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How Smart Beta Strategies Work in the Australian Market

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 Dec. 29, 2017.

- Low volatility and high momentum delivered the most persistent absolute and risk-adjusted quintile 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 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](#).
- The strong sector bias and dominance of large-cap stocks in the Australian market had a significant impact on the excess return and characteristics of the factor portfolios.
- Our macro regime analysis showed that most factor portfolios in Australia were sensitive to local market cycles and investor sentiment regimes.
- The distinct cyclicity of factor performance in Australia indicated its potential for implementation of active views on the local equity market.

Exhibit 1: Factor Index 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 Dec. 29, 2017. 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 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.

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

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

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 60% year-over-year growth in net assets as of June 30, 2017, and accounting for 10% 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 S&P/ASX 200 Portfolio,¹ the financials and materials sectors contributed about 67% of the total performance of the portfolio over the past 13 years. At a stock level, the top five large-cap contributors (Commonwealth Bank of Australia, BHP Billiton Limited, Westpac Banking Corporation, Australia and New Zealand Banking Group Limited, and National Australia Bank Limited) together contributed approximately 50% of the total portfolio performance over the same period. This suggests that sector or size bias had 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 5 Sector and Stock Contributors to the S&P/ASX 200 Portfolio* Performance

TOP 5 SECTORS	PERFORMANCE CONTRIBUTION (%)	TOP 5 STOCKS	PERFORMANCE CONTRIBUTION (%)
Financials	48.4	Commonwealth Bank of Australia	13.6
Materials	18.7	BHP Billiton Limited	13.3
Health Care	7.6	Westpac Banking Corporation	9.5
Industrials	7.2	Australia and New Zealand Banking Group Limited	7.5
Consumer Staples	6.0	National Australia Bank Limited	6.0
Total	87.9	Total	49.9

Source: S&P Dow Jones Indices LLC. Data from Dec. 17, 2004, to Dec. 29, 2017. 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

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 Dec. 29, 2017.

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.

For each risk factor, we ranked all stocks in the S&P/ASX 200 based on their designated factor measure² 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.

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

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, and 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.

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.

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

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].

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

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 market and underperform during down market.

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

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 (%)	7.8	3.9	3.2	7.8	7.3
Annualized Volatility (%)	17.1	22.1	23.0	17.5	16.4
Risk-Adjusted Return	0.46	0.18	0.14	0.45	0.44
Rolling 252-Day Maximum Drawdown (%)	-47.4	-62.2	-64.1	-45.7	-46.3
Annualized Excess Return (%)	-	-3.9	-4.6	0.0	-0.5
Annualized Tracking Error (%)	-	12.9	14.1	1.8	3.5
Information Ratio	-	-0.30	-0.33	-0.01	-0.16
Average Annualized Turnover (%)	7.4	82.3	86.8	26.6	26.6

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

*Small-Cap Portfolios (Q1) and Large-Cap Portfolios (Q5) are hypothetical portfolios.

VALUE

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

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

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

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-score⁵ 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). The high value portfolios exhibited strong bias to small cap compared to the [S&P/ASX 200](#) and the low value portfolios, which influenced the high value portfolios' underperformance.

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).

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.

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 (%)	7.8	5.0	4.4	9.4	8.9
Annualized Volatility (%)	17.1	19.8	21.0	19.2	21.4
Risk-Adjusted Return	0.46	0.25	0.21	0.49	0.42
Rolling 252-Day Maximum Drawdown (%)	-47.4	-63.1	-63.7	-48.9	-54.3
Annualized Excess Return (%)	-	-2.9	-3.4	1.6	1.1
Annualized Tracking Error (%)	-	10.3	12.2	9.9	10.9
Information Ratio	-	-0.28	-0.28	0.17	0.10
Average Annualized Turnover (%)	7.4	90.4	82.6	67.6	68.1

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 Value Portfolios (Q1) and Low Value Portfolios (Q5) are hypothetical portfolios.

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

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.

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

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.

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 (%)	7.8	4.5	1.8	9.4	10.3
Annualized Excess Return (%) Over Q5	NA	-4.9	-8.5	NA	NA
Annualized Volatility (%)	17.1	20.6	20.9	20.0	22.3
Risk-Adjusted Return	0.46	0.22	0.08	0.47	0.46
SALES-TO-PRICE RATIO: Q1 = HIGHER RATIO					
Annualized Return (%)	7.8	11.6	8.7	5.1	4.0
Annualized Excess Return (%) Over Q5	NA	6.6	4.7	NA	NA
Annualized Volatility (%)	17.1	17.1	19.5	18.9	21.4
Risk-Adjusted Return	0.46	0.68	0.45	0.27	0.19
BOOK VALUE-TO-PRICE RATIO: Q1 = HIGHER RATIO					
Annualized Return (%)	7.8	7.2	4.1	11.4	10.6
Annualized Excess Return (%) Over Q5	NA	-4.2	-6.4	NA	NA
Annualized Volatility (%)	17.1	20.7	21.4	19.4	19.1
Risk-Adjusted Return	0.46	0.35	0.19	0.59	0.55

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 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 an equal- and float-cap-weighted basis. However, the float-cap-weighted low volatility portfolio did not outperform the S&P/ASX 200, mainly due to sector allocation bias.

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

In Australia, there are few companies from the traditional defensive sectors, like telecommunication 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 market.

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 time in down markets, but mostly underperforming during 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 (%)	7.8	6.6	8.3	1.2	0.7
Annualized Volatility (%)	17.1	15.8	13.4	30.3	28.6
Risk-Adjusted Return	0.46	0.42	0.62	0.04	0.02
Rolling 252-Day Maximum Drawdown (%)	-47.4	-40.5	-40.4	-76.1	-71.5
Annualized Excess Return (%)	-	-1.2	0.5	-6.6	-7.1
Annualized Tracking Error (%)	-	7.2	7.9	19.6	18.4
Information Ratio	-	-0.17	0.07	-0.34	-0.39
Beta	1.00	0.84	0.70	1.41	1.32
Average Annualized Turnover (%)	7.4	45.8	51.9	72.8	80.3

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

*Low Volatility Portfolios (Q1) and High Volatility Portfolios (Q5) are hypothetical portfolios.

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 constructed for the analysis are based on 12-month risk-adjusted price momentum.

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 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 80% of the outperformance.

Compared to the [S&P/ASX 200](#), the float-cap-weighted high momentum portfolio had slightly lower return, mainly due to sector allocation bias. In addition, the high momentum portfolios had a small-cap bias relative to the S&P/ASX 200, which resulted in higher return volatility, lower risk-adjusted returns, and bigger return drawdowns.

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

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 (%)	7.8	7.5	8.0	0.4	0.8
Annualized Volatility (%)	17.1	20.1	20.7	20.6	21.0
Risk-Adjusted Return	0.46	0.37	0.39	0.02	0.04
Rolling 252-Day Maximum Drawdown (%)	-47.4	-56.6	-60.7	-54.8	-63.2
Annualized Excess Return (%)	-	-0.3	0.2	-7.4	-7.0
Annualized Tracking Error (%)	-	9.5	10.0	11.2	12.1
Information Ratio	-	-0.03	0.02	-0.66	-0.58
Average Annualized Turnover (%)	7.4	133.3	121.3	138.1	129.2

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 financial leverage.

Performance of high quality stocks cannot be comprehensively explained by classical 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-score⁷ of the return on equity (ROE), balance sheet accruals ratio (BSA), and financial leverage (LEV).

Historically, only the equal-weighted high quality portfolio outperformed the corresponding low quality portfolio on an absolute and risk-adjusted basis (see Exhibit 8). The float-cap-weighted high quality portfolio underperformed the market benchmark and the float-cap-weighted low quality portfolio, mainly due to the unfavorable sector allocation bias. However, under both weighting schemes, the high quality portfolios delivered lower volatility and smaller return drawdowns compared to the low quality portfolios.

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 consumer discretionary and materials 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 (%)	7.8	7.4	8.2	8.8	7.4
Annualized Volatility (%)	17.1	19.3	17.8	20.7	21.0
Risk-Adjusted Return	0.46	0.39	0.46	0.42	0.35
Rolling 252-Day Maximum Drawdown (%)	-47.4	-45.8	-53.4	-53.7	-60.7
Annualized Excess Return (%)	-	-0.4	0.4	1.0	-0.4
Annualized Tracking Error (%)	-	8.8	8.1	8.5	9.6
Information Ratio	-	-0.04	0.05	0.12	-0.04
Average Annualized Turnover (%)	7.4	69.8	81.3	22.8	79.2

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 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.

BSA was the only measure that generated a positive quintile return spread under equal- and market-cap-weighting methods.

Among the three quality measures, BSA was the most defensive component, while financial leverage was the most pro-cyclical.

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

As shown in Exhibit 9, BSA was the only measure that generated a positive quintile return spread under both weighting methods, while ROE recorded positive quintile return spread only when the portfolios were equal weighted. 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).

Among the three quality measures, BSA was the most defensive component, while financial leverage was the most pro-cyclical, driven by the strong sector bias of low LEV portfolios to energy and materials (see Exhibit 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
BALANCE SHEET ACCRUALS RATIO (BSA): Q1 = LOWER RATIO					
Annualized Return (%)	7.8	12.4	11.5	4.7	2.9
Annualized Excess Return (%) Over Q5	NA	7.7	8.5	NA	NA
Annualized Volatility (%)	17.1	17.5	17.8	22.2	22.9
Risk-Adjusted Return	0.46	0.71	0.64	0.21	0.13
FINANCIAL LEVERAGE (LEV): Q1 = LOWER RATIO					
Annualized Return (%)	7.8	6.2	5.1	8.7	9.1
Annualized Excess Return (%) Over Q5	NA	-2.5	-4.0	NA	NA
Annualized Volatility (%)	17.1	22.6	23.1	19.2	17.3
Risk-Adjusted Return	0.46	0.28	0.22	0.46	0.53
RETURN ON EQUITY (ROE): Q1 = HIGHER RATIO					
Annualized Return (%)	7.8	8.4	9.8	11.5	9.6
Annualized Excess Return (%) Over Q5	NA	-3.0	0.2	NA	NA
Annualized Volatility (%)	17.1	19.3	18.7	20.4	21.9
Risk-Adjusted Return	0.46	0.44	0.53	0.56	0.44

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

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 higher absolute and risk-adjusted return 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 disappeared, but the high dividend portfolio had lower volatility and higher risk-adjusted return.

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 to the low dividend portfolios.

Despite lower return volatility, 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).

The high dividend portfolios exhibited pro-cyclical features.

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 portfolios delivered higher risk-adjusted returns than the low dividend portfolios.

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 (%)	7.8	8.0	5.2	7.3	5.2
Annualized Volatility (%)	17.1	18.8	19.3	20.4	23.2
Risk-Adjusted Return	0.46	0.42	0.27	0.36	0.22
Rolling 252-Day Maximum Drawdown (%)	-47.4	-63.1	-70.9	-54.6	-62.9
Annualized Excess Return (%)	-	0.2	-2.6	-0.5	-2.6
Annualized Tracking Error (%)	-	9.1	10.7	11.3	12.9
Information Ratio	-	0.02	-0.24	-0.04	-0.20
Average Annual Turnover (%)	7.4	71.7	79.9	63.7	63.7

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 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 an absolute and a risk-adjusted basis versus the S&P/ASX 200.

Over the examined period between Dec. 31, 2004, and Dec. 29, 2017, 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 the 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.

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

FACTOR	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY	S&P/ASX 200
Annualized Return (%)	4.9	8.1	4.8	5.7	10.7	8.3	7.8
Annualized Volatility (%)	17.7	19.7	19.8	16.4	17.2	13.3	17.1
Risk-Adjusted Return	0.28	0.41	0.25	0.35	0.62	0.62	0.46
252-Day Maximum Drawdown (%)	-60.1	-56.8	-64.9	-47.2	-43.4	-38.7	-47.4
Annualized Excess Return (%)	-2.9	0.3	-3.0	-2.1	2.8	0.5	NA
Annualized Tracking Error (%)	8.5	9.1	10.3	6.0	6.5	8.0	NA
Information Ratio	-0.34	0.04	-0.29	-0.35	0.44	0.06	NA
Average Annualized Turnover (%)	40.0	113.8	67.9	62.6	60.9	50.3	7.4

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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 2017.

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

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 industrials and real estate 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 industrials, consumer discretionary, and consumer staples (see Exhibit 12).

Exhibit 12: Sector Breakdown of the S&P DJI Australian Factor Indices

AVERAGE SECTOR BIAS (%)	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Energy	3.0	4.9	1.0	-0.1	2.5	-4.1
Materials	1.6	0.9	-1.2	-5.9	3.9	-14.6
Industrials	9.1	6.7	14.9	8.0	3.6	0.5
Consumer Discretionary	11.6	6.0	2.5	8.0	7.8	3.9
Consumer Staples	-4.0	-1.6	1.4	6.3	2.5	2.2
Health Care	1.2	5.3	-1.1	-0.8	4.8	3.0
Financials	-26.8	-20.3	-25.4	-12.2	-23.1	-16.3
Information Technology	3.3	0.9	-0.7	0.4	2.0	0.0
Telecommunication Services	-2.2	-2.1	-3.9	0.9	3.1	0.7
Utilities	2.0	2.3	0.9	3.0	-1.0	7.0
Real Estate	1.3	-3.1	11.6	-7.6	-6.1	17.7

Source: S&P Dow Jones Indices LLC. Data from December 2004, to December 2017 for the S&P DJI Australian factor indices. 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.

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

...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, high beta, low dividend yield, low financial leverage, 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 financial leverage, and low ROE. The S&P/ASX Dividend Opportunities Index demonstrated tilts to low the 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	-10.8	-7.1	-10.9	-3.4	-4.5	-5.4
12-Month Volatility	10.5	3.2	3.6	-0.5	2.2	-6.7
36-Month Beta	1.8	0.1	1.0	-1.4	-0.3	-5.0
1-Year Price Change	-0.6	5.1	-2.7	-1.9	0.2	-0.7
Dividend Yield	-5.0	-4.8	1.4	2.4	-1.2	2.3
Price-to-Earnings	-0.6	1.8	-2.3	0.4	-0.5	-0.1
Price-to-Sales	1.8	1.1	-2.9	-2.7	0.2	1.2
Price-to-Book	-1.4	2.2	-8.4	0.6	3.1	-1.2
Historical 3-Year Sales Growth	3.2	1.0	0.6	0.4	0.6	-0.1
Historical 3-Year EPS Growth	0.6	0.7	-1.0	-0.8	1.5	-0.3
Long-Term Debt to Capital	-8.9	-1.9	-3.0	-0.2	-5.1	-0.5
ROE	-4.1	-0.5	-3.6	0.7	3.7	-1.7
BSA Ratio (L90D)	0.2	0.6	1.0	-1.3	0.8	1.6

Source: S&P Dow Jones Indices LLC, Factset Characteristics Tilt Report. Data as of January 2017. Averaged characteristic 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 2017. 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 and small-cap indices tended to have better performance in up markets, but vice versa for the low volatility and quality indices.

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 and small-cap indices tended to have better performance in up markets, but vice versa for the low volatility and quality indices. However, the dividend and momentum indices 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

INDICES	MONTHS OUTPERFORMED (%)			AVERAGE MONTHLY EXCESS RETURN (%)		
	UP MONTHS	DOWN MONTHS	ALL MONTHS	UP MONTHS	DOWN MONTHS	ALL MONTHS
Small Cap	52.6	49.2	51.3	0.1	-0.6	-0.2
Momentum	49.5	52.5	50.6	0.1	0.0	0.1
Value	56.7	32.2	47.4	0.4	-1.0	-0.1
Dividend	42.3	45.8	43.6	-0.1	-0.1	-0.1
Quality	51.5	61.0	55.1	0.1	0.4	0.2
Low Volatility	43.3	72.9	54.5	-0.5	0.9	0.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

Correlation across different factors was fairly low historically in the Australian market.

Exhibit 15: Correlation of Factor Excess Returns

CORRELATION	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
SMALL CAP	1.00	0.43	0.35	0.17	0.42	0.11
MOMENTUM	-	1.00	-0.09	-0.08	0.34	-0.07
VALUE	-	-	1.00	0.37	0.14	0.16
DIVIDEND	-	-	-	1.00	0.24	0.34
QUALITY	-	-	-	-	1.00	0.12
LOW VOLATILITY	-	-	-	-	-	1.00

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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

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

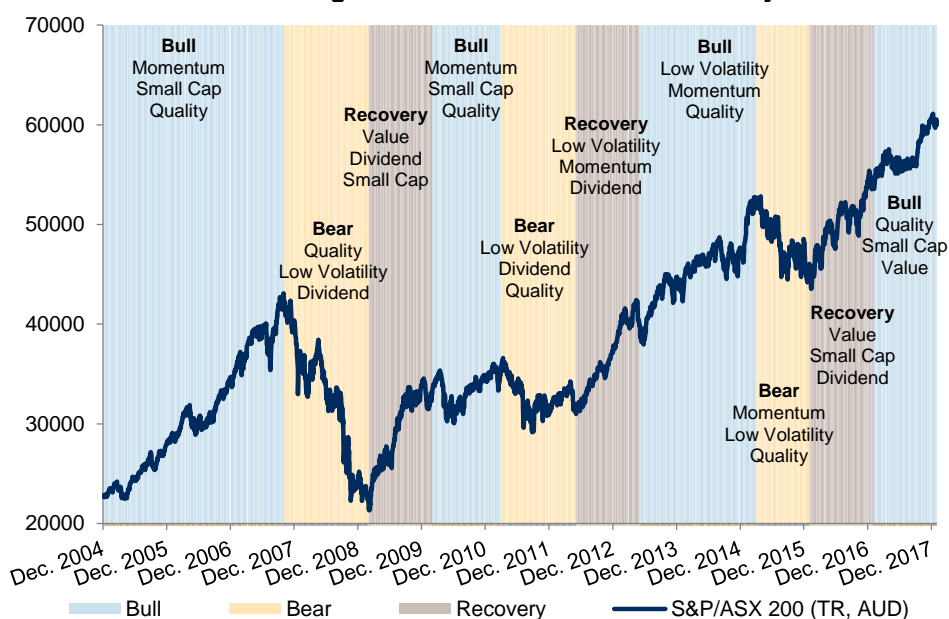
Although empirical evidence suggests factor strategies may generate enhanced risk-adjusted return in the long run, in our study the cyclical behavior in their returns resulted in short-term periods of outperformance and underperformance, making them potentially useful tools for implementation of active 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 Dec. 29, 2017.

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 10 market cycle phases (three bearish, three 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).

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

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



Historically, value stocks and high dividend stocks had strong outperformance when the market rebounded from its troughs.

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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).

Momentum and small cap appeared more often as top-performing factors in bullish markets. However, momentum stocks suffered the most 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.

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...

...with more pronounced excess returns during bearish markets.

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	4.9	-3.6	-4.7	3.3	-2.0
Bear	-6.4	3.3	-13.9	-0.9	7.1	10.4
Recovery	-4.5	-10.1	19.3	4.0	-3.1	-5.4
INFORMATION RATIO						
Bull	0.25	0.86	-0.48	-1.16	0.61	-0.37
Bear	-0.56	0.27	-0.95	-0.10	1.05	1.17
Recovery	-0.43	-1.24	1.46	0.63	-0.60	-0.85
PERCENTAGE OF OUTPERFORMANCE (%)						
Bull	58.8	55.0	46.3	35.0	53.8	48.8
Bear	45.0	57.5	32.5	50.0	67.5	70.0
Recovery	41.7	33.3	66.7	55.6	44.4	50.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

Factor Performance Across Different Investor Sentiment Regimes

The 30-day realized return volatility of the S&P/ASX 200 was used as the indicator of investor sentiment toward the Australian equity market.

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...

...while value stocks only outperformed the market in bullish 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 small-cap stocks were penalized the most.

Low volatility and high dividend stocks performed better in bearish sentiments than in bullish or neutral 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	-0.9	2.5	3.1	-6.7	10.2	-3.1
Neutral	-1.3	3.8	-2.9	-1.6	-1.5	-0.6
Bearish	-4.5	-9.1	-2.0	2.9	8.8	6.2
INFORMATION RATIO						
Bullish	-0.15	0.38	0.47	-1.68	2.26	-0.64
Neutral	-0.16	0.51	-0.32	-0.37	-0.29	-0.10
Bearish	-0.33	-0.73	-0.10	0.27	1.15	0.59
PERCENTAGE OF OUTPERFORMANCE (%)						
Bullish	48.4	48.4	54.8	32.3	67.7	45.2
Neutral	56.4	53.2	46.8	43.6	47.9	54.3
Bearish	38.7	45.2	41.9	54.8	64.5	64.5

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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.

Investor sentiment analysis could serve as a useful complement to explain short-term factor performance in different market 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.¹⁰

¹⁰ 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.

Exhibit 19: Factor Index 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 Dec. 29, 2017. 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.

CONCLUSION

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

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 Dec. 29, 2017.

Sector or size bias had a significant impact on the excess returns of factor portfolios in the Australian market. From the quintile analysis, we observed that low volatility and high momentum 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 and high quality portfolios generated absolute and risk-adjusted return spreads only with one of the two weighting methods.

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 low volatility 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.

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 and quality being the most defensive. The market cycle analysis helped to identify the cyclical characteristics of different factors.

Most factor portfolios in Australia displayed distinct cyclical performance historically...

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, momentum, and small-cap 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.

...they could be ideal tools for implementation of active views of the local equity market.

As most factors in Australia displayed distinct cyclical 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	% 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	47.4	44.1	46.2	0.4	-1.2	-0.2
Value	51.5	33.9	44.9	0.7	-1.4	-0.1
Low Volatility	40.2	78.0	54.5	-0.5	1.0	0.0
Momentum	54.6	47.5	51.9	0.4	-0.4	0.1
Quality	55.7	45.8	51.9	0.2	-0.1	0.1
Dividend	49.5	40.7	46.2	0.6	-1.2	0.0
FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS						
Small Cap	51.5	44.1	48.7	0.3	-0.9	-0.2
Value	55.7	47.5	52.6	0.3	-0.8	-0.1
Low Volatility	44.3	59.3	50.0	-0.4	0.3	-0.1
Momentum	47.4	55.9	50.6	-0.1	0.2	0.0
Quality	49.5	50.8	50.0	-0.2	0.3	0.0
Dividend	49.5	50.8	50.0	0.4	-0.4	0.1

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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	% 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	56.7	59.3	57.7	0.4	0.2	0.3
Financial Leverage	57.7	42.4	51.9	0.5	-0.9	-0.1
ROE	62.9	44.1	55.8	0.6	-0.4	0.2
FLOAT-CAP-WEIGHTED TOP QUINTILE QUALITY FACTOR SUB-PORTFOLIOS						
BSA Ratio	52.6	67.8	58.3	0.0	1.0	0.4
Financial Leverage	56.7	45.8	52.6	-0.1	0.0	0.0
ROE	46.4	49.2	47.4	-0.1	0.3	0.1

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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**EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS**

CORRELATION	BSA RATIO	FINANCIAL LEVERAGE	ROE	QUALITY
BSA RATIO	1.00	0.43	0.45	0.59
FINANCIAL LEVERAGE	-	1.00	0.60	0.58
ROE	-	-	1.00	0.80
QUALITY	-	-	-	1.00

FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS

CORRELATION	BSA RATIO	FINANCIAL LEVERAGE	ROE	QUALITY
BSA RATIO	1.00	0.13	0.27	0.33
FINANCIAL LEVERAGE	-	1.00	0.25	0.30
ROE	-	-	1.00	0.87
QUALITY	-	-	-	1.00

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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**EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200 EQUAL WEIGHT INDEX**

AVERAGE SECTOR BIAS (%)	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Energy	-0.2	2.9	-2.2	-6.8	-0.6	-6.2
Materials	3.7	3.8	-1.8	-12.1	0.5	-14.9
Industrials	0.5	-1.2	9.4	3.0	-2.3	-6.9
Consumer Discretionary	3.7	-0.1	-3.0	6.5	6.7	-4.9
Consumer Staples	-1.1	-0.4	3.8	-0.6	0.7	3.4
Health Care	-0.8	1.2	-1.7	-4.4	3.2	0.9
Financials	-6.8	-0.9	-5.5	7.6	-0.8	5.7
Information Technology	1.9	0.5	-2.1	-1.9	2.5	-1.3
Telecommunication Services	0.4	0.5	-1.7	0.2	2.0	2.5
Utilities	1.2	-0.3	-1.5	3.2	-3.5	5.7
Real Estate	-2.5	-6.0	6.4	5.3	-8.5	15.9

FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200

AVERAGE SECTOR BIAS (%)	SMALL CAP	MOMENTUM	VALUE	DIVIDEND	QUALITY	LOW VOLATILITY
Energy	1.3	2.3	0.3	-4.9	0.8	-4.1
Materials	2.6	1.9	-5.1	-16.2	10.4	-13.9
Industrials	8.0	3.4	11.8	-1.0	-1.1	-2.4
Consumer Discretionary	15.2	1.3	1.0	0.6	1.6	-2.0
Consumer Staples	-3.7	0.0	4.1	-4.9	7.4	4.3
Health Care	0.9	3.6	-2.3	-4.3	10.8	0.1
Financials	-29.8	-12.2	-21.5	23.2	-26.9	10.8
Information Technology	3.6	0.4	-0.7	-0.7	0.4	-0.5
Telecommunication Services	-1.6	1.9	-4.0	8.8	4.8	3.9
Utilities	3.4	1.1	0.9	0.0	-1.3	1.0
Real Estate	0.2	-3.6	15.6	-0.5	-7.0	2.7

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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**EQUAL-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200 EQUAL WEIGHT INDEX**

AVERAGE SECTOR BIAS (%)	E/P	S/P	B/P	VALUE	BSA RATIO	LEVERAGE	ROE	QUALITY
Energy	-1.0	-3.3	-0.3	-2.2	-1.4	8.7	-1.3	-0.6
Materials	-0.3	-1.1	-3.3	-1.8	1.2	14.2	0.8	0.5
Industrials	2.2	16.5	-0.1	9.4	-0.5	-7.5	0.3	-2.3
Consumer Discretionary	-3.1	0.0	-3.0	-3.0	2.1	-3.2	6.6	6.7
Consumer Staples	-0.9	8.4	-0.9	3.8	1.7	-3.4	-0.1	0.7
Health Care	-5.0	-1.0	-2.7	-1.7	0.0	1.6	1.9	3.2
Financials	-3.0	-6.1	-5.9	-5.5	-0.3	0.0	-1.9	-0.8
Information Technology	-1.9	-2.0	-2.2	-2.1	0.6	3.0	3.6	2.5
Telecommunication Services	0.0	-1.5	-1.8	-1.7	0.3	-1.9	2.9	2.0
Utilities	-1.4	-2.9	0.4	-1.5	-0.9	-4.1	-3.3	-3.5
Real Estate	14.5	-7.0	19.9	6.4	-2.9	-7.2	-9.6	-8.5

FLOAT-CAP-WEIGHTED TOP QUINTILE PORTFOLIOS RELATIVE TO S&P/ASX 200

AVERAGE SECTOR BIAS (%)	E/P	S/P	B/P	VALUE	BSA RATIO	LEVERAGE	ROE	QUALITY
Energy	0.5	-0.9	1.5	0.3	-1.6	9.9	-0.3	0.8
Materials	-1.0	-6.2	-6.2	-5.1	2.9	16.5	12.7	10.4
Industrials	1.4	9.0	5.1	11.8	2.6	-1.1	0.7	-1.1
Consumer Discretionary	-0.9	-0.3	1.0	1.0	2.9	3.9	0.3	1.6
Consumer Staples	-6.0	35.2	-6.0	4.1	0.3	-4.7	2.6	7.4
Health Care	-3.7	-2.4	-2.1	-2.3	0.4	1.0	7.4	10.8
Financials	-7.7	-25.0	-23.1	-21.5	-8.4	-15.7	-28.4	-26.9
Information Technology	-0.7	-0.7	-0.7	-0.7	0.0	2.2	0.8	0.4
Telecommunication Services	2.6	-4.2	-4.3	-4.0	-0.2	-4.3	12.6	4.8
Utilities	0.2	-1.2	1.1	0.9	0.2	-1.8	-1.3	-1.3
Real Estate	15.3	-3.3	33.8	15.6	1.0	-5.8	-7.1	-7.0

Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 2004, to Dec. 29, 2017. 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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