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Alternative assets – a new challenge to property? An analysis of superannuation funds

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ABSTRACT

Leading Australian superannuation funds now have major exposure of approximately 20% to a sector classified as alternative assets. Within this sector, there are infrastructure products, which have similar characteristics to property. Thus, an ongoing debate on whether alternatives can replicate the performance of property in mixed-asset portfolios. This research examines the diversification benefits of property, infrastructure, private equity, hedge funds and commodities within two-asset and multi-asset optimisation portfolios. It uses ex-post data (1995–2015), from A$431 billion industry superannuation funds balanced portfolio. The methodology also involves substituting smoothed with desmoothed property data to detect any subsequent change in property allocation levels. The results from the two-asset portfolios illustrate that including infrastructure, hedge funds and private equity in the direct property portfolio provides high risk-adjusted returns (.45–.51), although portfolio weight is dominated by direct property. Analysis on multi-asset portfolios clearly shows that substituting smoothed property with desmoothed property data is insignificant to both industry fund performance and its weighting to property. Despite similar asset allocation range assigned to property and infrastructure (0–20%), infrastructure allocation was 3%, lower than property (13%). Strong allocations to property highlight its significance in institutional portfolios, even with the availability of similar alternative assets. For industry superannuation funds, the empirical results show that allocation to property can be higher than current 10%, backed by improved portfolio risk-adjusted returns. The research contributes to both practical and academic fields as it offers a methodological approach on how allocation to property assets can be improved using a series of asset allocation strategies.

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Introduction

According to Bond, Hwang, Mitchell, and Satchell (2007a), property assets provide strong diversification potential when included in a mixed-asset portfolio. Typically, institutional investors have used their property allocations to improve portfolio performance by adding an uncorrelated asset class to the investment portfolio. Property assets generate regular

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income and long-term capital growth prospects. Despite the benefits, asset allocation studies by Brown and Schuck (1996), Hoesli, Lekander, and Witkiewicz (2003) and Worzala and Bajtelsmit (1997) have concluded invariably that property is significantly under-represented in the typical investment portfolio.

Baum and Hartzell (2012, p. 11) stated that property's under-weighting in institutional portfolios can be attributed to several factors including:

(1) The operational difficulties of holding properties, including illiquidity, lumpiness (specific risks) and the difficulty in aligning the investment management process for property and equities.
(2) The introduction of new alternative asset classes, such as indexed-linked bonds, private equity, infrastructure and hedge funds. Some of these alternatives, such as infrastructure funds, offer income security and diversification benefits that are similar to those associated with property.

Newell and Peng (2008a) found that the shortage of good quality commercial real estate, along with yield compression, has resulted in a significant flow of funds into the alternative sector. Large Australian fund managers such as Future Fund have 30% of its A$118 billion funds invested in the alternatives space. Leading superannuation asset consultants such as Mercer are also mandating the use of alternatives to improve client portfolios. Across the industry superannuation sector, allocation to alternatives has nearly increased fourfold from 5% in June 1998 to 18% in September 2015. During the same period, allocation to property assets has remained virtually unchanged at 10% (Australian Prudential Regulation Authority [APRA], 2015; Future Fund, 2016; Rainmaker Group, 2012; Smith, 2016).

There is ongoing debate on whether alternative assets can replicate the performance of property assets or even reduce property's weightage in the mixed-asset portfolio. Market commentators, JP Morgan Asset Management (2012) and Jones Lang LaSalle (2012) anticipate that in the next decade, institutional real assets (property and infrastructure) allocation alone will increase to 25% as fund managers seek more stable portfolio risk-adjusted returns. Consequently, this research tests this notion by investigating the diversification benefits of different property and alternative assets components by constructing two-asset and multi-asset portfolio models. In particular, the study investigates whether alternative assets reduce property's weightage in the mixed-asset portfolio. To do this, the research examines the performance of industry superannuation balanced fund asset classes over a 20-year period (1995–2015); using quarterly benchmark data for each asset class.

The A$431 billion industry funds are the largest institutional superannuation investment options in Australia. Industry superannuation funds generally have extensive investments in both property and alternative asset classes. Typically, institutional superannuation funds favour direct/unlisted property for diversification and stability reasons. Industry superannuation unlisted wholesale property exposure are generally externally managed by several major property fund managers in Australia, including AMP, Lend Lease, QIC, ISPT and GPT. At 30 June 2015, industry superannuation fund combined allocation to property and alternatives were 27%; being property 10% and alternatives 17%. Table 1 lists the leading APRA regulated Australian industry superannuation funds and the fund allocation to property and alternatives, as at June 2015.

AustralianSuper and Unisuper are the highest ranked industry funds with net assets of A$92 billion and A$49 billion, respectively, as at June 2015. Several industry superannuation funds have in excess A$2 billion invested in both property and alternative assets. The

Table 1. Leading industry funds: property, alternatives allocation: June 2015.

		Property allocation		Alternatives allocation	
Superannuation funds	Net assets (A$ billion)	(%)	$ billion	(%)	$ billion
AustralianSuper	91.8	9.2	8.5	13.8	12.6
Unisuper	49.2	8.8	4.3	8.4	4.1
Retail Employees Superannuation Trust	37.4	7.0	2.6	5.0	1.9
Sunsuper Superannuation Fund	33.5	9.3	3.1	19.3	6.5
Health Employees Superannuation Trust	32.4	9.0	2.9	9.0	2.9
Construction & Building Unions	30.7	11.0	3.4	16.5	5.1

Source: APRA (2015).

Table 2. Industry superannuation balanced fund option portfolio: June 1995–2015.

Proportion of investments (%)	June 2013	June 2014	June 2015	June 1995–2015
Cash	13	11	11	8
Fixed income	14	15	16	18
Australian fixed income	9	9	9	13
International fixed income	5	6	7	5
Equity	43	46	46	52
Australian listed equity	26	25	22	31
International listed equity	17	21	24	21
Property	10	10	10	10
Listed property	2	2	2	5
Unlisted/direct property	8	8	8	5
Alternatives	20	18	17	12
Infrastructure	6	7	8	5
Hedge funds	0	0	2	1
Private equity	9	7	5	5
Commodities/other	5	4	2	1
Total investments	100	100	100	100

Source: APRA (2015) and Rainmaker Group (2012).

AustralianSuper fund holds the largest proportion of investments in both property (A$8.5 billion) and alternatives (A$12.6 billion) within the industry superannuation sector. Other industry funds with significant investments in property include Unisuper (A$4.3 billion) and Construction & Building Unions Superannuation (A$3.4 billion). Sunsuper Superannuation Fund (A$6.5 billion) and Construction & Building Unions Superannuation (A$5.1 billion) also hold significant investments in alternative assets. The level of allocation to alternatives is not surprising given that it now represents the third largest asset class for industry fund balanced portfolio (see Table 2).

Table 2 details the industry fund proportion of investments for the conventional Strategic default balanced portfolio. Balanced funds offer stable income returns and capital growth derived from a diversified range of asset classes. Balanced funds account for approximately 67% of the industry funds' investments. The balanced portfolio generally consists of five major components, namely: equities (Australian and international), fixed income (Australian and international), property, alternatives and cash.

Table 2 shows that over the 20-year study period, equities (Australian and international) was the dominant asset class, representing 52% of the industry superannuation balanced fund portfolio, followed by fixed income securities (Australian and international) 18%, alternatives (12%), property (10%) and cash (8%). The combined allocation to property and alternative assets averaged 19% before June 2007, having peaked at 33% during the

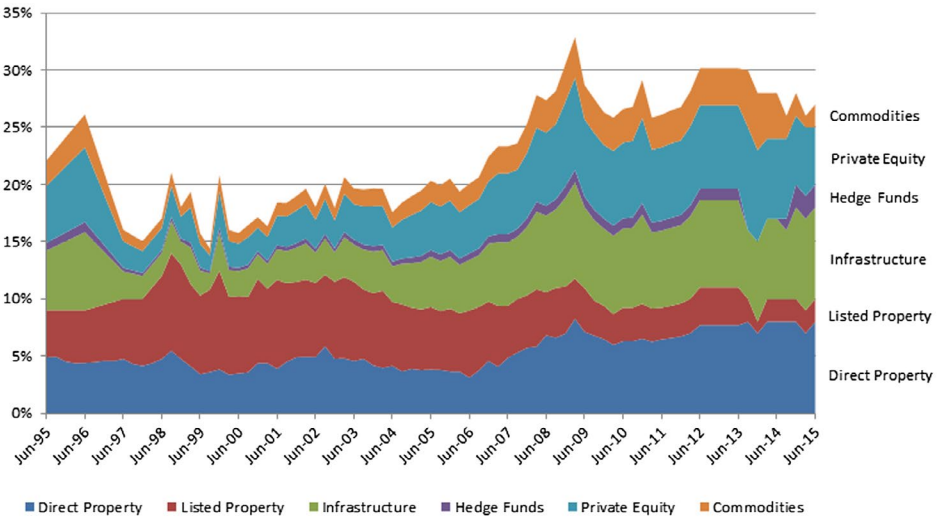

Figure 1. Industry superannuation property and alternative allocations, 1995–2015. Source: APRA (2015) and Rainmaker Group (2012).

Global Financial Crisis (GFC) and currently averages 28% (see Figure 1). Industry superannuation fund's increased exposure to property and alternatives is a result of fund managers seeking greater portfolio stability, given the continued volatility in global equities and bonds market. Industry funds have responded to the problem by reducing their exposure to mainstream asset classes such as equities and bonds; they are investing more in real assets such as property and infrastructure. However, it is evident that industry funds place a higher portfolio weighting towards alternative assets compared to property. The next section provides literature review on the challenges posed by alternatives to property asset allocation in institutional portfolios.

Literature review

Alternative assets, as the name suggests, are described as alternative investments within an existing asset class. Generally, alternatives are those assets that do not have an immediate trading market. Most alternative assets derive their value from either debt or equity markets. For example, hedge fund strategies involve the purchase and sale of either equity or debt instruments. In addition, hedge fund managers can invest in derivatives instruments whose value is derived from the equity or debt markets (Anson, Fabozzi, & Jones, 2011; Skully, 2007). However, what constitutes an alternative asset class is argumentative. For example, property is considered as mainstream assets in Australia, but generally classified as alternative assets by most US fund managers. REITs are sometimes classified as an alternative asset class by some fund managers. Typical alternative investments for Australian superannuation funds include hedge funds, commodities, infrastructure funds, private equity and venture capital funds. Other alternative assets that some superannuation funds invest in include, but not limited to, are arts, wine, antiques, collectables, taxi licences and song rights (APRA, 2015).

Large institutional fund managers can offer investors both unlisted and listed alternatives products, such as infrastructure funds, venture capital and other forms of private equity. The individual alternative assets discussed in this research are briefly defined below:

- *Infrastructure* investments involve providing capital which enables the planning, development and operation of essential systems and services of the economy such as transport networks, energy, utilities and telecommunication networks.
- *Hedge funds* are privately organised investment vehicles that manage a concentrated portfolio of public and private securities and derivatives. Hedge fund investments tend to focus on only one sector of the economy, or one segment of the market.
- *Private equity* and *venture capital* are vessels for companies to raise new equity capital to expand their operations. By definition, private equity is not publicly traded and therefore is an illiquid investment.
- *Commodities* can be categorised as rural (beef, wheat, wool etc.), metal (aluminium, copper etc.) and transformable resources (gold, crude oil etc.). While commodities do have economic value, they do not provide a claim on ongoing streams of income as in investments like property (Anson et al., 2011; Austrade, 2010).

Finkenzeller, Dechant, and Schäfers (2010) identified that institutional investors faced this classification problem when allocating alternatives in their portfolios. Some institutional investors tend to allocate alternative assets in existing real estate or fixed income securities portfolio, although the risk-adjusted return characteristics do not match. The analogy, particularly between direct property and infrastructure assets, could potentially explain why institutional investors group them together. Direct property and infrastructure have similar underlying asset characteristics, such as indivisibility, long lifecycles, site dependency, long-term investment horizons, restricted liquidity, valuation-based performance, inflation hedging, capital gains, high yield, and strong competition for quality assets. Both are real assets and offer relatively stable returns when compared to more volatile assets such as equities.

However, there are also significant differences between property and infrastructure assets. While property markets are described as relatively competitive, infrastructure markets often have oligopolistic or even monopolistic structures. In addition, there is a greater degree of transparency in the property markets compared to the infrastructure market. There is limited potential to obtain ownership of direct infrastructure assets due to regulatory constraints which often only allow user rights (Newell, Chau, & Wong, 2009; Newell & Peng, 2008a; RREEF, 2005). Finkenzeller et al. (2010) explained that although investments in direct property are inhibited by large investment scales, direct infrastructure investments are lumpier. Property as an asset class provides various uses, whereas infrastructure assets are limited to very specific and restricted uses. The acquisition and sale of direct infrastructure projects is time-consuming, and thus reduces the potential for investors to react immediately to changing market conditions.

Bond, Hwang, Mitchell, and Satchell (2007b) investigated whether the performance of property could be replicated by hedge funds, private equity, commodities and infrastructure in UK institutional portfolios. The authors found that alternative assets could not deliver the same level of portfolio hedging benefits as property. Their study found that adding property to a portfolio of bonds and equities would have led to a substantial reduction in portfolio risk. By contrast, in no case does adding one of the alternative assets to the core asset mix achieve a significant level of risk reduction. They further identified that in the absence of

property, the greatest risk reduction occurs by adding private equity to the mixed-asset portfolio. Newell and Peng (2008b) in a similar study on the US market, found while utilities provided lower diversification options, infrastructure offer enhanced portfolio diversification benefits in property, property-related and mixed-asset portfolios. Ankrim and Hensel (1993) examined the diversification benefits for commodities and property in mixed-asset portfolios using both unconstrained and constrained optimisation models and found that allocation to commodities was lower than property in both models.

Several recent studies have evaluated the performance and diversification benefits of property and alternative assets in Australia. Earlier studies by Colonial First State Global Asset Management (CFS, 2009), Newell and Peng (2008a) and Peng and Newell (2007), found that the correlation between infrastructure and property in Australia is significantly low, explaining the potential diversification benefits of including both asset classes within the multi-asset portfolio. More recently, Newell and Lee (2011), Newell, Peng, and De Francesco (2011) found that while direct property is still seen to play a key role in the Australian multi-asset portfolio, direct property plays a less significant role when the alternative assets such as infrastructure are included. An evaluation of the correlation matrix by Newell and Lee (2011) showed that in most instances, the diversification benefits of alternative assets compared to assets such as shares and bonds were much greater than property, which could in general have a negative impact on the level of allocation to direct property in the multi-asset portfolio. Newell et al. (2011) study found that even with the impact of the GFC, the performance attributes of unlisted infrastructure was superior to direct property.

The literature review shows that direct property and alternative assets, such as infrastructure, have similar underlying asset characteristics. Infrastructure is a very heterogeneous asset class offering different risk-return profiles across a range of subsectors, similar to property. Both are real assets and offer relatively stable investment returns when compared to more volatile assets such as equities. However, there are a number of qualitative differences between direct property and infrastructure, which further adds weight to including alternative assets such as infrastructure separately alongside property in a portfolio. In the Australian context, whilst previous studies such Newell and Peng (2008a) and Newell et al. (2011) have investigated the portfolio diversification benefits of infrastructure and property assets, research that evaluates the different alternative asset components (infrastructure, hedge funds, private equity and commodity) separately within institutional portfolios is limited. Therefore, this research will examine the diversification benefits of different property assets (direct property and listed property), and property with different alternatives asset components within the setting of two-asset and multi-asset portfolios. The research data and methodology are discussed next.

Data and methodology

Data

This research will evaluate the diversification benefits and asset allocation components of different property and alternative assets within the setting of two-asset and multi-asset portfolios, including the industry funds' conventional Strategic investment approach. For the purpose of this research, alternative assets only include hedge funds, commodities, infrastructure funds and private equity funds. Asset data for this study covers a 20-year period (1995–2015), and comprises 81 quarterly data points.

The asset data and benchmark representations for the research are detailed below:

- Cash – RBA Interbank Rate.
- Australian Fixed Income (Aust fixed) – CBA Bond: All Series, All Maturities.
- International Fixed (Int fixed) – Citigroup World Government Bond Index (A$).
- Australian Equities (Aust eq) – ASX All Ordinaries Accumulation Index.
- International Equities (Int eq) – MSCI WORLD ex AUSTRALIA Standard (Large + Mid Cap) (A$).
- Direct Property (D/Prop) – Property Council/IPD Australian Quarterly All Property Index.
- Listed Property (L/Prop) – S&P/ASX 200 A-REIT Index.
- Infrastructure (Infr) – UBS Australia Infrastructure and Utilities Index*.
- Hedge Funds (HF) – Dow Jones Credit Suisse Hedge Fund Index (A$).
- Private Equity (PE) – Cambridge Associates Australia Private Equity & Venture Capital Index (A$).
- Commodities (C'dity) – RBA Index of Commodity Prices.

*From 1 April 2015, UBS has retired the UBS Australia Infrastructure and Utilities Index. Thus, the index has been replaced with data from CBA since March 2015.

The benchmark allocation series data for all asset classes was sourced from Australian Prudential Regulation Authority (APRA) and the Rainmaker Group, a leading superannuation service provider in Australia. The trend of asset allocation to different property and alternative assets over 1995–2015 is displayed in Figure 1.

Figure 1 illustrates that allocation to direct property ranged between 5 and 7%, having peaked at 10% in June 2012. This shift in direct property allocation was a result of the recent GFC that led to major falls in REIT prices. Allocation to listed property ranged between 5 and 8%, having peaked at 9% in December 1999, which corresponded with the push by REITs to offshore property investment. The lowest allocation to listed property was recorded at 1% in March 2012 (post-GFC period). Looking across the alternative asset classes, infrastructure (5%) and private equity (5%) dominates the index weighting. Industry fund allocation to infrastructure has grown significantly since 1990s, when it averaged around 2–3% to 8% currently, reflective of significant rise in private spending and privatisation of government assets. Allocation to private equity ranged between 5 and 8%, having peaked at 9% in September 2013. Allocation to hedge funds and commodities averaged 1%. A recent study by Smith (2016) attributes the significantly low institutional allocation to hedge funds to high fees and limits on when investors can redeem their capital.

The range of asset allocation, including minimum (min.), maximum (max.) asset allocations for the industry superannuation fund is exhibited in Table 3. Property allocation includes direct/unlisted property (D/Prop), and listed securitised property, A-REITs (L/Prop). The alternative assets include hedge funds (HF), commodities (C'dity), infrastructure funds (Infr) and private equity (PE) funds.

Table 3 shows the varying benchmark asset allocation weighting for the industry fund portfolio. The aggregated average over the study period (20 years) was: Australian equities 31%, international equities 21%, Australian fixed income 13%, international fixed income 5%, alternatives 12%, property 10%, and cash 8%. These asset allocation components do change over time as fund managers regularly rebalance investment portfolios to reflect prevailing market conditions. For example, allocation to property ranged from 9 to 14% in

Table 3. Industry balanced fund range of asset allocations (%), June 1995–2015.

	Aust eq	Int eq	D/Prop	L/Prop	Aust fixed	Int fixed	Cash	Infr	HF	PE	C'dity
Average	31	21	5	5	13	5	8	5	1	5	1
Min.	22	12	3	1	5	2	3	1	0	1	0
Max.	37	28	10	9	24	8	13	8	2	9	5
Range	15	16	7	8	19	6	10	7	2	8	5

Source: APRA (2015) and Rainmaker Group (2012).

the 20-year period to June 2015. In the same period, allocation to alternative assets ranged from 4 to 21%.

Methodology

The Markowitz (1952) classical mean–variance portfolio selection model serves as the starting point for constructing optimal asset allocation models in this research. In theory, the portfolio optimisation (or mean–variance setting) generates a maximum Sharpe ratio portfolio based on the expected return, volatility and pairwise correlation parameters for all assets to be included in the portfolio. For n number of assets in the portfolio, the asset allocation is optimised by minimising portfolio risk (σ_p^2) for a given level of expected return using Markowitz's (1952) quadratic programming problem (see Equation 1).

$$\begin{aligned} &\text{Minimise} \quad \sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} x_i x_j \sigma_{ij} \\ &\text{subject to} \quad \mu_p = \sum_{i=1}^{n} x_i \mu_i \\ &\mu_p \geq \mu_o \end{aligned} \tag{1}$$

where x_i = proportion of portfolio allocated to asset i; x_j = proportion of portfolio allocated to asset j; μ_p = expected portfolio return; μ_i = expected return on asset i; μ_0 = given level of expected return; σ_{ij} = covariance between asset i and asset j returns.

In practice, the Markowitz mean–variance framework is altered with various types of constraints that follow the institution's investment guidelines and objectives. This is because the classical mean–variance optimisation portfolio can often result in extreme allocation in specific assets. Therefore, in addition to the Strategic asset allocation policies, industry superannuation funds also formulate a range of permissible investable asset weights (minimum and maximum) as a primary risk management tool. Including holding constraints leads to a more industry practical application of the mean–variance optimisation problems. For this research, the individual asset weights were constrained to being positive (greater than or equal to zero), and the total portfolio weight should sum to 100%. The model does not allow short selling. The optimisation models are reviewed annually. The Australian government 10-year bonds are used as the risk-free rate. Table 4 illustrates the assumed predetermined weight constraints (minimum and maximum) for industry superannuation fund balanced portfolios. This information is prepared based on consensus data from six leading industry superannuation funds with A$183 billion of funds under management.

Table 4 illustrates that industry superannuation fund asset allocation parameters appear to place high weighting on the equity markets. The level of allocation can relate to historical

Table 4. Industry superannuation funds asset weight parameters.

Asset class	Minimum weight (%)	Maximum weight (%)
Australian equities	20	40
International equities	10	40
Property	0	20
Australian fixed	0	20
International fixed	0	15
Cash	0	15
Infrastructure	0	20
Hedge funds	0	15
Private equity	0	15
Commodities	0	15

performance, liquidity and transaction costs. The property and alternatives group asset components are constrained at two levels. The individual direct property and listed property allocation range is set at 0–20%, with maximum allocation permitted to composite property 20%. The allocation range for infrastructure is set at 0–20%, with other alternative assets at 0–15%. The total permissible allocation to alternatives (infrastructure, hedge funds, private equity and commodities) is 25%. Previous overseas studies (Lee & Byrne, 1995; Stevenson, 2000) have also examined the role of property within constrained mixed-asset portfolios, with the upper limit to property set at 20%.

The most common problem of using mean–variance approach for property analysis is the actual nature of property return data. The property index has a major drawback as most values are based on appraisals and not actual transactions. The result has been "smooth" returns over time, or underestimates the standard deviation of property returns. Since the volatility is underestimated, a mean–variance model would allocate more to property assets in portfolio construction. Therefore, the absence of daily or monthly data points, limitations of appraisal-based data, and flawed representation of real estate risk; all provide several constraints on applying the MPT to property assets (Baum & Hartzell, 2012; Parker, 2011; Rowland, 2010).

Ross and Zisler (1991) stated that property's true return index lies somewhere between the available securitised and unsecuritised property return indexes. Academic researchers have tried various approaches to construct this true index, either by adjusting (desmoothing) the direct property return series, or by adjusting (unlevering and hedging) the property share returns. Exploratory work by Geltner (1991, 1993) has been widely used by academics to develop statistical methods to unsmooth the underestimated risk parameter in appraisal-based time-series data. The consensus is that autocorrelation for property data series lowers the reported volatility, thus allowing for the development of more accurate optimal portfolios. However, recent studies such as AXA Real Estate (2012) in UK, and Newell and Lee (2011) in Australia, show that substituting the raw (smoothed) property index data with the desmoothed property returns did little to change property's weighting in the optimal portfolio. The normal industry practice is to use property index data in the original format.

Given the divergence in theory and practice, the asset allocation models in this research are constructed using both smoothed and desmoothed direct property data series. This is essential to understand whether desmoothing property index data makes any significant difference to portfolio performance or individual asset weighting in mixed-asset portfolios. There is extensive literature in the property discipline detailing the techniques to desmoothing direct property data series, such as Bond, Hwang, and Marcato (2012),

Table 5. Asset total return at different intervals – quarterly data, 1995–2015.

Time period	Cash	Aust fixed	Int fixed	Aust eq	Int eq	D/ Prop	L/Prop	Infr	HF	PE*	C'dity
1995–2000											
Return (%)	1.44	2.47	1.90	3.13	2.55	2.44	2.95	7.13	3.76	.20	1.02
SD** (%)	.25	2.55	1.64	4.87	12.25	.42	4.58	9.59	8.79	2.82	4.42
2001–2007											
Return (%)	1.27	1.26	.95	3.98	2.93	3.38	4.44	4.37	3.24	6.55	1.76
SD (%)	.13	1.77	1.55	6.14	13.03	1.00	4.30	5.16	8.42	8.37	6.18
2008–2015											
Return (%)	1.00	1.73	.63	.68	1.58	2.01	−.40	1.38	1.63	2.26	.42
SD (%)	.38	2.34	3.78	8.50	15.60	3.47	11.50	5.29	11.12	3.99	9.54
Sharpe ratio (1995–2015)	−.37	.21	−.08	.15	.07	.52	.08	.37	.15	.27	−.05
Ranking***	11	4	10	5	8	1	7	2	6	3	9

*Private equity data are available from June 2000.
**SD = standard deviation.
***Ranked by Sharpe ratio performance.

Geltner, Miller, Clayton, and Eichholtz (2007), Higgins (2014), Marcato and Key (2007) and Rowland (2010). Higgins (2014) explains that generally desmoothing takes the form of, a first- or second-order autoregressive model, a time-varying approach, or an applied unsmoothing parameter weighting (.4–.6) range. For the purpose of this research, although various statistical models were tested, the Geltner et al. (2007) equation with a parameter value of .4 was adopted to desmooth the direct property data series (see Equation 2). This follows Higgins (2014) method of desmoothing property index data.

$$R^{u}{}_{t+1} = \frac{R_{t+1} - \alpha \times R_t}{(1-\alpha)} \tag{2}$$

where $R^{u}{}_{t+1}$ = is the desmoothed return in period $t + 1$; R_{t+1} = is the recorded return in period $t + 1$; α = is the smoothing parameter; R_t = is the reduced capital growth in period t.

The industry superannuation individual asset and portfolio performances are analysed in the next section.

Results and discussion

Table 5 details the industry superannuation fund balanced investment option asset allocation trend, with property and alternative asset allocation split into different components. The total return data for all asset classes are displayed at different time intervals.

Table 5 results demonstrate that there is significant variance in quarterly total returns for most asset classes at different time intervals. The data displays sharp fluctuations for the Australian equities, international equities and A-REITs markets. The returns for cash, direct property and Australian fixed assets remained relatively stable. During 1995–2000, infrastructure recorded the highest mean return (7.1%). A-REITs recorded strong performance in 2001–2007, enjoying a "golden era" with increased investments in offshore properties and increased debt during the period, recording the second highest total return (4.4%) behind private equity (6.6%). However, during 2008–2015 (GFC/post-GFC period), the A-REIT sector declined to its lowest point, recording the only negative mean return

(−.4%). Although direct property performance lagged the A-REITs returns for most of the analysis period, it significantly outperformed the listed property sector during 2007–2015. Private equity (2.3%) was the only other asset class to record a mean return over two per cent during the GFC/post-GFC period.

The performance of the alternative asset class can be explained by the increase in allocation in recent years to underlying alternatives sector assets – specifically infrastructure investments. On average, the allocation to alternative assets in the industry fund portfolio has risen from 5% (prior to 2000) to 17% in 2015, having peaked at 21% in March 2009. Over a period of 20 years (1995–2015), direct property has significantly outperformed all other asset classes with a Sharpe ratio of .52. Alternatives; infrastructure (.37) and private equity (.27), recorded the second and third highest Sharpe ratios, respectively. Excluding commodities, all alternative index assets have outperformed the A-REIT sector. Cash, international fixed and commodities recorded negative Sharpe ratios. Whilst the results for cash can be explained by low mean returns, it seems that the international fixed income and commodities markets have suffered from high volatility since the GFC.

The diversification benefits of direct property, listed property and other asset classes can be ascertained by examining the correlation matrix. Tables 6 and 7 assess the correlation between direct property, listed property and other asset classes over different time periods. This follows the Jones Lang LaSalle (2012) correlation reporting methodology for property assets. Each time period involved a different number of data points. For example, 1-year represents four quarterly data points in 2015, 2-year represents eight quarterly data points from 2010 to 2015 and 20-year represents 81 quarterly data points from 1995 to 2015.

Table 6 demonstrates that over the short-term (1–2 years), the correlation between direct property and listed property is low (−.33 and −.19). This indicates strong diversification

Table 6. Correlation matrix: direct property and other assets at different intervals.

	Direct property correlation to:									
Time period	Cash	Aust fixed	Int fixed	Aust eq	Int eq	L/Prop	Infr	HF	PE*	C'dity
1-year	−.45	−.34	.80	−.65	.74	−.33	−.18	.73	−.85	.33
2-year	.13	−.44	−.64	−.37	−.47	−.19	.34	−.59	.45	.51
3-year	−.29	−.07	−.22	−.44	−.41	−.21	.01	−.45	.45	−.09
5-year	.15	.10	−.06	−.10	.18	−.01	.11	.14	.08	−.29
10-year	.25	−.05	−.12	.17	.11	.27	.26	.04	.53	.08
15-year	.27	−.03	−.03	.19	.10	.28	.26	.04	.35	.07
20-year	.18	−.04	−.11	.16	.09	.27	.17	.03	.35	.08

*Private equity data are available from June 2000.

Table 7. Correlation matrix: Listed property and other assets at different intervals.

	Listed Property correlation to:									
Time period	Cash	Aust fixed	Int fixed	Aust eq	Int eq	D/Prop	Infr	HF	PE*	C'dity
1-year	.59	1.00	.30	.86	−.09	−.33	−.69	−.13	.72	.58
2-year	.17	.85	−.06	.32	−.22	−.19	−.61	−.16	.16	−.38
3-year	.40	.75	.05	.23	−.24	−.21	−.44	−.18	−.14	−.28
5-year	−.23	.20	−.23	.48	.29	−.01	.27	.27	.18	−.32
10-year	−.23	−.20	−.46	.71	.42	.27	.55	.16	.51	−.22
15-year	−.16	−.13	−.40	.64	.39	.28	.50	.21	.34	−.23
20-year	−.10	.01	−.30	.59	.36	.27	.49	.18	.29	−.21

*Private Equity data are available from June 2000.

Table 8. Performance statistics and optimal allocation results – two asset portfolios.

Portfolios	Assets	Mean return (%)	SD (%)	Sharpe ratio	Optimal Weight – Property (%)	Optimal Weight – Altern'ves (%)	Rank**
A	Direct Prop & Infr.	3.19	3.73	.50	95	5	2
B	Direct Prop & HFs	2.55	2.38	.51	95	5	1
C	Direct Prop & PE	2.79	3.23	.45	96	4	3
D	Direct Prop & C'dity	2.13	3.73	.21	90	10	10
E	Listed Prop & Infr.	3.06	5.92	.29	36	64	6
F	Listed Prop & HFs	2.13	7.16	.11	59	41	11
G	Listed Prop & PE	2.71	5.01	.27	28	72	8
H	Listed Prop & C'dity	1.85	5.34	.10	45	55	12
I	Prop* & Infr.	2.91	4.20	.37	96	4	4
J	Prop & HFs	2.43	3.92	.28	90	10	7
K	Prop & PE	2.67	3.67	.36	76	24	5
L	Prop & C'dity	2.21	3.36	.26	73	27	9

*Represents composite property index (direct and listed property combined).
**Ranked by Sharpe ratio performance.

potential between the assets. In the medium term, (3–5 years) the correlation between direct and listed property ranges from −.01 to −.21, and increases to .27 over the 20-year sample period. Direct property displays strong diversification potential with most asset classes, including alternative assets such as infrastructure, hedge funds and commodities, in both short-term and long-term horizons. Table 7 shows that listed property displayed strong diversification benefits with cash, fixed income (Australian and international), and to some extent with commodities and hedge funds, in the short- and long-term horizon. The correlation between A-REITs and Australian equities was high (>.60) in both the short-term and long-term, displaying potential lack of diversification benefit.

The literature highlighted that the ongoing, limited supply of quality real estate is likely to see funds seek higher allocation to alternative sectors in future, such as infrastructure. The research tests this notion by investigating the diversification benefits of different property and alternative assets by constructing two-asset optimal portfolio models. The asset allocation is determined using the mean–variance portfolio optimisation technique. Table 8 details the performance statistics and optimal allocation results for the two-asset models, being Portfolios A–D (Direct Prop & alternatives), Portfolios E–H (Listed Prop & alternatives) and Portfolios I–L (composite property & alternatives).

Table 8 illustrates that combining direct property with infrastructure (Portfolio A), hedge funds (Portfolio B) and private equity (Portfolio C) provides significantly high risk-adjusted returns (.45–.51) than including alternative assets in the listed property portfolio (E–H) and composite property portfolio (J–L). It can also be observed that the combining infrastructure or hedge funds with direct property produces risk-adjusted returns identical to a direct property only portfolio (.52). Including alternative assets in listed property portfolio is insignificant, evident from the low risk-adjusted return performances (.10–.29) and low portfolio weighting to listed property (except Portfolio F). Alternatives allocation was significantly low in both the direct property portfolio (4–10%) and composite property portfolio (4–27%), but improved with listed property (41–64%). Overall, the results provide evidence

Table 9. Different investment strategies: asset weighting, maximum allocation (%).

Strategies	Cash	Aust fixed	Int fixed	Aust eq	Int eq	D/ Prop	L/ Prop	Infr	HF	PE	C'dity
Strategic (actual)	**8**	**13**	**5**	**31**	**21**	**5**	**5**	**5**	**1**	**5**	**2**
Optimal – Weight Constrained S*	**10**	**12**	**10**	**23**	**12**	**12**	**3**	**2**	**6**	**8**	**2**
Max.	15	20	15	38	32	20	20	20	15	15	15
Optimal – Weight Constrained D**	**9**	**12**	**11**	**23**	**12**	**11**	**2**	**3**	**5**	**9**	**2**
Max.	15	20	15	40	32	20	20	20	15	15	15

Note: The portfolio asset weighting for the different investment strategies is highlighted in bold.
*Portfolio analysis using smoothed (S) direct property data series.
**Portfolio analysis using desmoothed (D) direct property data series.

that placing alternatives in the listed property portfolios is not a viable investment option. However, including alternatives in the direct property or composite property portfolios seems beneficial. In particular, including infrastructure, hedge funds and private equity in the direct property portfolio provides the best risk-adjusted returns, although portfolio weight is dominated by direct property.

The asset allocation and performance of different property and alternative assets needs to be tested further within the parameters of multi-asset portfolios. Table 9 details the weightings for the selected asset classes within the different asset allocation models. The analysis was conducted using both smoothed (S) and desmoothed (D) direct property data series.

The minimum and maximum allocation for different asset classes varies within each asset allocation strategy. With the Optimal – Weight Constrained models, equities were restricted to 40%; direct property, listed property, Australian fixed and infrastructure to 20% and the remaining assets to 15%. The only additional weight restrains imposed is that the total allocation to property is restricted to a maximum of 20% and alternative assets to a maximum of 25%. The allocation ranges for assets across the constrained strategies were: cash (9–10%), Australian fixed (12%), international fixed (10–11%), Australian equities (23%), international equities (12%), alternatives (18–19%) and property (13–15%). This is comparable to the industry superannuation fund conventional Strategic approach guided by the weight parameters. Except for equities, all asset classes recorded the maximum allocation range set within the Optimal – Weight Constrained portfolios at some point during the analysis period.

The results also show that substituting smoothed with desmoothed property is insignificant to the industry fund portfolio make-up. The resultant portfolio weighting change was minimal for all asset classes (−1 to 1%); with cash, direct property, listed property and hedge funds (−1%); international fixed, infrastructure and private equity (+1). There was no change in Australian fixed equities (Australian and international) and commodities asset weights. Therefore, it can be concluded that substituting smoothed property with the desmoothed property returns data series does little to change the property's weighting in constrained optimal portfolios similar to that which industry superannuation fund managers would generally impose. The findings are consistent with earlier studies (AXA Real Estate, 2012; Newell & Lee, 2011; Stevenson, 2000) that have investigated property's significance in mixed-asset portfolios using desmoothed property data.

The Optimal – Weight Constrained D (desmoothed property) investment strategy demonstrates a 13% allocation to property and 19% allocation to alternative assets. The combined allocation to property and alternatives within this constrained model was 32%. This can be compared to recent industry fund allocation to property and alternative assets in APRA report (2015, p. 21) of 27% (10% property, and 17% alternatives). Looking across the different property and alternative asset classes, portfolio allocation recommendation for direct property is 11% (+4%); listed property 2% (−3%); infrastructure 3% (−2%); hedge funds 5% (+4%); private equity 9% (+4%); commodities 2% (no change) compared to the industry superannuation fund actual allocation. In addition, it can be observed that total recommended allocation to real assets (property, infrastructure and commodities) is 18%, up to 1% compared to industry fund Strategic portfolio, although weighting is dominated by direct property with the proposed model.

Despite a similar asset allocation range assigned to infrastructure and property (0–20%), the allocation to infrastructure was 3%, lower than the direct property allocation (11%). Recent studies (Finkenzeller et al., 2010; Newell & Lee, 2011; Newell et al., 2011) have concluded that property may play a less significant role in multi-asset portfolios when the alternative assets, such as infrastructure, are included. However, the consensus was that both are distinct assets and offer different diversification benefits. This research provides evidence of strong allocation to direct property in both the two-asset and multi-asset portfolio, which further highlights property's significance in institutional portfolios. Higher allocation to direct property has limitations, such as illiquidity, higher transaction costs, availability of stocks and management fees. Lack of liquidity could act as a deterrent for higher allocation to direct property. However, the continued evolution of unlisted property fund vehicles (such as wholesale property funds and property syndicates) could provide the medium for increasing allocations to direct property. These vehicles would allow fund managers to meet specific member investment and liquidity requirements, alongside retaining some input into property allocation decisions. Australian superannuation funds normally do not invest in property directly. According to Newell, Lee, and Kupke (2015), industry superannuation funds achieve its direct property exposure to property using unlisted wholesale property funds.

Table 10 illustrates the quarterly performance of the weight constrained (*Optimal – Weight Constrained*) mean–variance models.

Mean total returns for all asset allocation strategies were similar (around the low 2% mark), although standard deviation for industry fund Strategic portfolio was significantly high (5.0%) compared to the alternative models (3.1%). The alternative strategies have outperformed the industry superannuation fund Strategic investment option, which recorded a

Table 10. Different investment strategies: performance statistics, June 1995–2015.

Asset allocation strategy	Mean return (%)	SD (%)	Sharpe ratio	Annualised return (%)	Annualised SD (%)
Strategic (actual)	2.15	4.97	.17	8.90	9.93
Optimal – Weight Constrained S*	2.14	3.05	.26	8.82	6.11
Optimal – Weight Constrained D**	2.13	3.07	.26	8.79	6.13

*Portfolio analysis using smoothed (S) direct property data series.
**Portfolio analysis using desmoothed (D) direct property data series.

Sharpe ratio of .17. The Optimal – Weight Constrained S and Optimal – Weight Constrained D models both recorded .26 risk-adjusted return profiles. The constrained strategies have similar modelling restraints to industry superannuation fund-balanced portfolio. However, it is appreciated that rebalancing the portfolio is not without costs. To increase the Sharpe ratio from .17 to .26 could provide minimal gains due to added management and transactions costs. The results also clearly show that substituting smoothed direct property data with desmoothed property makes minimal or insignificant difference to the industry fund performance, evident from the similar Sharpe ratio for the constrained portfolios.

Conclusion

This research examined the diversification benefits of property and alternative assets within two-asset and multi-asset optimisation portfolios. The analysis was undertaken for a 20 year timeframe (1995–2015) using ex-post quarterly total returns and asset weight data from A$431 billion industry superannuation fund default balanced portfolio. Alternative index assets are separated as infrastructure, hedge funds, private equity and commodity. Property includes direct/unlisted property and listed securitised property (A-REITs)

Over a period of 20 years (1995–2015), direct property has significantly outperformed all other asset classes with a Sharpe ratio of .52. Equities (Australian and international) dominate the industry fund balanced portfolio with an average allocation over 50%. Alternatives are the third largest asset group, weighted heavily in infrastructure and private equity. The allocation to alternative assets in the industry fund portfolio has risen from 5% (prior to 2000) to 17% in 2015. Allocation to property ranged between 9 and 11%. The lowest allocation to property was recorded at 9% during the GFC. Generally, allocation to listed property has been higher than direct property in the pre-GFC period. Post 2007, allocation to listed property has declined from 6% to 2%. In contrast, the allocation level to direct property has improved significantly, from an average of 4% prior to 2007, to 8% in 2015. The two-asset portfolio analysis provides evidence that includes alternative assets in the direct property portfolio produce better risk-adjusted returns than including alternatives in the listed property portfolio. In particular, infrastructure, hedge funds and private equity assets in the direct property portfolio provides the best Sharpe ratios (.45–.51), although portfolio weight is dominated by direct property.

The alternative multi-asset investment strategy evaluated included Optimal – Weight Constrained models, constructed using both smoothed direct property and desmoothed property data series. The modelling constraints (asset weight ranges, no short selling) were similar to that imposed by industry superannuation funds. The alternative models outperformed the industry superannuation funds' conventional Strategic portfolio. Strategic portfolio had a high standard deviation (4.97%), reflected in the relatively low Sharpe ratio (.17). The Optimal – Weight Constrained models with either smoothed or desmoothed property data produce similar risk-adjusted return profile (.26). The resultant portfolio weight change by substituting smoothed with desmoothed property was minimal for all asset classes (–1 to 1%). Overall, the results show that substituting smoothed with desmoothed property is insignificant to the industry fund portfolio make-up or performance.

The recommended allocation to property for industry funds is 13% (11% direct and 2% listed), compared to the current 10% (8% direct and 2% listed). Interestingly, despite similar asset allocation range assigned to property and infrastructure (0–20%), the allocation to

infrastructure was 3% lower than property. The combined allocation to property and alternative assets has increased from average 19% (pre-GFC) to 28% currently. Going forward, fund managers are expected to continue to reduce exposure to mainstream asset (equities and bonds) in favour of real assets (property and infrastructure) to achieve stable portfolio returns. Australia's increasing population pressures would require more investments in infrastructure. Whilst innovations in private equity market like "Equity Crowdfunding" would continue the fund-flow towards the alternative sectors. However, the increased allocation to alternatives is not likely to directly impact the industry superannuation fund's allocation to property. The high allocation to property in both the two-asset and multi-asset portfolios provides concrete evidence that property will command significant allocation in institutional portfolios despite the availability of similar alternative assets such as infrastructure.

In conclusion, the research has the potential to change how the Australian fund managers view property asset and alternative asset allocation. In particular, it highlights the reliable returns and a relatively low standard deviations performance of property in asset allocation models. There is a case to increase property allocation above the current 10% exposure for the popular industry superannuation fund strategic asset allocation model irrespective of changes in alternative asset allocations. This knowledge will be beneficial for funds currently re-profiling investment portfolios to achieve stable risk-adjusted returns.

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