Australian Water Entitlements

Correlation & Diversification Analysis

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Summary

Leaving aside an excellent long term fundamental story of declining rainfall and increased demand for agricultural production, the Australian Water Entitlements market exhibits a number of statistical characteristics which we believe make it a very interesting portfolio diversifier:

- Zero correlation to other asset classes,
- Single digit downside deviation,
- Positive skew

Introduction

We were presented with three indices that relate to water entitlements

1. The 'Capital' Index which reflects at-the-time valuations on entitlements,
2. The 'Income' index which considers the value of annual allocations which are the natural yield of owning entitlements (you can think of this as a dividend, which can only be positive save for some very minor costs which occasionally result in a very small negative number).
3. The 'Water' Index which can be thought of as an accumulation index, combining both capital and income gains and losses. The S&P 500 is an accumulation index, although plenty of major indices are not.

These indices have been compiled by Kilter Rural but their methodology for so doing is well documented and I am very confident the indices accurately reflect the underlying markets.

The indices are given a base value of 100 as of July 1st, 2007 which is the date that water was officially separated from land, and reliable market data began to be captured.

When I started this analysis, I ran the numbers for all three indices for all the matters I wanted to look at but concluded after a while this was unnecessary as the Water and Capital index are 99% correlated to each other. The Income index has a small correlation to the Water Index (15.6%) which is unsurprising given it is a component part of that index, but zero corelation (0.1%) with the Capital index, of which it is not a component.

Therefore, for the purposes of this summary I am going to focus largely on the Water Index but am happy to provide the same analysis on the other two indices upon request.

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Benchmarks

My focus in this report is on the S&P 500 for which I could easily get the data I needed. Whilst, for completeness sake, I would quite like to undertake the same analysis against the JPM WGBI (or equivalent) and similarly on the CRB Commodity Index, I am very confident that that the outcome will be similar: that the Australian water market is completely and consistently uncorrelated to anything.

This conclusion is backed up by Kilter's own analysis of water to the S&P Australian Govt Bond Index and to the Australian accumulation REIT index.

Monthly Data

This report uses monthly data

Order

- First, I will examine a range of correlation metrics that I have found useful in the past.
- Second, I will look at the volatility of Australian Water. In this, I am most interested in how it has evolved since the market was launched and why.
- Third, I will look at skew and kurtosis
- I will also touch on past performance but, where past performance is not a reliable indicator of future performance, in my experience, non-correlation – especially when it can be explained and is logical – can be relied upon.

Correlation

Correlation table, July 2007 through Oct 2020

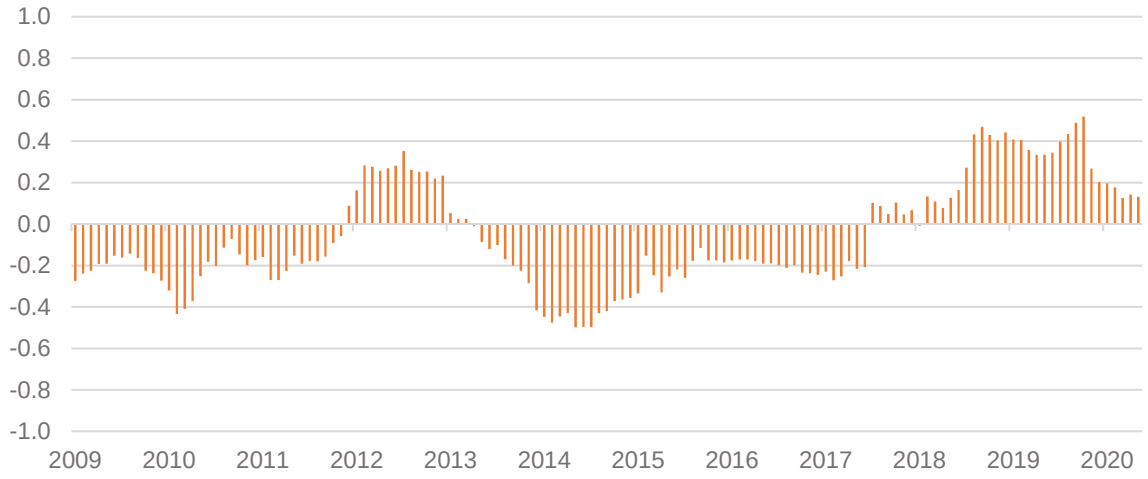
	S&P 500	Capital Index	Income Index	Water Index
S&P 500	100.0%	-12.4%	-6.5%	-13.3%
Capital Index	-12.4%	100.0%	0.1%	98.8%
Income Index	-6.5%	0.1%	100.0%	15.6%
Water Index	-13.3%	98.8%	15.6%	100.0%

- Based over the whole period, the Australian Water Entitlements market exhibits no correlation to the S&P.
- There is very high correlation between the Capital and Water Indices, as expected.
- There is no correlation between water income and the underlying asset (reflected in the Capital Index), which is interesting as I might have expected some in the same way a stock price might exhibit some correlation to significant changes in its dividend (for better or worse). The reason this relationship does not exist here – I think – is because whilst a falling (or rising) dividend may reflect some fundamental change in the underlying company's position, changes in water allocations reflect seasonal changes in rainfall which have next to no bearing on the long-term value of a perpetual asset.
- There is some (low) correlation between Income and Water, which is to be expected given the former is a component of the latter.

This is an encouraging start but, in my experience, looking at a single statistic that covers a long period of time, can be misleading. It is always worth looking at how correlation has evolved over time and, if there has been a change, trying to work out why.

To do this, I favour 24 months rolling correlation charts:

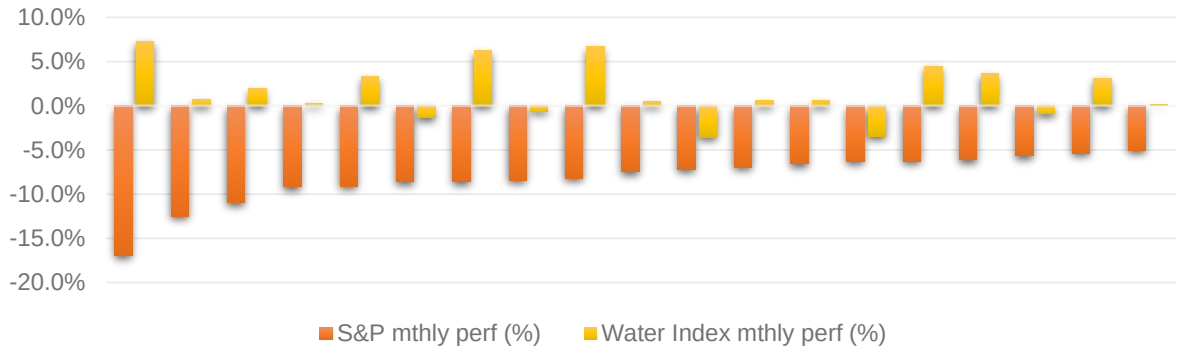
24 months rolling correlation between the Water Index and the S&P 500 (Y axis ranges from +1 to -1)



- To me, this confirms these two indices are wholly non-correlated: the bars alternate from below the line to above it several times over 13 years, whilst remaining generally low or very lowly correlated (plus or minus).
- The two brief instances when the bars breach >+/- 0.4 are on opposite sides and will be down to some coincidental, above- or below-mean, performance. For example, both indices had above average years in 2014, whereas in 2016 water performed below average all year, whilst the S&P had another above average year.
- I strongly suspect that if daily information were available for water, this coincidental correlation would disappear.

Next, I wanted to look at how water performed in risk-off moments for the S&P:

Performance of the Water Index in down 5% months in the S&P

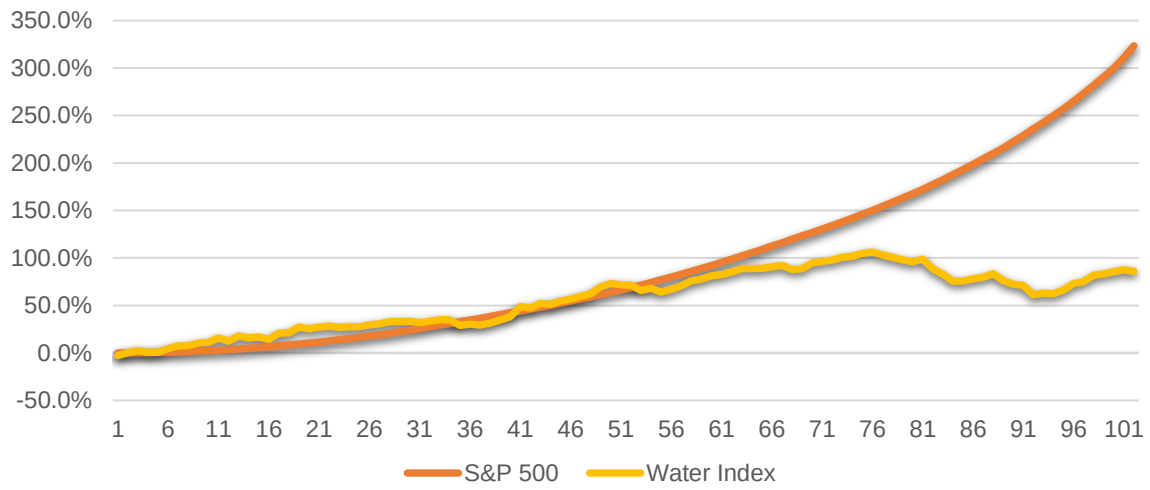


- This chart shows, in order of severity, the 19 months since 2007 when the S&P has declined by 5% or more in a single month.
- I think the conclusions are self-explanatory: these markets are not correlated to each other.
- Indeed, in 13 years of history, there is not a single month, when both indices fell by more than 5% in the same month.
- On this evidence water is a seriously good diversifier.

Upside / downside capture

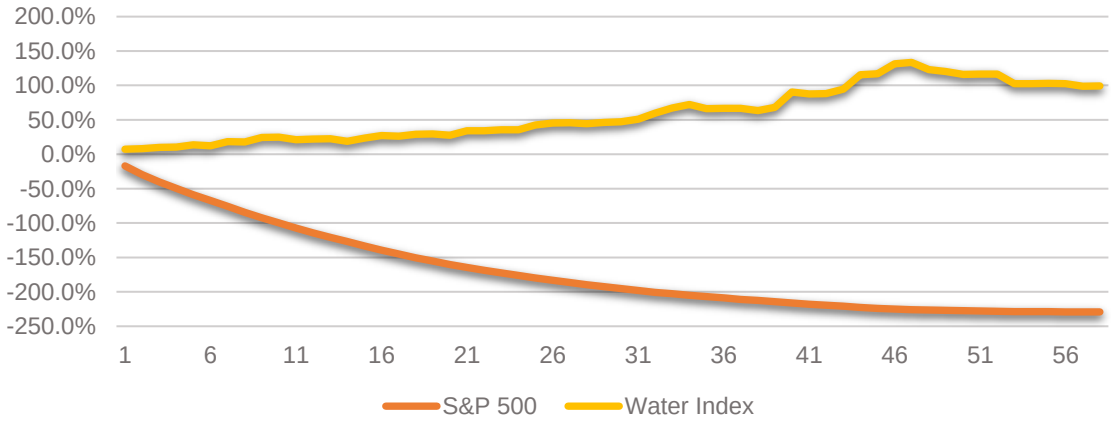
Finally, in respect of correlation, I wanted to examine how Water had performed across all the positive months for the S&P and, more pertinently, how it had performed in the negative months.

Performance of the Water Index in up months in the S&P



- Across the 102 positive months for the S&P during the period, the Water Index was up, in aggregate, 86% whilst the S&P was up 323%.
- Whilst the concept of performance capture is substantially meaningless given the complete lack of correlation between these two indices, we might say that the Water Index has only 'captured' 27% of the S&P's upside performance.

Performance of the Water Index in down months in the S&P



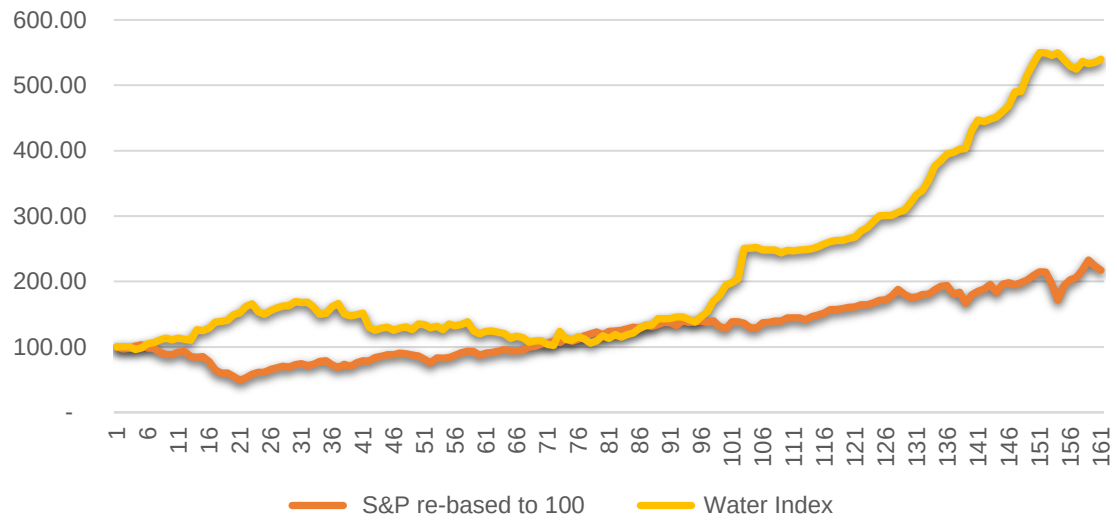
- Across the 58 months in which the S&P has delivered a negative return, the Water Index has performed similarly to how it did during S&P positive months, up 99%.
- The concept of capture, here, is truly meaningless – Water is up nearly 100% whilst the S&P is down 229%.

This is how this looks in a table:

	S&P	Water
S&P up months	+324%	+86%
S&P down months	-229%	+99%
Total	**+94%**	**+185%**

This upside/downside capture analysis uses aggregate numbers (for good reasons) but, once compounding is accounted for the performance differential is even greater.

Cumulative performance: Water vs S&P through the whole period



Over the whole period, the Water Index has outperformed the S&P by 3.7x (+440% vs +118%).

Volatility

So far, we have established that Australian Water is very non-correlated to the S&P 500 index but what of its volatility?

Let us start by looking at the headline stats: annualised vol (using monthly data) over the whole period:

Index	S&P 500	Capital	Income	Water
Annualised Vol	**15.6%**	**15.5%**	**2.4%**	**15.7%**

- From this, we can observe that over the entire 13-year period, the Australian water market has exhibited very similar volatility to the S&P.
- We can also observe that the Income Index has exhibited very low vol of 2.4%

As with correlation, I think single statistics over long periods of time, can be misleading, often hiding more complex patterns (for better or for worse).

Before looking at how these volatilities have evolved, let us first consider downside deviation, as this is what mostly concerns us. For this purpose I have used semi-deviation, which calculates the standard deviation of below-mean months but I think the results would have been similar had I used either of the other commonly used metrics for calculating downside deviation: actual negative numbers, or any returns below a minimum acceptable

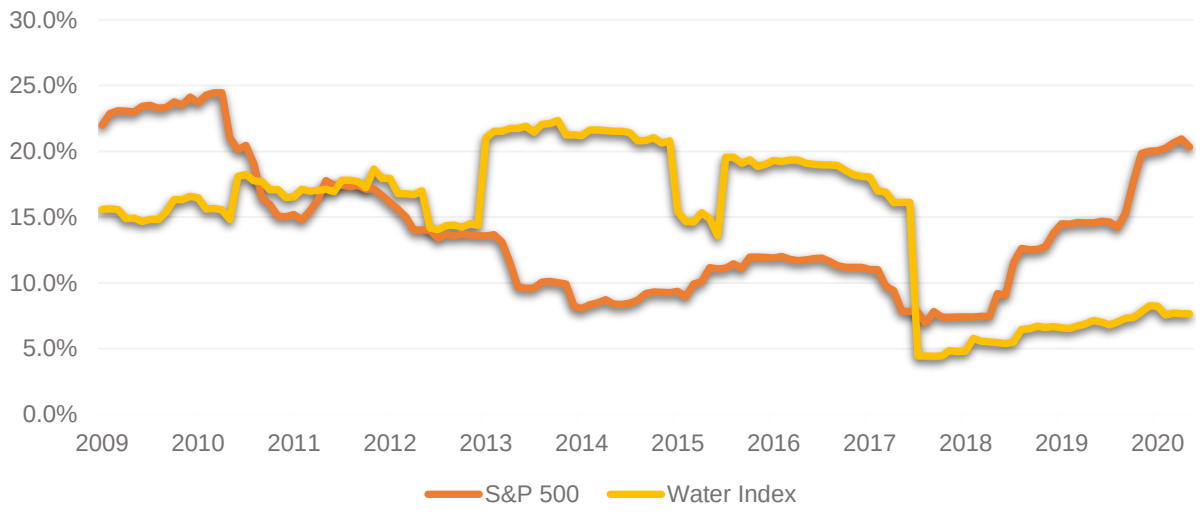
return (MAR), which over the past 13 years would not have been much above 2.5% annualised.

Index	S&P 500	Capital	Income	Water
Annualised semi-deviation	**12.5%**	**10.2%**	**0.4%**	**10.4%**

- Not a huge amount to learn from this although Water does seem to have – over the whole period – 20% less downside deviation than the S&P. Not huge but not nothing either.

Now let us look at how both vol and downside deviation have evolved over time, focusing on Water and the S&P 500. For consistency, let us stick with 24 month rolling data:

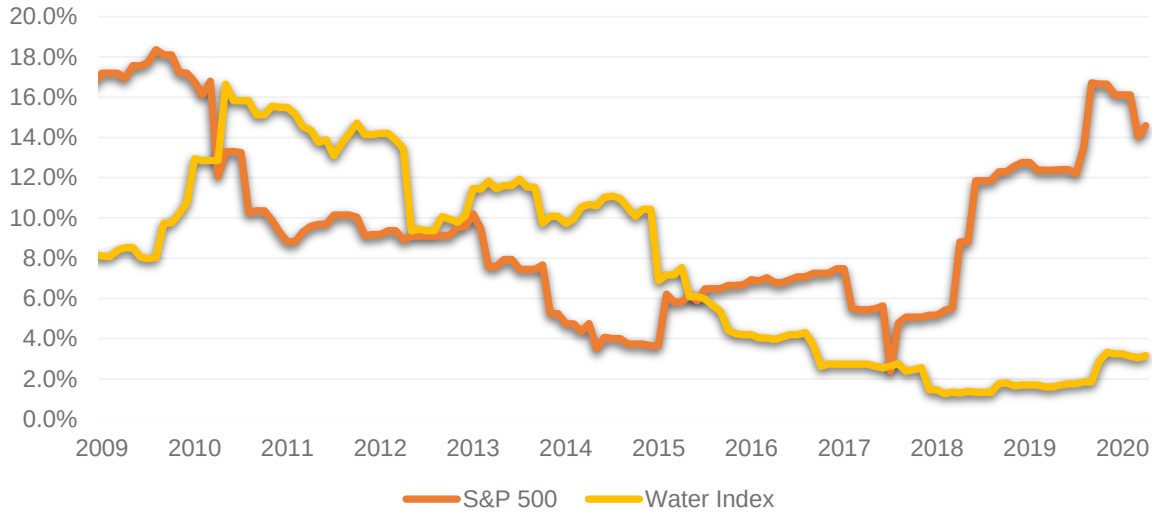
24 months rolling volatility



- I am not going to dwell on this chart too much because I think the next one is far more informative.
- What we can say is that S&P vol declined (as we all remember) from post-GFC highs to sit in a range of 7.5% to 12.5% for more than 5 years between Q4 2013 and Q1 2019 before reverting to more normal levels.
- It is harder to read the Water Index because both significant spikes in vol (in July 2013 and Jan 2016) were caused by significant UP months.

Let us look at downside deviation instead:

24 months rolling downside deviation



- I think this is far more interesting and relevant: whilst the S&P's downside deviation looks much like its standard deviation, this is not the case for the Water Index, whose downside deviation declines steadily over from a peak of 17% in Dec 2010 to 6% or below for the past five years.

This raises the obvious question: are there structural changes that can legitimately explain this drop or will water one day do what the S&P has done and revert to more normal levels?

We strongly believe that there are several logical, explainable factors that came together in 2010, contributing to a significant rise in volatility at that time, most of which will not repeat. Going into these is not the purpose of this report but we would be delighted to discuss these with you. One factor I will mention here though is that a great many loose entitlement holders were shaken out in 2010 (these often being people who have been given them for free). Today this market is much more tightly held by those who have paid for the asset and recognise its value and who know that a rainy season or two may reduce the immediate yield but not the long-term value.

That does not mean there won't be moments of volatility, rather that we think these will be relatively short-lived and, therefore, always worth buying into.

Skewness and Kurtosis

Since Jun '07	S&P 500	Capital Index	Income Index	Water Index
Skewness	-0.68	0.89	2.46	0.84
Kurtosis	1.41	6.53	6.51	5.76

Last 5 years	S&P 500	Capital Index	Income Index	Water Index
Skewness	-0.59	4.61	1.95	4.39
Kurtosis	1.95	28.44	3.08	26.54

- Over the full period, Water – attractively – has moderate positive skew vs the S&P which has moderately negative skew.
- Over the last 5 years this has been far more pronounced: there have been just four negative months of greater than down 2% in that period, with the worst single month down 3.5%. In the same period there have been 33 up months of greater than 2%, with the best being 22.7%.
- The Water Index does exhibit high kurtosis compared to the S&P (reflecting longer tails) but, at least over the past 5 years, this is substantially down to the right tail performance outlined above, rather than the left tail.

Conclusion

Leaving aside an excellent long term fundamental story of declining rainfall and increased demand for agricultural production, Australian Water Entitlements have all the statistical elements you would look for in a portfolio diversifier:

- Zero correlation to other asset classes,
- Single digit downside deviation,
- Positive skew