S&P Dow Jones Indices

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How Smart Beta Strategies Work in the Australian Market

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EXECUTIVE SUMMARY

With increasing interest in smart beta strategies in the Australian equity market, we examined the effectiveness of six well-known risk factors, size, value, low volatility, momentum, quality, and dividends, in the Australian equity market from Dec. 31, 2004, to May 29, 2020.

- Quintile analysis showed that low volatility, high momentum, and high quality delivered the most persistent absolute and risk-adjusted return spreads, but small cap and value did not generate incremental return in the Australian market.
- Among the Australian factor indices offered by S&P Dow Jones Indices (S&P DJI), the quality and momentum indices delivered the highest excess returns, while the low volatility and dividend indices had lower volatility than the S&P/ASX 200.
- Our macro regime analysis showed that most factor portfolios in Australia were sensitive to local market cycles and investor sentiment regimes.
- The distinct cyclicality of factor performance in Australia indicated its potential for implementation of active views on the local equity market.

Exhibit 1: Performance across Different Market Cycles and Investor Sentiment Regimes in Australia

CATEGORY	PHASE	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Market Cycles	Bullish	▲	▼	▼	▼	▼	▼
	Bearish	▼	▲	▼	▼	▼	▼
	Recovery Period	▼	▼	▼	▼	▼	▼
Investor Sentiment	Bullish	▲	▼	▲	▼	▼	▼
	Neutral	▼	▼	▼	▼	▼	▼
	Bearish	▼	▼	▼	▲	▼	▼

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on total returns in AUD. Past performance is no guarantee of future results. Table is provided for illustrative purposes.
Note: Light blue, upward triangles represent favorable performance, while dark blue, downward triangles represent unfavorable performance based on excess return versus the S&P/ASX 200 of each factor. The two factors with the highest information ratio in each of the market cycle phases are circled in yellow.

FACTOR-BASED INVESTING IN THE AUSTRALIAN EQUITY MARKET

Smart beta strategies have gained significant attention in the asset management industry, and the exchange-traded products (ETPs) tracking factor indices have experienced significant asset growth since the end of 2008 [1]. Factor-based strategies are a category of smart beta strategies that target specific risk factors. They share some common characteristics with passive investing, such as rules-based construction, transparency, and cost-efficiency, and they also share features of active investing in that they aim to enhance return and reduce risk compared to market-cap-weighted indices.

In Australia, the growth of factor-based ETPs has accelerated in recent years.

Single-factor indices are constructed explicitly to capture a specific risk factor and exhibit distinct cyclicality in response to a changing market environment, which also makes them ideal tools for implementation of active views.

In Australia, although the adoption of factor-based investing by local market participants is behind the U.S. and some Asian markets (like Japan), the growth of factor-based ETPs has accelerated in recent years, achieving 46% growth in net assets in the past 18 months in local currency terms as of Dec. 31, 2018, and accounting for 10.5% of the Australian ETF market [1]. Dividend products still dominate the Australian factor-based ETP market, but we observed the proliferation in categories and the increasing demand for factor-based index-linked products within the Australian equity market.

Sector or size bias had a significant impact on the excess return of factor portfolios in the Australian market.

Based on the performance contribution analysis for the S&P/ASX 200 portfolio,[1] the Financials and Materials sectors contributed about 63.6% of the total performance of the portfolio for more than 15 years. At a stock level, the top five large-cap contributors (BHP Group Ltd, Commonwealth Bank of Australia, Westpac Banking Corporation, CSL Limited, and Australia and New Zealand Banking Group Limited) together contributed approximately 49% of the total portfolio performance over the same period. This suggests that sector or size bias might have a significant impact on the excess return of factor portfolios in the Australian market.

In this paper, we examined the effectiveness of six well-known risk factors (size, value, low volatility, momentum, quality, and dividend) in the Australian equity market and the behavior of these factors under different market regimes.

[1] The S&P/ASX 200 portfolio is a hypothetical portfolio, rebalanced semiannually on the third Friday of June and December, with exactly the same constituents and weights as the S&P/ASX 200 as of rebalance dates.

Exhibit 2: Top Five Sector and Stock Contributors to the S&P/ASX 200 Portfolio* Performance

TOP FIVE SECTORS	PERFORMANCE CONTRIBUTION (%)	TOP FIVE STOCKS	PERFORMANCE CONTRIBUTION (%)
Financials	42.8	BHP Group Ltd	14.9
Materials	20.8	Commonwealth Bank of Australia	12.9
Health Care	10.0	Westpac Banking Corporation	8.0
Industrials	7.9	CSL Limited	6.7
Consumer Staples	6.4	Australia and New Zealand Banking Group Limited	6.6
Total	**88.0**	**Total**	**49.3**

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the S&P/ASX 200 Portfolio*. 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.
*The S&P/ASX 200 Portfolio is a hypothetical portfolio, rebalanced semiannually on the third Friday of June and December, with exactly the same constituents and weights as the S&P/ASX 200 as of rebalance dates.

UNIVERSE AND METHODOLOGY

For each risk factor, we ranked all stocks in the S&P/ASX 200 based on their designated factor measure and formed the hypothetical top and bottom quintile portfolios.

Our study was based on the constituents of the S&P/ASX 200, which is the headline index for the Australian equity market. Our sample period for the analysis was from Dec. 31, 2004, to May 29, 2020.

For each risk factor, we ranked all stocks in the S&P/ASX 200 based on their designated factor measure[2] and formed the hypothetical top and bottom quintile portfolios (Q1 and Q5, respectively) with equal- and float-adjusted market-cap weighting, respectively. All portfolios were rebalanced semiannually.[3] We examined these portfolios across multiple dimensions including return, volatility, turnover, sector composition, and performance during up and down markets.

[2] Size was measured by float-adjusted market cap. Value was measured as the average z-score of earnings-to-price, sales-to-price, and book value-to-price ratios. Volatility was measured as the one-year realized price return volatility. Momentum was measured by the z-score of the 12-month risk-adjusted momentum, calculated as the price return over the past 12 months (excluding the most recent month) divided by the standard deviation of daily price returns during the same period. Quality was measured as the average z-score of the balance sheet accrual (BSA) ratio, financial leverage (LEV), and return on equity (ROE). Dividend was measured by the past 12-month gross dividend yield.

[3] The dividend portfolios were rebalanced semiannually, effective on the last trade day of January and July. The rest of the factor portfolios were rebalanced semiannually, effective on every third Friday in June and December.

In addition, we reviewed the indexing implementation of each factor strategy based on various S&P DJI Australian factor indices, which are designed to track the performance of stocks with specific factor characteristics in the Australian market.[4] Apart from historical risk/return characteristics, we also reviewed their sector biases, fundamental characteristic tilts, as well as their return characteristics across different market cycle phases and investor sentiment regimes. Due to the difference in the stock selection and weighting methods, and the incorporation of rebalancing buffers and other portfolio diversification constraints, performance characteristics of the S&P DJI Australian factor indices might deviate from those observed in their respective hypothetical quintile portfolios.

Small cap did not deliver persistent factor risk premium in the Australian equity market over the examined period.

SMALL CAP

Small cap (size) was one of the earliest-identified systematic risk factors [2-3]. Academic explanations for the small-cap premium mainly focus on the uncertainty, vulnerability, and illiquidity of small-cap companies, as well as market participants' behavioral bias [4-8]. The small-cap anomaly has been observed in developed and emerging markets [9].

The small-cap portfolios tended to outperform the benchmark during up markets and underperform during down markets.

In our analysis, the size portfolios were constructed based on companies' float-adjusted market cap. Stocks with the lowest float-adjusted market cap formed the small-cap portfolio (Q1) and vice versa for the large-cap portfolio (Q5). During the examined period, the equal- and float-cap-weighted small-cap portfolios recorded much lower absolute and risk-adjusted returns, higher return volatility, and worse historical return drawdowns than their respective large-cap portfolios (see Exhibit 3). Small cap did not deliver persistent factor risk premium in the Australian equity market over the examined period.

The small-cap portfolios tended to outperform the benchmark during up markets and underperform during down markets, demonstrating the pro-cyclical nature of small-cap stocks (see Exhibit 20 in the Appendix). Compared to the S&P/ASX 200, the small-cap portfolios were more concentrated in Consumer Discretionary and carried less weight in the Financials sector (see Exhibit 23 in the Appendix).

[4] The S&P/ASX Small Ordinaries comprises companies in the S&P/ASX 300, but not in the S&P/ASX 100, with all the stocks weighted by their market cap. The S&P/ASX Dividend Opportunities Index includes the 50 stocks from the S&P/ASX 300 with the highest dividend yield, while meeting price momentum and dividend growth criteria, with all the stocks weighted by their total dividend. The S&P/ASX 200 Enhanced Value, S&P/ASX 200 Momentum, and S&P/ASX 200 Quality Index include the 40 stocks from the S&P/ASX 200 with the highest factor scores, and the stocks are weighted by their score-tilted market cap, subject to security and sector constraints. The S&P/ASX 200 Low Volatility Index includes the 40 stocks from the S&P/ASX 200 with the lowest realized return volatility, and the stocks are weighted by the inverse of volatility. All indices were rebalanced semiannually apart from the S&P/ASX 200 Low Volatility Index, which was rebalanced quarterly.

Exhibit 3: Risk/Return Profile of Small-Cap Portfolios

CATEGORY	S&P/ASX 200	SMALL-CAP PORTFOLIOS (Q1)*		LARGE-CAP PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	3.9	3.2	6.8	6.3
Annualized Volatility (%)	17.5	22.0	22.9	17.9	16.8
Risk-Adjusted Return	0.39	0.18	0.14	0.38	0.37
Rolling 252-Day Maximum Drawdown (%)	-47.4	-62.2	-64.1	-45.7	-46.3
Annualized Excess Return (%)	-	-2.9	-3.7	0.0	-0.5
Annualized Tracking Error (%)	-	12.5	13.6	1.8	3.5
Information Ratio	-	-0.23	-0.27	0.00	-0.16
Average Annualized Turnover (%)	7.1	81.4	85.5	8.1	26.3

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from 2005 to 2019.
*Small-Cap Portfolios (Q1) and Large-Cap Portfolios (Q5) are hypothetical portfolios.

Our value portfolios were constructed based on the average z-score of earnings-to-price, sales-to-price, and book value-to-price ratios.

VALUE

Historically, the high value portfolios underperformed the low value portfolios on an absolute and a risk-adjusted basis.

Value investing was first documented in 1934 by Graham and Dodd [10]. According to academic reviews, value companies may have a higher level of risk, as they tend to have less flexibility in times of financial distress compared with their growth counterparts and therefore demand a higher risk premium [11]. The value factor is traditionally measured by price valuation ratios, such as earnings yield, cash flow yield, sales yield, book value-to-price ratio, and dividend yield.

Our value portfolios were constructed based on the average z-score[5] of earnings-to-price, sales-to-price, and book value-to-price ratios. Stocks with the cheapest valuations formed the high value portfolios (Q1) and vice versa for the low value portfolios (Q5). Historically, the equal- and float-cap-weighted high value portfolios underperformed the low value portfolios on an absolute and a risk-adjusted basis, with worse return drawdowns and higher portfolio turnover (see Exhibit 4). Factor attribution analysis indicated the strong bias of the high value portfolios to the low momentum factor and the Real Estate sector compared to the S&P/ASX 200 and the low value portfolios had significant contributions to their underperformance.

[5] The z-score for each of the three ratios for each security was calculated using the mean and standard deviation of the relevant variable within the S&P/ASX 200. The higher the fundamental ratio, the higher the resulting z-score. For each security, the average z-score was computed by taking a simple average of the three z-scores. A security must have at least one z-score for it to be included in the index. Outlier average z-scores were winsorized at ±4.

The high value portfolios historically performed better in up markets, with the equal-weighted portfolio demonstrating stronger pro-cyclical characteristics than the float-cap weighted portfolio due to a stronger small-cap bias (see Exhibit 20 in the Appendix). Companies in the high value portfolios were most concentrated in the Industrials, Materials, and Real Estate sectors. When weighted by market cap, the high value portfolio had significant underweight in Financials and overweight in Real Estate and Industrials compared to the benchmark (see Exhibit 23 in the Appendix).

Factor attribution analysis indicated the strong bias of the high value portfolios to low momentum and Real Estate compared to the S&P/ASX 200.

Exhibit 4: Risk/Return Profile of Value Portfolios

CATEGORY	S&P/ASX 200	HIGH VALUE PORTFOLIOS (Q1)*		LOW VALUE PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	3.6	3.7	10.7	9.2
Annualized Volatility (%)	17.5	20.3	20.9	19.8	21.8
Risk-Adjusted Return	0.39	0.18	0.18	0.54	0.42
Rolling 252-Day Maximum Drawdown (%)	-47.4	-63.1	-63.7	-48.9	-54.3
Annualized Excess Return (%)	-	-3.2	-3.1	3.8	2.3
Annualized Tracking Error (%)	-	10.0	11.7	10.1	11.1
Information Ratio	-	-0.32	-0.27	0.38	0.21
Average Annualized Turnover (%)	7.1	88.9	82.9	62.2	67.7

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from 2005 to 2019.
*High Value Portfolios (Q1) and Low Value Portfolios (Q5) are hypothetical portfolios.

The high value portfolios historically exhibited pro-cyclical characteristics, with better performance in up markets.

To decompose the risk/return contribution from each of the three value components (earnings-to-price, sales-to-price, and book value-to-price ratios) to the value portfolios, we constructed the top and bottom value quintile sub-portfolios based on each of these three valuation ratios following the same methodology.

The sub-portfolio with the highest sales-to-price ratio had distinct sector bias compared to the sub-portfolios with high earnings-to-price and book value-to-price ratios (see Exhibit 24 in the Appendix). As shown in Exhibit 5, only the high sales-to-price ratio sub-portfolios (Q1) outperformed their respective Q5 sub-portfolios, but this was not true for the sub-portfolios based on the other two valuation ratios. This explained the underperformance of the high value portfolios.

Only the high sales-to-price sub-portfolios (Q1) outperformed their respective Q5 sub-portfolios…

…but not for the sub-portfolios based on the other two valuation ratios.

Exhibit 5: Value Factor Performance Decomposition

CATEGORY	S&P/ASX 200	Q1 PORTFOLIOS*		Q5 PORTFOLIOS*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
EARNINGS-TO-PRICE RATIO: Q1 = HIGHER RATIO					
Annualized Return (%)	6.9	2.9	1.4	9.2	9.6
Annualized Excess Return (%) over Q5	N/A	-6.2	-8.2	N/A	N/A
Annualized Volatility (%)	17.5	20.9	20.9	20.3	22.6
Risk-Adjusted Return	0.39	0.14	0.07	0.45	0.43
SALES-TO-PRICE RATIO: Q1 = HIGHER RATIO					
Annualized Return (%)	6.9	9.5	6.5	6.7	4.9
Annualized Excess Return (%) over Q5	N/A	2.8	1.6	N/A	N/A
Annualized Volatility (%)	17.5	17.4	19.9	19.3	21.4
Risk-Adjusted Return	0.39	0.55	0.33	0.35	0.23
BOOK VALUE-TO-PRICE RATIO: Q1 = HIGHER RATIO					
Annualized Return (%)	6.9	4.9	2.9	12.5	11.6
Annualized Excess Return (%) over Q5	N/A	-7.5	-8.7	N/A	N/A
Annualized Volatility (%)	17.5	21.3	21.6	19.8	19.6
Risk-Adjusted Return	0.39	0.23	0.13	0.63	0.59

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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.
*High Value Portfolios (Q1) and Low Value Portfolios (Q5) are hypothetical portfolios.

LOW VOLATILITY

The low volatility portfolios delivered higher absolute and risk-adjusted returns than the high volatility portfolios.

The inverse relationship between equity volatility and long-term return has been well documented [12-18]. The academic explanations for the low volatility premium have mainly focused on the behavioral biases that drive excess demand for high risk stocks and the limitations on arbitrage in practice [19]. The two most commonly used metrics to measure volatility are realized volatility and the combination of predicted volatility and covariance. The low and high volatility portfolios constructed for our analysis were based on stocks' one-year realized daily price return volatility.

Exhibit 6 summarizes the risk/return characteristics of the low and high volatility quintile portfolios (Q1 and Q5, respectively) based on the realized return volatility of stocks. The low volatility portfolios delivered higher absolute and risk-adjusted returns than the high volatility portfolios, with the return spread of the equal-weight portfolios being more pronounced. The return volatility of the low volatility portfolios was almost one-half that of the high volatility portfolios on equal- and float-cap-weighted bases. However, the float-cap-weighted low volatility portfolio did not outperform the S&P/ASX 200, mainly due to sector allocation bias.

In Australia, there are few companies from the traditional defensive sectors, like Communication Services, Utilities, and Consumer Staples, therefore companies in the low volatility portfolios were mostly from the Financials and Real Estate sectors. In contrast, companies in the high volatility portfolios were mainly from the Materials and Energy sectors.

The low volatility portfolios exhibited strong defensive features, with better performance in down markets.

The market-cap-weighted low volatility portfolio had significant underweight in Materials and overweight in Financials (see Exhibit 23 in the Appendix). The low volatility portfolios exhibited a marked defensive nature, outperforming the benchmark the majority of the time in down markets, but mostly underperforming in up markets (see Exhibit 20 in the Appendix).

Exhibit 6: Risk/Return Profiles of Low Volatility Portfolios

CATEGORY	S&P/ASX 200	LOW VOLATILITY PORTFOLIOS (Q1)*		HIGH VOLATILITY PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	5.5	7.4	1.9	0.7
Annualized Volatility (%)	17.5	16.6	14.1	29.9	28.4
Risk-Adjusted Return	0.39	0.33	0.52	0.06	0.02
Rolling 252-Day Maximum Drawdown (%)	-47.4	-40.5	-40.4	-76.1	-71.5
Annualized Excess Return (%)	-	-1.4	0.5	-5.0	-6.2
Annualized Tracking Error (%)	-	7.0	7.8	19.0	17.8
Information Ratio	-	-0.20	0.07	-0.26	-0.35
Beta	1.00	0.87	0.72	1.37	1.29
Average Annualized Turnover (%)	7.1	46.1	50.7	73.6	79.7

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from 2005 to 2019.
*Low Volatility Portfolios (Q1) and High Volatility Portfolios (Q5) are hypothetical portfolios.

The high and low momentum portfolios constructed for the analysis are based on 12-month risk-adjusted price momentum.

MOMENTUM

The momentum effect has been well documented in the U.S. market and other markets [20-21]. These studies have found that stock price trends tended to extend over certain periods, meaning winners continued to win and losers continued to lose. Theories behind the momentum effect have mainly been in an investor behavioral context [22-24].

The high and low momentum portfolios (Q1 and Q5, respectively) constructed for the analysis were based on 12-month risk-adjusted price momentum.[6] Historically, the equal- and float-cap-weighted high momentum portfolios have outperformed the low momentum portfolios on an absolute and a risk-adjusted basis, with similar return volatility and slightly smaller drawdowns (see Exhibit 7). The outperformance of high momentum portfolios versus the low momentum portfolios was strongly driven by sector allocation bias, which contributed about 70% of the outperformance.

Historically, the high momentum portfolios outperformed the low momentum portfolios on absolute and risk-adjusted bases.

Compared to the S&P/ASX 200, both the equal- and float-cap-weighted high momentum portfolios had higher absolute returns, but significantly higher return volatility and bigger return drawdowns.

As observed in other markets, high momentum portfolios had much higher portfolio turnover than other factor portfolios in Australia, and the sector composition of the high momentum portfolios also rotated more rapidly than other factor portfolios historically.

The high momentum portfolios had much higher portfolio turnover than other factor portfolios.

Exhibit 7: Risk/Return Profiles of Momentum Portfolios

CATEGORY	S&P/ASX 200	HIGH MOMENTUM PORTFOLIOS (Q1)*		LOW MOMENTUM PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	8.6	7.8	-1.1	-0.4
Annualized Volatility (%)	17.5	20.2	21.1	21.2	21.2
Risk-Adjusted Return	0.39	0.42	0.37	-0.05	-0.02
Rolling 252-Day Maximum Drawdown (%)	-47.4	-56.6	-60.7	-54.8	-63.2
Annualized Excess Return (%)	-	1.7	0.9	-7.9	-7.3
Annualized Tracking Error (%)	-	9.5	10.1	11.0	11.8
Information Ratio	-	0.18	0.09	-0.72	-0.62
Average Annualized Turnover (%)	7.1	131.5	121.2	137.5	129.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from 2005 to 2017.
*High Momentum Portfolios (Q1) and Low Momentum Portfolios (Q5) are hypothetical portfolios.

[6] The 12-month risk-adjusted price momentum was calculated as the price return over the past 12 months (excluding the most recent month), respectively, divided by the standard deviation of daily price returns during the same period.

QUALITY

The S&P Quality Indices measure quality based on the average z-score of return on equity, balance sheet accruals ratio, and LEV.

Performance of high quality stocks cannot be comprehensively explained by classic risk factors alone—namely size, momentum, volatility, and value. We believe that quality is a multifaceted concept, as demonstrated by the three-pronged approach to identify high quality companies that consider profitability generation, earnings sustainability, and financial robustness [25]. In this paper, we constructed the high and low quality portfolios (Q1 and Q5, respectively) following the S&P Quality Indices framework, which measures quality based on the average z-score[7] of the return on equity (ROE), balance sheet accruals ratio (BSA), and financial leverage (LEV).

Historically, both the equal- and float-cap-weighted high quality portfolios have outperformed the low quality portfolios on an absolute and a risk-adjusted basis, with lower return volatility and smaller drawdowns (see Exhibit 8). Under both weighting schemes, the high quality portfolios outperformed the market benchmark, however, with higher volatility.

The high quality portfolio behaved more defensively with float-cap-weighting due to increased bias to defensive sectors.

Historically, most companies in the top quintile quality portfolios were from the Materials and Consumer Discretionary sectors, while the bottom quintile quality portfolios were dominated by Financials and Materials. However, when the portfolio was weighted by float cap, the high quality portfolio had significantly increased bias to defensive sectors (see Exhibit 23 in the Appendix). Therefore, the high quality portfolio exhibited defensive features when it was float-cap weighted, but its return became more pro-cyclical when it was equal weighted (see Exhibit 20 in the Appendix). This suggests the sector bias resulting from different weighting methods might have a significant impact on the returns of the quality portfolios in the Australian market.

[7] The z-score for each of the three ratios for each security was calculated using the mean and standard deviation of the relevant variable within the S&P/ASX 200. The higher the ROE ratio, the higher the resulting z-score. However, the higher BSA and LEV ratios, the lower the resulting z-score. For each security, the average z-score was computed by taking a simple average of the three z-scores. A security must have at least one z-score for it to be included in the index. Outlier average z-scores were winsorized at ±4.

Exhibit 8: Risk/Return Profile of Quality Portfolios

CATEGORY	S&P/ASX 200	HIGH QUALITY PORTFOLIOS (Q1)*		LOW QUALITY PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	8.8	8.2	6.2	5.6
Annualized Volatility (%)	17.5	19.4	18.2	21.3	21.3
Risk-Adjusted Return	0.39	0.45	0.45	0.29	0.26
Rolling 252-Day Maximum Drawdown (%)	-47.4	-45.8	-53.4	-53.7	-60.7
Annualized Excess Return (%)	-	2.0	1.4	-0.6	-1.2
Annualized Tracking Error (%)	-	8.9	8.1	8.6	9.5
Information Ratio	-	0.22	0.17	-0.07	-0.13
Average Annualized Turnover (%)	7.1	68.6	80.0	22.6	78.3

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from 2005 to 2019.
*High Quality Portfolios (Q1) and Low Quality Portfolios (Q5) are hypothetical portfolios.

The equal-weighted high quality portfolio delivered higher absolute and risk-adjusted returns than the corresponding low quality portfolio.

To understand the contribution of BSA, LEV, and ROE to the overall performance of quality portfolios, we constructed the top and bottom quality quintile sub-portfolios based on each of these three quality measures, following the same methodology.[8]

Both BSA and ROE generated positive quintile return spreads under equal- and market-cap-weighting methods.

As shown in Exhibit 9, under both weighting methods, BSA and ROE generated positive quintile return spreads, while LEV recorded negative quintile return spreads. Although BSA was the best-performing measure, ROE had more of an influence on the performance of the high quality portfolios, as demonstrated by the highest return correlation between the high quality portfolios and the high ROE sub-portfolios (see Exhibit 22 in the Appendix).

All three quality measures exhibited pro-cyclical features, with higher win ratios and higher average monthly excess returns in up markets. However, when they were float-cap weighted, low BSA and high ROE portfolios became defensive with higher win ratios and higher average monthly excess returns in down markets. Among the three measures, LEV was the most pro-cyclical, driven by the strong sector bias of low LEV portfolios to Energy and Materials (see Exhibits 21 and 24 in the Appendix).

[8] The quintile stocks with the highest ROE z-scores formed the Q1 ROE portfolio and vice versa for the Q5 ROE portfolio. The quintile stocks with the lowest LEV z-scores formed the Q1 LEV portfolio and vice versa for the Q5 LEV portfolio. The quintile stocks with the lowest BSA z-scores formed the Q1 BSA portfolio and vice versa for the Q5 BSA portfolio.

Exhibit 9: Quality Factor Performance Decomposition

CATEGORY	S&P/ASX 200	Q1 PORTFOLIOS*		Q5 PORTFOLIOS*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
BSA: Q1 = LOWER RATIO					
Annualized Return (%)	6.9	11.0	9.1	6.2	3.7
Annualized Excess Return (%) over Q5	N/A	4.8	5.4	N/A	N/A
Annualized Volatility (%)	17.5	18.0	18.4	21.9	22.9
Risk-Adjusted Return	0.39	0.61	0.49	0.28	0.16
LEV: Q1 = LOWER RATIO					
Annualized Return (%)	6.9	6.7	5.3	6.9	7.0
Annualized Excess Return (%) over Q5	N/A	-0.1	-1.7	N/A	N/A
Annualized Volatility (%)	17.5	22.4	23.0	19.7	17.7
Risk-Adjusted Return	0.39	0.30	0.23	0.35	0.40
ROE: Q1 = HIGHER RATIO					
Annualized Return (%)	6.9	9.7	10.1	9.1	7.6
Annualized Excess Return (%) over Q5	N/A	-3.0	0.2	N/A	N/A
Annualized Volatility (%)	17.5	19.4	18.7	20.8	22.2
Risk-Adjusted Return	0.39	0.50	0.54	0.44	0.34

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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.
*Q1 and Q5 Portfolios are hypothetical portfolios.

Among the three quality measures, LEV was the most pro-cyclical.

DIVIDEND

The high and low dividend portfolios were constructed based on companies' 12-month trailing gross dividend yield.

Dividend yield has been traditionally considered as a value metric, however it deserves separate attention due to its distinct risk/return profile. Dividend strategies have also been popular among income-seeking market participants.

In our analysis, the high and low dividend portfolios (Q1 and Q5, respectively) were constructed based on companies' 12-month trailing gross dividend yield. During the examined period, the high dividend portfolio delivered slightly higher absolute and risk-adjusted returns than the low dividend portfolio when the portfolios were weighted by float cap (see Exhibit 10). When the portfolios were equally weighted, the quintile return spread became negative, though the high dividend portfolio still had lower volatility. Performance attribution showed the underperformance of the equal-weighted Q1 dividend portfolio was mainly due to stock selection effects.

The high dividend portfolios had bigger return drawdowns in the 2008 financial crisis, mainly due to their higher concentration in the Real Estate and Financials sectors compared with the low dividend portfolios.

The high dividend portfolios exhibited pro-cyclical features.

Consistent with its higher volatility compared to the market benchmark, the high dividend portfolios in Australia displayed pro-cyclical features, with higher win ratios and average monthly excess return in up markets than in down markets (see Exhibit 20 in the Appendix).

Historically, most companies in the high dividend portfolios were from cyclical sectors such as the Consumer Discretionary, Financials, Industrials, and Real Estate sectors. When float-cap weighted, the high dividend portfolios had a strong bias to the Financials sector (see Exhibit 23 in the Appendix).

The high dividend portfolios delivered higher risk-adjusted returns than the low dividend portfolios only when it was float-cap weighted.

Exhibit 10: Risk/Return Profile of Dividend Portfolios

CATEGORY	S&P/ASX 200	HIGH DIVIDEND PORTFOLIOS (Q1)*		LOW DIVIDEND PORTFOLIOS (Q5)*	
		FLOAT-CAP WEIGHTED	EQUAL WEIGHTED	FLOAT-CAP WEIGHTED	EQUAL WEIGHTED
Annualized Return (%)	6.9	5.7	2.3	5.2	5.1
Annualized Volatility (%)	17.5	19.1	19.4	22.7	24.4
Risk-Adjusted Return	0.39	0.30	0.12	0.23	0.21
Rolling 252-Day Maximum Drawdown (%)	-47.4	-60.7	-71.4	-58.5	-63.5
Annualized Excess Return (%)	-	-1.2	-4.6	-1.6	-1.8
Annualized Tracking Error (%)	-	9.2	10.3	12.5	13.6
Information Ratio	-	-0.13	-0.44	-0.13	-0.13
Average Annual Turnover (%)	7.1	73.2	79.1	79.4	71.4

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on total return in AUD of the factor quintile portfolios. 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 calculated from January 2005 to January 2020.
*High Dividend Portfolios (Q1) and Low Dividend Portfolios (Q5) are hypothetical portfolios.

INDEXING IMPLEMENTATION OF SMART BETA STRATEGIES

The S&P DJI Australian factor indices demonstrate indexing implementation of the examined factor strategies in the Australian market.

The S&P DJI Australian factor indices demonstrate indexing implementation of the examined factor strategies in the Australian market. These indices are designed to track the performance of stocks with specific factor characteristics. Due to the difference in stock selection and weighting methods, along with the incorporation of rebalancing buffers and other portfolio diversification constraints, performance characteristics of the S&P DJI Australian factor indices might deviate from those observed in their respective hypothetical quintile portfolios.

The S&P/ASX Small Ordinaries comprises companies in the S&P/ASX 300, but not in the S&P/ASX 100, with all the stocks weighted by market cap. The S&P/ASX Dividend Opportunities Index includes the 50 stocks from the S&P/ASX 300 with the highest dividend yield, while meeting price momentum and dividend growth criteria, with all the stocks weighted by their total dividends.[9] The S&P/ASX 200 Enhanced Value, S&P/ASX 200 Momentum, and S&P/ASX 200 Quality Index include the 40 stocks from the S&P/ASX 200 with highest factor scores, weighted by their score-tilted market cap and subject to security and sector constraints. The S&P/ASX 200 Low Volatility Index includes the top 40 stocks from the S&P/ASX 200 with the least realized return volatility, weighted by the inverse of their volatility. All indices are rebalanced semiannually, apart from the S&P/ASX 200 Low Volatility Index, which is rebalanced quarterly.

The S&P/ASX 200 Quality Index and the S&P/ASX 200 Low Volatility Index delivered excess returns on absolute and risk-adjusted bases.

Over the examined period between Dec. 31, 2004, and May 29, 2020, the S&P/ASX 200 Quality Index and the S&P/ASX 200 Low Volatility Index delivered excess returns on an absolute and risk-adjusted basis versus the S&P/ASX 200 (see Exhibit 11). The S&P/ASX Momentum also recorded a higher absolute return than the benchmark but had higher return volatility.

From a return volatility perspective, the S&P/ASX 200 Low Volatility Index and S&P/ASX Dividend Opportunities Index recorded lower volatility and smaller return drawdowns than the S&P/ASX 200, while the S&P/ASX 200 Enhanced Value and S&P/ASX 200 Momentum had the most volatile returns.

The S&P/ASX 200 Low Volatility Index and S&P/ASX Dividend Opportunities Index recorded lower volatility and smaller return drawdowns than the S&P/ASX 200.

Exhibit 11: Risk/Return Profile of the S&P DJI Australian Factor Indices

CATEGORY	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY	S&P/ASX 200
Annualized Return (%)	4.3	8.3	3.5	4.4	9.6	7.4	6.9
Annualized Volatility (%)	18.1	20.0	19.8	17.1	17.5	14.0	17.5
Risk-Adjusted Return	0.24	0.41	0.18	0.26	0.55	0.53	0.39
252-Day Maximum Drawdown (%)	-60.1	-56.8	-64.9	-47.2	-43.4	-38.7	-47.4
Annualized Excess Return (%)	-2.5	1.4	-3.3	-2.4	2.8	0.5	N/A
Annualized Tracking Error (%)	8.5	8.9	9.9	5.9	6.7	7.9	N/A
Information Ratio	-0.30	0.16	-0.34	-0.42	0.42	0.07	N/A
Average Annualized Turnover (%)	38.8	112.9	66.6	62.9	60.9	49.9	7.1

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on total returns in AUD of the S&P DJI Australian factor indices. 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 calculated from 2005 to 2019.

[9] Dividend yield multiplied by market capitalization.

Compared to the S&P/ASX 200, all the factor indices tended to underweight the Financials sector.

Compared to the S&P/ASX 200, which was heavily dominated by the Financials sector, all the factor indices tended to underweight the Financials sector. Apart from that, different sector tilts were observed in various factor indices. While the S&P/ASX 200 Enhanced Value was historically overweight in the Real Estate and Industrials sectors, the S&P/ASX Small Ordinaries and S&P/ASX 200 Momentum were more biased toward the Consumer Discretionary and Industrials sectors. The S&P/ASX 200 Low Volatility Index, weighted by the inverse of volatility, was more allocated toward the Real Estate and Utilities sectors, while the S&P/ASX 200 Quality Index had bias toward the Consumer Discretionary and Health Care sectors. The S&P/ASX Dividend Opportunities Index had average sector bias to Consumer Discretionary, Industrials, and Consumer Staples (see Exhibit 12).

The S&P Australia factor indices exhibited designated characteristic tilts relative to the S&P/ASX 200…

Exhibit 12: Average Sector Bias (%) of the S&P DJI Australian Factor Indices

SECTOR	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Energy	2.5	4.6	1.4	0.2	1.9	-4.3
Materials	1.5	0.5	-1.1	-3.6	4.2	**-14.1**
Industrials	**7.9**	**6.3**	**12.9**	**6.3**	3.0	0.7
Consumer Discretionary	**11.3**	**5.6**	2.0	**8.3**	**7.5**	3.1
Consumer Staples	-3.2	-1.1	0.9	**5.3**	2.9	1.7
Health Care	0.8	4.5	-1.1	-1.8	**5.0**	2.1
Financials	**-26.2**	**-20.4**	**-25.1**	**-10.9**	**-22.4**	**-15.5**
Information Technology	3.8	2.0	-0.9	0.1	2.2	-0.3
Communication Services	-1.8	-2.1	-3.6	0.5	2.5	0.5
Utilities	1.6	1.8	1.0	3.2	-0.8	**6.2**
Real Estate	1.7	-1.7	**13.4**	**-7.5**	**-6.1**	**19.8**

Source: S&P Dow Jones Indices LLC. Data from December 2004 to January 2020. Table is provided for illustrative purposes. Light blue numbers indicate sectors in which the factor index was most underweight, and dark blue numbers indicate sectors in which the factor index was most overweight.

…and all of them had significant small-cap tilts.

As shown in Exhibit 13, the S&P DJI Australian factor indices exhibited designated characteristic tilts relative to the S&P/ASX 200, and all of them had significant small-cap tilts. Unintended fundamental characteristic tilts were also observed for various indices. The small-cap index exhibited tilts to high volatility, low dividend yield, low LEV, and low ROE. The S&P/ASX 200 Momentum displayed high volatility tilt and low dividend yield. The S&P/ASX 200 Enhanced Value had additional tilts to high volatility, low LEV, and low ROE. The S&P/ASX Dividend Opportunities Index demonstrated tilts to the low price-to-sales ratio. The S&P/ASX 200 Quality Index exhibited historical tilt to the high price-to-book ratio, while the S&P/ASX 200 Low Volatility Index had unintended bias to high dividend yield.

Exhibit 13: Characteristics of the S&P DJI Australian Factor Indices

CHARACTERISTIC	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Market Capitalization	-11.0	-6.7	-10.8	-3.0	-4.6	-5.4
12-Month Volatility	10.6	3.1	3.5	-0.3	2.3	-6.9
36-Month Beta	1.4	0.1	0.8	-1.3	-0.2	-4.8
1-Year Price Change	-0.2	5.0	-2.8	-1.8	0.4	-0.7
Dividend Yield	-5.1	-4.7	1.3	2.8	-1.4	2.2
Price-to-Earnings	-0.3	1.8	-2.4	-0.1	-0.5	-0.4
Price-to-Sales	1.9	1.3	-2.6	-2.7	0.2	1.2
Price-to-Book	-1.4	2.1	-7.8	0.1	3.0	-1.3
Historical 3-Year Sales Growth	3.4	1.1	0.6	0.3	0.8	0.0
Historical 3-Year EPS Growth	1.0	0.8	-0.7	-0.5	1.5	-0.1
Long-Term Debt to Capital	-9.0	-2.1	-3.2	-0.4	-5.3	-0.5
ROE	-3.8	-0.5	-3.3	0.5	3.8	-1.8
BSA Ratio (L90D)	0.7	0.7	1.0	-1.6	0.7	1.5

Source: S&P Dow Jones Indices LLC, FactSet Characteristics Tilt Report. Data as of January 2020. Averaged characteristics tilts of the S&P DJI Australian factor indices are calculated as the weighted Welch' s T-test relative to the S&P/ASX 200 as of semiannual rebalances between December 2004 to January 2020. 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. Light blue numbers indicate intended factor biases, and dark blue numbers indicate unintended biases.

The value, small-cap, and momentum indices tended to have better performance in up markets…

Due to the difference in sector and fundamental characteristic tilts, most factor indices in Australia exhibited distinct return characteristics during up and down markets, historically. The value, small-cap, and momentum indices tended to have better performance in up markets, and vice versa for the low volatility and quality indices. However, the dividend index did not display clear return differentials between up and down markets, historically (see Exhibit 14). Nevertheless, correlation across different factors was fairly low, historically, indicating the potential advantage of blending various factors for risk diversification benefits (see Exhibit 15).

Exhibit 14: Performance of the S&P DJI Australian Factor Indices in Up and Down Markets

INDEX	MONTHS OUTPERFORMED (%)			AVERAGE MONTHLY EXCESS RETURN (%)		
	UP MONTHS	DOWN MONTHS	ALL MONTHS	UP MONTHS	DOWN MONTHS	ALL MONTHS
Small Cap	52.2	47.1	50.3	0.1	-0.6	-0.1
Momentum	53.0	51.4	52.4	0.3	0.0	0.2
Value	54.8	34.3	47.0	0.3	-0.9	-0.2
Dividend	41.7	45.7	43.2	-0.2	-0.2	-0.2
Quality	53.0	55.7	54.1	0.1	0.4	0.2
Low Volatility	40.9	71.4	52.4	-0.5	0.9	0.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Figures based on monthly total return in AUD for the S&P DJI Australian factor indices. 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.

…but vice versa for the low volatility and quality indices.

Correlations across different factors were fairly low historically in the Australian market.

Exhibit 15: Correlation of Factor Excess Returns

INDEX	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
SMALL CAP	1.00	0.44	0.36	0.15	0.39	0.11
MOMENTUM	-	1.00	-0.07	-0.09	0.33	-0.04
VALUE	-	-	1.00	0.35	0.11	0.17
DIVIDEND	-	-	-	1.00	0.22	0.25
QUALITY	-	-	-	-	1.00	0.08
LOW VOLATILITY	-	-	-	-	-	1.00

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Correlation based on daily excess total returns in AUD for the S&P DJI Australian factor indices relative to the S&P/ASX 200. Past performance is on 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.

MACROECONOMIC REGIME ANALYSIS

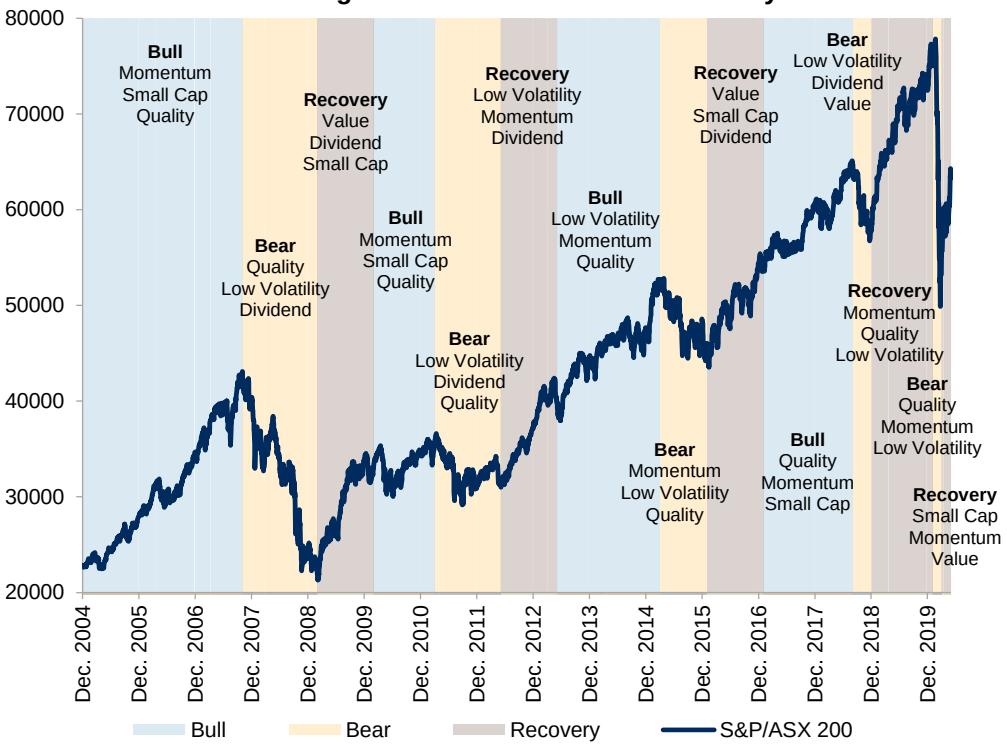
Although empirical evidence suggests factor strategies may generate enhanced risk-adjusted return in the long run, in our study the cyclicality in their returns resulted in short-term periods of outperformance and underperformance, making them potentially useful tools for implementation of active views of the local equity market. To better understand the cyclical behavior of factor strategies over time, we examined factor performance in two market regimes—the equity market cycle and investor sentiment—from Dec. 31, 2004, to May 29, 2020.

Factor portfolios exhibited cyclicality in their returns with short-term periods of outperformance and underperformance.

Factor Performance across Market Cycles

Market cycles refer to the upward and downward movements of financial or stock markets. We divided the Australian equity market into 14 market cycle phases (five bearish, five recovery, and four bullish) based on the performance trends of the S&P/ASX 200. A bearish phase is defined as a period during which the S&P/ASX 200 goes from peak to trough. A recovery phase is defined as the 12-month period after the S&P/ASX 200 trough. A bullish phase is defined as a period from the end of the recovery phase to the next S&P/ASX 200 peak (see Exhibit 16).

Exhibit 16: Best-Performing Factor Indices* across Market Cycle Phases



Momentum and small cap appeared more often as top-performing factors in bullish markets.

Historically, value stocks and high dividend stocks had strong outperformance in recovery periods.

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on total returns in AUD of the S&P DJI Australian factor indices. Past performance is no guarantee of future results. Chart 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.
*Top three best-performing factor indices ordered by excess return relative to the S&P/ASX 200 in descending order in each period.

Exhibit 16 highlights the three factors that delivered the most favorable returns in each bullish, bearish, and recovery period. Factor indices in Australia were sensitive to the local market cycles, with momentum and small cap being the most cyclical, and low volatility and quality being the most defensive (see Exhibit 17).

Low volatility stocks were defensive, with the most outperformance in bearish markets.

Momentum and small cap appeared more often as top-performing factors in bullish markets. However, momentum stocks suffered from price trend reversals during recovery periods. Historically, value stocks and high dividend stocks had strong outperformance when the market rebounded from its troughs, though both factors generated negative average monthly excess returns in the bull and bear markets.

Low volatility stocks were defensive, with the most outperformance in bearish markets, while underperforming in bullish markets and recovery periods. Quality stocks outperformed the benchmark in bullish and bearish market phases, with more pronounced excess returns during bearish markets, but their defensive features were not as strong as those seen in low volatility stocks.

Quality stocks outperformed the benchmark in bullish and bearish market phases…

Exhibit 17: Factor Index Performance Versus the S&P/ASX 200 Across Market Cycle Phases

MARKET CYCLE PHASE	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
AVERAGE EXCESS RETURN (ANNUALIZED, %)						
Bull	1.7	6.1	-3.8	-6.2	3.4	-2.1
Bear	-5.6	1.2	-10.7	-0.8	5.5	7.7
Recovery	-1.6	-4.2	16.8	3.6	-2.6	-5.9
INFORMATION RATIO						
Bull	0.24	1.04	-0.53	-1.52	0.64	-0.38
Bear	-0.50	0.10	-0.77	-0.10	0.61	0.91
Recovery	-0.16	-0.49	1.39	0.59	-0.51	-0.98
PERCENTAGE OF OUTPERFORMANCE (%)						
Bull	56.8	56.8	47.7	31.8	53.4	48.9
Bear	43.5	52.2	30.4	52.2	60.9	69.6
Recovery	45.1	45.1	60.8	54.9	49.0	43.1

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on monthly total returns in AUD of the S&P DJI Australian factor indices. 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. Excess return, information ratio, and percentage of outperformance were calculated relative to the S&P/ASX 200.

…with more pronounced excess returns during bearish markets.

Factor Performance across Different Investor Sentiment Regimes

Investor sentiment regimes refer to the overall attitude of market participants toward the financial market, as measured by the activity and price movement of the stock market. In our analysis, the 30-day realized return volatility of the S&P/ASX 200 was used as the indicator of investor sentiment (bullish, neutral, and bearish) toward the Australian equity market. We sorted the month-end volatility values over the examined period with values in the top quintile (high market volatility) representing a bearish market sentiment, values in the bottom quintile (low market volatility) representing a bullish market regime, and values between the top and bottom quintiles representing a neutral market regime. We then compared the performance of each factor index across the different regimes (see Exhibit 18).

The momentum index delivered excess returns in bullish and neutral sentiment conditions.

Historically, most examined factor indices in Australia tended to be more sensitive to bullish and bearish sentiments, as the most noticeable outperformance and underperformance appeared under these two conditions. The momentum index delivered excess returns in bullish and neutral sentiment conditions, while value stocks only outperformed the market in bullish sentiments. In contrast, low volatility and high dividend stocks performed better in bearish sentiments than in bullish or neutral sentiment conditions. Interestingly, quality stocks were rewarded by market participants in bullish and bearish sentiments, but they underperformed the benchmark in neutral sentiments. During bearish sentiments, momentum and value stocks were penalized the most.

Value stocks only outperformed the market in bullish sentiment conditions.

Exhibit 18: Factor Index Performance Versus the S&P/ASX 200 in Different Investor Sentiment Regimes

MARKET SENTIMENT	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
AVERAGE EXCESS RETURN (ANNUALIZED, %)						
Bullish	2.6	5.6	4.5	-7.4	9.0	-3.5
Neutral	-3.3	3.5	-3.7	-2.6	-2.0	0.2
Bearish	-1.0	-3.7	-3.0	2.5	9.9	3.6
INFORMATION RATIO						
Bullish	0.43	1.02	0.68	-1.62	1.89	-0.76
Neutral	-0.40	0.46	-0.44	-0.60	-0.38	0.03
Bearish	-0.07	-0.29	-0.16	0.25	1.03	0.36
PERCENTAGE OF OUTPERFORMANCE (%)						
Bullish	54.1	56.8	56.8	32.4	67.6	40.5
Neutral	52.3	52.3	45.9	43.2	46.8	54.1
Bearish	40.5	48.6	40.5	54.1	62.2	59.5

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on monthly total returns in AUD of the S&P DJI Australian factor indices. 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. Excess returns, information ratio, and percentage of outperformance were calculated relative to the S&P/ASX 200.

Low volatility, quality, and high dividend stocks performed better in bearish sentiments than in bullish or neutral sentiment conditions.

Investor sentiment changes more frequently than market cycle phases, and its analysis could serve as a useful complement to explain short-term factor performance in different market conditions. Exhibit 19 summarizes the factor performance characteristics across various market cycles and investor sentiment regimes.

Exhibit 19: Performance across Different Market Cycles and Investor Sentiment Regimes in Australia

CATEGORY	PHASE	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Market Cycles	Bullish	▲	▲	▼	▼	▲	▼
	Bearish	▼	▲	▼	▼	▲	▲
	Recovery Period	▼	▼	▲	▲	▼	▼
Investor Sentiment	Bullish	▲	▲	▲	▼	▲	▼
	Neutral	▼	▲	▼	▼	▼	▲
	Bearish	▼	▼	▼	▲	▲	▲

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Index performance based on monthly total returns in AUD of the S&P DJI Australian factor indices. Past performance is no guarantee of future results. Table is provided for illustrative purposes.
Note: Light blue, upward triangles represent favorable performance, while dark blue, downward triangles represent unfavorable performance based on excess returns versus the S&P/ASX 200 of each factor. The two factors with the highest information ratio in each of the market cycle phases are circled in yellow.

Investor sentiment analysis could serve as a useful complement to explain short-term factor performance in different market conditions.

CONCLUSION

In this paper, we examined the effectiveness of six well-known factors, including size, value, low volatility, momentum, quality, and dividend, in the Australian equity market, as well as the behavior of these factors under different market regimes from Dec. 31, 2004, to May 29, 2020.

Factor-based investing might provide return enhancement or risk reduction in the Australian equity market.

From the quintile analysis, we observed that low volatility, high momentum, and high quality portfolios delivered the most consistent absolute and risk-adjusted return spreads under equal- and market-cap-weighted methods. In contrast, risk premiums were not observed in the small-cap and high value portfolios. The high dividend portfolios generated absolute and risk-adjusted return spreads only when they were float-cap weighted.

From a return volatility perspective, we also noticed volatility and drawdown reduction from the low volatility and quality factors, historically. This result showed the potential benefit on return enhancement and risk reduction of various factor-based strategies in the Australian equity market.

Due to the difference in sector and fundamental characteristic tilts, most factor indices exhibited distinct cyclical features.

The results of our study on the S&P DJI Australian factor indices suggests the quality and momentum indices delivered the highest excess returns, while the low volatility and dividend indices had reduced return volatility and drawdown compared to the S&P/ASX 200. Compared to the S&P/ASX 200, which was heavily dominated by the Financials sector, all factor indices had their unique sector tilts, but all of them tended to underweight Financials.

On the other hand, various S&P DJI Australian factor indices exhibited designated characteristic tilts relative to the S&P/ASX 200, and all of them had significant small-cap tilts. Due to the difference in sector and fundamental characteristic tilts, most factor indices exhibited distinct cyclical features, with different factors leading and lagging in the up and down markets, respectively. Correlation across different factors was fairly low, historically, indicating the potential advantage of blending various factors for risk diversification benefits.

Most factor portfolios in Australia displayed distinct cyclicality and could be ideal tools for implementation of active views of the local equity market.

Based on our macro regime analysis, factor portfolios in Australia tended to be sensitive to local market cycles, with momentum and small cap being the most cyclical, and low volatility being the most defensive. The quality factor performed well in both bullish and bearish markets. The market cycle analysis helped to identify the cyclical characteristics of different factors.

Investor sentiment, on the other hand, switches more frequently than market cycle phases, and its analysis could serve as a useful complement to explain short-term factor performance in different market conditions. Most examined factor portfolios tended to be more sensitive to bullish and bearish sentiments in the Australian equity market, as most noticeable outperformance and underperformance appeared under these two

conditions. The low volatility and dividend factors performed better in bearish than in bullish or neutral sentiment, while value and momentum indices tended to perform better in bullish than in bearish sentiment. Interestingly, quality stocks were favored by market participants during bullish and bearish sentiments in Australia.

As most factors in Australia displayed distinct cyclicality in performance historically, they could be useful tools for implementation of active views of the local equity market. In addition, a multi-factor approach may also be a potential way to harvest the factor premium while diversifying factor risk exposure.

APPENDIX

Exhibit 20: Performance of Top Quintile Factor Portfolios in Up and Down Markets

FACTOR	PERCENTAGE OF MONTH OUTPERFORMED (%)			AVERAGE MONTHLY EXCESS RETURN (%)		
	UP MONTHS	DOWN MONTHS	ALL MONTHS	UP MONTHS	DOWN MONTHS	ALL MONTHS
EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS						
Small Cap	47.8	44.3	46.5	0.4	-1.1	-0.1
Value	50.4	32.9	43.8	0.6	-1.2	-0.1
Low Volatility	39.1	75.7	53.0	-0.5	0.9	0.0
Momentum	56.5	48.6	53.5	0.5	-0.4	0.2
Quality	59.1	44.3	53.5	0.3	-0.1	0.1
Dividend	46.1	41.4	44.3	0.3	-1.1	-0.2
FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS						
Small Cap	52.2	45.7	49.7	0.3	-0.8	-0.1
Value	55.7	47.1	52.4	0.2	-0.8	-0.2
Low Volatility	44.3	57.1	49.2	-0.3	0.3	-0.1
Momentum	50.4	57.1	53.0	0.0	0.3	0.2
Quality	51.3	51.4	51.4	0.0	0.5	0.2
Dividend	47.8	54.3	50.3	0.0	-0.1	0.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Portfolio performance based on monthly total return in AUD. 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.
Note: Factor portfolios shown are hypothetical.

Exhibit 21: Performance of Top Quintile Quality Factor Sub-Portfolios in Up and Down Markets

FACTOR	PERCENTAGE OF MONTH OUTPERFORMED (%)			AVERAGE MONTHLY EXCESS RETURN (%)		
	UP MONTHS	DOWN MONTHS	ALL MONTHS	UP MONTHS	DOWN MONTHS	ALL MONTHS
EQUAL-WEIGHTED TOP QUINTILE QUALITY FACTOR SUB-PORTFOLIOS						
BSA Ratio	55.7	55.7	55.7	0.4	0.0	0.2
LEV	54.8	44.3	50.8	0.5	-0.8	0.0
ROE	61.7	45.7	55.7	0.6	-0.2	0.3
FLOAT-CAP-WEIGHTED TOP QUINTILE QUALITY FACTOR SUB-PORTFOLIOS						
BSA Ratio	53.9	64.3	57.8	0.0	0.8	0.3
LEV	57.4	45.7	53.0	0.1	0.1	0.1
ROE	50.4	54.3	51.9	0.1	0.4	0.2

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Portfolio performance based on monthly total return in AUD. 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.
Note: Factor portfolios shown are hypothetical.

Exhibit 22: Correlation of Top Quintile Quality Factor Excess Return

PORTFOLIO	BSA RATIO	LEV	ROE	QUALITY
EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS				
BSA RATIO	1.00	0.45	0.44	0.59
LEV	-	1.00	0.59	0.59
ROE	-	-	1.00	0.80
QUALITY	-	-	-	1.00
FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS				
BSA RATIO	1.00	0.13	0.21	0.30
LEV	-	1.00	0.23	0.28
ROE	-	-	1.00	0.87
QUALITY	-	-	-	1.00

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to May 29, 2020. Correlation based on daily excess total returns in AUD. 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.
Note: Factor portfolios shown are hypothetical.

Exhibit 23: Sector Bias (%) of Top Quintile Factor Portfolios

SECTOR	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200 EQUAL WEIGHT INDEX						
Energy	-0.5	**2.7**	-1.7	**-5.5**	-0.8	**-6.1**
Materials	**2.9**	**2.8**	-1.5	**-11.4**	1.0	**-14.4**
Industrials	0.6	-0.6	**7.3**	0.8	-2.3	**-6.1**
Consumer Discretionary	**3.5**	-0.3	-3.4	**6.2**	**6.0**	**-5.1**
Consumer Staples	-0.6	-0.4	3.7	-0.8	1.1	2.6
Health Care	-0.2	1.2	-1.4	**-4.2**	**3.4**	0.3
Financials	**-6.7**	-1.8	**-5.0**	**7.2**	-0.4	**5.8**
Information Technology	1.4	1.7	-2.6	-2.5	2.4	-1.9
Communication Services	1.2	0.2	-1.7	2.5	1.3	1.8
Utilities	0.9	-0.5	-1.3	2.4	-3.3	**5.1**
Real Estate	-2.4	**-5.0**	**7.6**	**5.2**	**-8.7**	**18.0**
FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200						
Energy	0.8	1.8	0.7	-3.1	0.2	**-4.3**
Materials	1.9	2.0	-5.1	**-13.8**	**9.8**	**-13.6**
Industrials	**7.6**	**3.7**	**10.0**	-1.7	-1.6	-1.9
Consumer Discretionary	**14.4**	1.1	0.4	0.2	1.9	-1.8
Consumer Staples	-2.8	0.2	3.5	-2.8	**7.5**	**3.9**
Health Care	0.8	**4.7**	-2.9	**-4.8**	**12.7**	-0.5
Financials	**-29.3**	**-13.3**	**-20.5**	**18.0**	**-26.4**	**11.9**
Information Technology	3.5	0.8	-0.9	-0.9	0.4	-0.7
Communication Services	-0.3	1.4	-3.8	**8.9**	3.9	3.0
Utilities	2.8	0.7	1.0	0.2	-1.2	0.7
Real Estate	0.5	-2.9	**17.4**	-0.2	**-7.0**	**3.2**

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Jan. 31, 2020. Table is provided for illustrative purposes. Light blue numbers indicate sectors in which the factor portfolio was most underweight, and dark blue numbers indicate sectors in which the factor portfolio was most overweight.
Note: Factor portfolios shown are hypothetical.

Exhibit 24: Sector Bias (%) of Top Quintile Sub-Portfolios

SECTOR	EARNINGS-TO-PRICE RATIO	SALES-TO-PRICE RATIO	BOOK VALUE-TO-PRICE RATIO	VALUE	BSA RATIO	LEV	ROE	QUALITY
EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200 EQUAL WEIGHT INDEX								
Energy	-0.3	-2.4	-0.4	-1.7	-0.9	**7.5**	-1.7	-0.8
Materials	0.1	-0.7	-2.3	-1.5	0.6	**14.7**	0.6	1.0
Industrials	1.0	**14.6**	-1.5	**7.3**	0.1	**-7.3**	0.1	-2.3
Consumer Discretionary	**-3.5**	-0.2	**-3.6**	**-3.4**	**2.3**	-3.5	**6.3**	**6.0**
Consumer Staples	-0.9	**8.7**	-1.3	**3.7**	1.4	-3.1	0.7	1.1
Health Care	**-5.1**	-0.9	-2.2	-1.4	0.3	1.4	2.3	**3.4**
Financials	**-3.1**	**-5.5**	**-4.9**	**-5.0**	-0.4	0.8	-1.8	-0.4
Information Technology	-2.3	-2.6	-2.7	-2.6	0.2	3.2	3.5	2.4
Communication Services	-0.2	-1.4	-1.6	-1.7	0.8	-2.4	2.7	1.3
Utilities	-1.3	-2.5	0.1	-1.3	-0.8	**-3.8**	**-3.2**	**-3.3**
Real Estate	**15.6**	**-7.1**	**20.3**	**7.6**	**-3.6**	**-7.5**	**-9.7**	**-8.7**
FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200								
Energy	0.5	-0.1	1.4	0.7	-1.1	**8.5**	-0.9	0.2
Materials	-0.8	**-6.5**	**-5.1**	**-5.1**	4.7	**16.5**	**10.9**	**9.8**
Industrials	0.8	**7.9**	3.4	**10.0**	2.2	-1.7	0.9	-1.6
Consumer Discretionary	-1.4	0.3	0.6	0.4	3.4	3.2	1.3	1.9
Consumer Staples	**-5.7**	**33.7**	**-5.9**	3.5	-0.1	-3.4	2.7	**7.5**
Health Care	**-4.3**	-3.1	-2.7	-2.9	-0.6	0.1	**9.5**	**12.7**
Financials	**-6.4**	**-23.3**	**-21.6**	**-20.5**	**-8.8**	**-14.2**	**-28.2**	**-26.4**
Information Technology	-0.8	-0.9	-0.9	-0.9	-0.2	2.9	0.8	0.4
Communication Services	2.6	-4.0	-4.0	-3.8	0.3	-4.1	**11.5**	3.9
Utilities	0.2	-0.6	0.7	1.0	0.1	-1.8	-1.4	-1.2
Real Estate	**15.3**	-3.4	**34.2**	**17.4**	0.1	**-5.9**	**-7.1**	**-7.0**

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Jan. 31, 2020. Table is provided for illustrative purposes. Light blue numbers indicate sectors in which the factor portfolio was most underweight, and dark blue numbers indicate sectors in which the factor portfolio was most overweight.
Note: Factor portfolios shown are hypothetical.

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PERFORMANCE DISCLOSURE

The S&P/ASX 200 and the S&P/ASX Small Ordinaries were launched April 3, 2000. The S&P/ASX Dividend Opportunities Index was launched September 21, 2010. The S&P/ASX 200 Quality Index was launched October 16, 2015. The S&P/ASX 200 Enhanced Value and S&P/ASX 200 Momentum were launched July 31, 2017. The S&P/ASX 200 Growth was launched October 6, 2017. The S&P/ASX 200 Low Volatility Index was launched October 17, 2017. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. However, when creating back-tested history for periods of market anomalies or other periods that do not reflect the general current market environment, index methodology rules may be relaxed to capture a large enough universe of securities to simulate the target market the index is designed to measure or strategy the index is designed to capture. For example, market capitalization and liquidity thresholds may be reduced. Complete index methodology details are available at www.spdji.com. Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

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