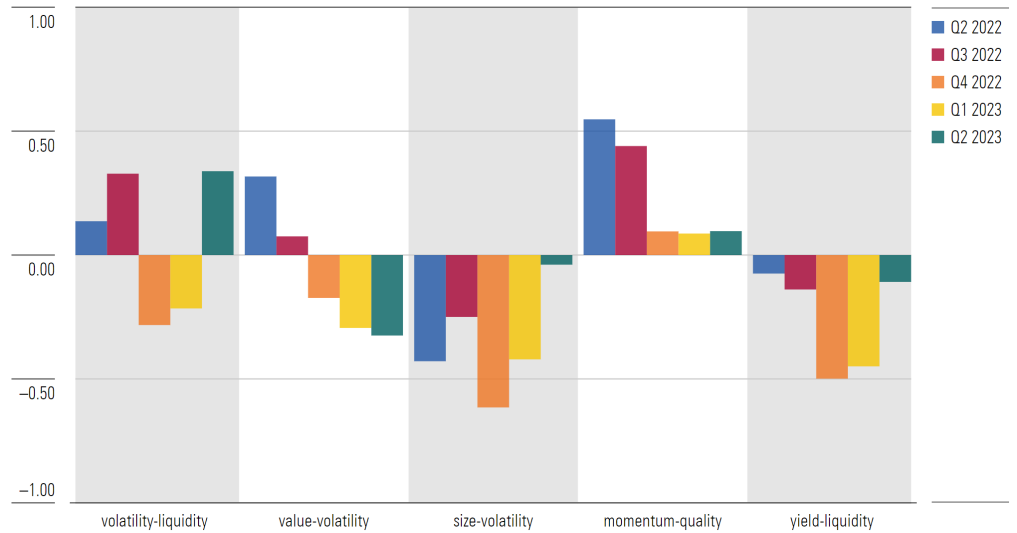
Source: Morningstar Direct. Data as of June 30, 2023.

Value-Liquidity Reverses Course Sharply as the Size-Volatility Inverse Relationship Weakens
Exhibit 11 highlights the style factor correlation pairs with the highest variability over the past five quarters. The correlation between value and liquidity hit its highest mark in the past five quarters just after seeing an inverse relationship the two preceding quarters. The inverse relationship between value and volatility continues to strengthen as the correlation hit its lowest mark in the past five quarters. Both inverse relationships between size and volatility as well as yield and volatility saw a sharp rise this quarter and are now weak. The correlation between momentum and quality peaked as one of the strongest in Q2 of 2022, but the weakening we saw at the end of last year has stayed to the midpoint of this year.

Risk Factor Attribution
Exhibits 12 and 13 show the contribution of style and sector factors to the returns of the Morningstar US Market Index from April 1, 2023, to June 30, 2023, using the Risk Factor Attribution tool in Morningstar Direct.[6]

While the style factors had a mostly neutral impact on the overall portfolio, size made the most significant positive contribution of 0.04%, which is a reversal from last quarter when it had the most negative impact. The rest of the factors had relatively minor contributions to the portfolio. In total, the style factors contributed 0.06% to the portfolio, primarily driven by the size factor.

Technology was by far the headliner for the sector factors regarding portfolio contribution. Technology was the most impactful sector factor with a positive 2.24% contribution. It had the highest exposure of

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[6] https://indexes.morningstar.com/our-indexes/details/morningstar-us-market-FSUSA00KGP?currency=USD&variant=TR&tab=overview

all the sector factors and had the second highest returns, so it is no surprise that the combination resulted in a significant positive contribution. The other sector factors paled in comparison with regard to impact. The only other notable positive factor was financial services with a 0.51% contribution. On the negative side, we see consumer defensive and energy checking in as the factors with the most impact. Consumer defensive had the lowest factor premium percentage and detracted the most from the portfolio with a negative 0.52% contribution. Energy followed up with the third-lowest factor premium percentage and provided a negative 0.43% contribution. ▮M▮

Exhibit 12 Risk Factor Attribution — Style

Risk Factor Attribution • Standard Factor Model (USD) • 04/01/2023 - 06/30/2023 • MSTART

	Portfolio Exposure	Benchmark Exposure	Active Exposure	Factor Premium %	Portfolio Contrib %	Benchmark Contrib %	Active Contrib %
Total Return ⓘ	—	—	—	—	8.49 ●	—	—
Risk Free Return	—	—	—	—	1.22 ●	—	—
Investment Specific ⓘ	—	—	—	—	1.44 ●	—	—
Factor Total ⓘ	—	—	—	—	5.84 ●	—	—
▼ **Style**	—	—	—	—	0.06 ●	—	—
Style	0.02	—	—	−0.21	−0.01 ●	—	—
Yield	−0.00	—	—	−0.15	0.00 ●	—	—
Momentum	0.02	—	—	0.33	0.01 ●	—	—
Quality	0.04	—	—	−0.05	−0.00 ●	—	—
Volatility	−0.02	—	—	−0.66	0.01 ●	—	—
Liquidity	0.05	—	—	−0.01	0.00 ●	—	—
Size	−0.13	—	—	−0.37	0.04 ●	—	—
Cash	0.00	—	—	1.22	0.00 ●	—	—
▶ **Sector**	—	—	—	—	1.36 ●	—	—
▶ **Region**	—	—	—	—	4.83 ●	—	—
▶ **Currency**	—	—	—	—	−0.41 ●	—	—

Source: Morningstar Direct. Data as of June 30, 2023.

Exhibit 13 Risk Factor Attribution — Sector

Risk Factor Attribution • Standard Factor Model (USD) • 04/01/2023 - 06/30/2023 • MSTART

	Portfolio Exposure	Benchmark Exposure	Active Exposure	Factor Premium %	Portfolio Contrib %	Benchmark Contrib %	Active Contrib %
Total Return ⓘ	—	—	—	—	8.49 ●	—	—
Risk Free Return	—	—	—	—	1.22 ●	—	—
Investment Specific ⓘ	—	—	—	—	1.44 ●	—	—
Factor Total ⓘ	—	—	—	—	5.84 ●	—	—
▶ **Style**	—	—	—	—	0.06 ●	—	—
▼ **Sector**	—	—	—	—	1.36 ●	—	—
Basic Materials	0.00	—	—	−6.52	−0.03 ●	—	—
Communication Services	0.03	—	—	−1.46	−0.05 ●	—	—
Consumer Cyclical	0.06	—	—	4.15	0.28 ●	—	—
Consumer Defensive	0.07	—	—	−7.62	−0.52 ●	—	—
Healthcare	0.13	—	—	−2.87	−0.36 ●	—	—
Industrials	0.03	—	—	7.31	0.23 ●	—	—
Real Estate	0.07	—	—	−3.65	−0.25 ●	—	—
Technology	0.31	—	—	6.43	2.24 ●	—	—
Energy	0.08	—	—	−5.38	−0.43 ●	—	—
Financial Services	0.12	—	—	4.12	0.51 ●	—	—
Utilities	0.05	—	—	−4.88	−0.25 ●	—	—
▶ **Region**	—	—	—	—	4.83 ●	—	—
▶ **Currency**	—	—	—	—	−0.41 ●	—	—

Source: Morningstar Direct. Data as of June 30, 2023.

Notable Risk Model Feature Releases in the First Half of 2023

1. DEU Standard model

2. Global Industry standard in AUD currency

3. Emerging Market Standard model

About Morningstar® Quantitative Research

Morningstar Quantitative Research is dedicated to developing innovative statistical models and data points, including the Morningstar Quantitative Rating, the Quantitative Equity Ratings and the Global Risk Model.

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