The choice of performance test benchmark of Superannuation funds' investments in infrastructure

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Executive Summary

In this contribution to the exposure draft consultation on the "Your Future, Your Super" package, we do not comment on the general approach taken by the regulator to benchmark MySuper products but solely focus on the choice of benchmark for the unlisted infrastructure asset class. **We propose abandoning the use of listed equity indices to proxy investments made in the unlisted infrastructure equity asset class in the proposed performance tests of MySuper products. We argue that recent advances in data collection and innovation in asset pricing provide a robust and academically validated alternative to the currently proposed benchmark**. This listed equity index (the FTSE Developed Core Index) is wholly inadequate because it is not representative of the universe or of the risks to which Superannuation products are exposed when investing in unlisted infrastructure. Instead, the infra300, an index built to be representative of the unlisted infrastructure universe, constitutes a robust and fair alternative that can benefit plan members and managers alike as well as meeting the prudential objectives of the regulator.

In this short paper, we make four key points and two recommendations, which are summarised below:

1. Superannuation investments in infrastructure focus on those countries and sectors that make up the unlisted infrastructure universe.

The majority of their infrastructure equity investments are made in unlisted assets, via asset specialist asset managers, in Europe and Australia and in the Transport and Utilities sectors. We collect data for 424 investments made by Superannuation funds and still held at the end of 2019, 324 of which are in the 25 countries included in the EDHECinfra and infra300 universe, or more than 70% of the unlisted infrastructure investments currently held by these funds.

The unlisted infrastructure investments made by Superannuation funds span the entire breadth of the unlisted universe including a number of sectors such as social infrastructure or renewable energy companies which are seldom found in listed markets. In terms of both geographic and sector distribution, the infrastructure portfolios of Superannuation funds are in line, albeit not similar to, with the investible universe. We report the following stylised facts:

1. There is a home bias: Australia represents close to 12% of the global unlisted infrastructure universe, but a quarter of the AUMs Superannuation funds dedicate to unlisted infrastructure.
2. Superannuation funds make 70-80% of their unlisted infrastructure equity investments in Europe and Australia.
3. Superannuation funds also favour investments in transport and utilities. These two sectors represent around 70% of their unlisted infrastructure investments by size.
4. 80% of investments in unlisted infrastructure by Superannuation funds, by count or by size, are made indirectly via managers. This is relevant when considering the role of fees when computing net returns for the performance tests. Current fee assumptions for infrastructure in APRA tests do not correspond to the main route through which investors access unlisted infrastructure.

2. The benchmark currently used in the APRA Heatmap test for infrastructure is not representative of the way Superannuations invest in infrastructure.

1. The FTSE Developed Core index corresponds to twice as few firms but 49 times as much market capitalisation than the unlisted infrastructure equity held by superannuation funds. The type of firms found in the FTSE index differs greatly from those unlisted infrastructure companies Superannuation funds invest in. The top 10 largest firms found in the FTSE index are very large telcos and energy firms that are closer to industrial conglomerates than infrastructure projects.
2. The FTSE index is extremely concentrated in Network Utilities which represent about half of the index weight. The FTSE Index is also underweight in key sectors of the unlisted infrastructure sector notably transport and social infrastructure, which are sectors in which Superannuation funds hold a significant part of their unlisted infrastructure investments. The FTSE index fails to represent entire segments of the unlisted infrastructure universe. Moreover, 16% of the index by market capitalisation (18% by size) cannot be considered infrastructure under the TICCS taxonomy.

Thus, the FTSE Developed Core Infrastructure Index is not at all representative of the Superannuation fund portfolios, which are focused on the transport sector and a spread of investments over all other segments of the unlisted universe.

The FTSE Core Index also exhibits strong return correlation with listed markets with very high and significant levels of correlation in the 70-80% range with equities in and outside Australia and Real estate. Indeed, we find that **more than half the number of constituents in the FTSE Developed Core Infrastructure Index are found in other APRA equity benchmarks**, translating to a 91% overlap in terms of market capitalisation for the FTSE Developed Core Infrastructure Index. We also show that the FTSE Core index does not in fact represent a unique asset class when compared with the other benchmarks of the APRA Heatmap: it is already 'spanned' by the risk-returns characteristics of the other asset classes used in the Heatmap.

Looking at the financial characteristics of the FTSE Core Index and the infra300 index of unlisted infrastructure produced by EDHEC, we see that:

1. Unlisted infrastructure is **more defensive** than the listed infrastructure would suggest: this is illustrated by the Value-at-Risk and Maximum Drawdown of the infra300 (hedged to AUD) and the FTSE Core Infrastructure (hedged to AUD). While the listed infrastructure index exhibits a 99.5% one-year VaR in the 25-30% range depending on the horizon, the VaR of the infra300 ranges between 15-18%. Likewise, the maximum drawdown of the FTSE Core index is in the 16-28% range while the infra300 never exhibits drawdown greater than 10-12%.
   This confirms that unlisted infrastructure does exhibit drawdown protection characteristics. In the next section, we show that this finding is not driven by any 'smoothing' of the infra300 returns but is instead the result of unlisted infrastructure companies being exposed to fundamentally different risks than the constituents of listed indices, including during the Covid-10 lock-downs. This result suggests that unlisted infrastructure could be treated different in the 'simple reference portfolio' test conducted by APRA and categorised as more defensive than it currently is.
2. Unlisted infrastructure exhibits **higher risk-adjusted returns** than listed proxies: the Sharpe ratio i.e. the return per unit of risk, is 0.7 in Q2 2020 for the infra300 but 0.5 for the FTSE Core Index. A similar difference exists for all investment horizons. This higher risk-adjusted return is what attracts Superannuation funds to the unlisted infrastructure asset class.
   It must be noted that this is not the result of 'alpha' over a listed equivalent. First, we have established above that the listed index is not representative of the unlisted

universe. Second, the higher risk adjusted returns of unlisted infrastructure investments are the result of systematic risk exposures and rewards. Proxying these risks in the context of the APRA SAA test requires using the right benchmark corresponding to the risks and rewards of the unlisted infrastructure asset class.

3. Unlisted infrastructure has **higher dividend yields** compared to listed infrastructure: the infra300 index has a 9.41% dividend yield compared to the FTSE Core mean dividend yield of 3.28%. Such a very significant difference in dividend yield, which is also one of the main reasons why investors are attracted to unlisted infrastructure, shows that the underlying firms and risks of the FTSE Core and infra300 indices are completely different.

Thus, the FTSE Core Infrastructure Index is completely inadequate as a proxy for the unlisted infrastructure portfolios or strategies of Superannuation funds:

1. It is not capturing the same universe or the same type of firms;
2. It is highly concentrated in a few firms that are not representative of the unlisted infrastructure universe in which the Superannuation funds invest;
3. It is highly correlated with other listed indices and in fact cannot be statistically distinguished from them as demonstrated by mean-variance spanning tests;
4. As expected, it exhibits risk and return characteristics that are very close to listed equity indices and is quite different from a global index of unlisted infrastructure equity (the infra300) which exhibits more defensive characteristics and different risk dynamics.

3. Better benchmarks exist that captures the characteristics of the unlisted infrastructure asset class in which Superannuation invest.

A better benchmark than the listed infrastructure index put forward to test the performance of MySuper products can be designed using a representative dataset and mark-to-market valuations that adequately capture the risks and returns of the unlisted infrastructure asset class. The infra300 is an index of the international market for unlisted infrastructure equity produced by EDHECinfra each quarter along with several hundreds of indices of the segments of the unlisted infrastructure universe.

While a listed index is not adequate when it comes to capturing the characteristics of the unlisted infrastructure asset class, until recently the only alternative was an index based on private appraisals (like the ones published by MSCI mentioned and rejected in the 2018 Productivity Commission report). Indeed, as the 2018 PC report highlighted, this type of data suffers from multiple issues and biases including a lack of representativeness (selection and survivorship biases) and no robust measure of risk due to the 'smoothing' of appraisals and returns.

These issues have now been addressed by recent advances in research: a representative dataset of the investible universe, and measures of the mark-to-market performance of the unlisted assets in this representative sample i.e. applying IFRS 13 guidelines and using the latest transaction data to update the estimate of the risk premia that applies to each investment, are possible.

With this approach there is no more smoothing in the returns and a proper measurement of the variance of returns is possible. Representative and realistic risk and risk-adjusted characteristics are produced.

The Covid-19 crisis provides a test of the inadequacy of the FTSE Core of unlisted infrastructure as represented by the infra300 index of unlisted infrastructure companies:

1. In **Q1 2020**, with the first wave of Covid-19 lock-downs all listed equities, including the FTSE Core index, experienced very negative quarterly returns due to their significant exposure to the market beta. Note that while the FTSE Core is mostly dominated by energy and telecom companies, which were not immediately impacted by Covid-19 lock-downs, the FTSE Core index had a -16% returns in that quarter. In comparison, the infra300 had smaller negative returns. Indeed, while the index includes numerous transport companies that were affected by the lock-downs, it also includes many more 'contracted' infrastructure businesses which did not see their cash flows impacted by the Covid-19 lock-downs. The infra300 Q1 2020 returns are negative because the risk premia increased for almost all assets but in aggregate the impact on the unlisted infrastructure sector was less dramatic than for listed equities, despite sectors like airports having strong negative returns. The FTSE Core Index could not have captured this effect, despite the fact that it was at the heart of the Superannuation unlisted infrastructure investment strategies.
2. In **Q2 2020**, with the spread of the pandemic and the economic impact of the lock-downs, more infrastructure sectors began to be affected negatively such as utilities and roads. The infra300 continued to exhibit negative returns but listed benchmarks including the FTSE Core Index returned to positive quarterly returns as a result of the strong rebound in capital markets. Once again, we see that the unlisted and listed indices follow very different dynamics and that the FTSE Core does not represent what happened to the unlisted infrastructure asset class.
3. In **Q3 2020**, the infra300 returned to positive territory as the unlisted infrastructure market risk premia stabilised and some infrastructure sectors exhibited a strong rebound in revenues such as toll roads. The FTSE Core index was also positive but not for the same reasons since it is exposed to different risks and does not include significant exposure to transportation assets, one of the main types of unlisted infrastructure held in superannuation products.
4. On a **YTD basis in 2020**, we see that the FTSE Core exhibits -7% returns in AUD hedged terms whereas unlisted infrastructure has proven more resilient and is down -4.7% globally, despite the larger losses experienced in the most exposed merchant transport sectors. Clearly, as a benchmark of how the unlisted infrastructure performed during the Covid-19 pandemic, the FTSE Core is a poor proxy of the unlisted infrastructure sector. The infra300, which is build directly from measures of the fair market value of a representative set of unlisted infrastructure companies, shows the actual impact of higher risk premia, lower cash flows and lower interest rates on unlisted infrastructure NAVs.

Thus, while the FTSE Core Index is shown to be wholly inadequate as a proxy for unlisted infrastructure, in particular in terms of coverage and representativeness of the investments made by Superannuation funds, it is possible to build and produce a fair benchmark of the unlisted infrastructure asset class: the infra300 is designed to be a bias-free, representative view of the 'principal' market i.e. the main markets in which buyers and sellers of unlisted infrastructure companies are the most active, including Australian Superannuation funds. It is based on a mark-to-market asset pricing technology that captures the risks inherent to the asset class and produces robust, realistic results that can serve as the basis for benchmarking the investments made in MySuper products, as the example of the Covid-19 crisis demonstrates.

4. Using the infra300 as the unlisted infrastructure benchmark in the APRA tests is supportive of the regulator's objectives

We look at the two performance tests that APRA currently produces for the Heatmap: the Simple Reference Portfolio (SRP) test and the Strategic

Asset Allocation test (SAA) and consider how they may be impacted by switching the benchmark of the unlisted infrastructure asset class from the listed FTSE Core Index to the infra300 index of unlisted investments in infrastructure equity described in detail in the previous section.

We examine two potential evolutions of the treatment of unlisted infrastructure in the APRA performance tests:

1. The impact on the SRP of classifying unlisted infrastructure as more defensive that it currently is, given the evidence provided by the infra300 on the defensiveness of the asset class, which is not captured by the FTSE Core benchmark currently used (as shows in section 3)
2. The impact on the SAA test of using the infra300 instead of the FTSE Core Index, in particular, whether it would support the regulator's objective to 'punish underperformance' in MySuper products.

We argue that unlisted infrastructure should be considered more defensive since it possess properties that help protect portfolios in downside markets like lower VaR and lower maximum drawdown as shown by the infra300. This index also exhibits significant correlations with both international fixed income and Australian fixed income, asset classes that are considered defensive in the APRA classification, and lower correlations to listed equities.

To conduct this analysis, we use the MySuper asset allocations for the 138 products obtained from MySuper statistics. We make the same SRP calculation than APRA but using a 50-50 split between growth and defensive styles for unlisted infrastructure. We find that increasing the defensive classification of unlisted infrastructure from 25% to 50%, decreases the SRP for funds who invest in infrastructure from 7.227% to 7.165%. This is normal since the defensive style can be expected to have lower returns but the change is marginal, thus *making the test equally robust from the point of view of the regulator* but better reflecting the defensive characteristics of the unlisted infrastructure asset class in individual cases.

Next, in the context of the SAA test, the use of the wrong proxy results in making incorrect conclusions as to how much value is added by managers. Implementing the SAA test with listed benchmark assigned to proxy unlisted infrastructure would lead to random, unscientific and fundamentally unfair outcomes:

- In some periods the listed market exhibits much stronger returns than unlisted infrastructure, which is characterised by its defensive characteristics and attractive risk-adjusted returns. In this case, investors in unlisted infrastructure would be unjustly punished by the SAA test.
- In other periods, listed markets may have lower returns than private assets and investors would benefit from an 'apparent' alpha just by allocating finds to unlisted infrastructure but without exhibiting any skills while doing so.
- In the long run, it may also tend to make asset managers pick assets that are closer to the benchmark so they are more likely to meet the performance test.

Using a representative index like the infra300 (hedged-AUD) would solve this problem. The infra300 is much closer to the investment strategy of Superannuation funds in unlisted infrastructure and also designed to be representative of the unlisted infrastructure equity universe.

To determine what the impact of using the infra300 in the SAA test instead of the FTSE Core Index would be, we make a similar comparative analysis between 63 MySuper products and report how many products achieve or fail the APRA SAA test using the infra300 instead of the FTSE Core. We find that:

1. 14 out of 63 products, score better than the SAA benchmark when using the infra300 instead of the FTSE Core index
2. 39 products score less well than they would using the FTSE index
3. 10 products fare the same irrespective of the choice of infrastructure benchmark, mostly because they invest very little or not at all in this asset class.
4. A single product actually switches from outperforming its SAA benchmark to underperforming it because of the change of infrastructure benchmark from the FTSE Core to the infra300.

Thus, **using the infra300 index as the proxy of unlisted infrastructure does not overturn the results of existing SAA tests and preserves the regulator's objective to apply a robust market test to Superannuation products. Because it uses the correct benchmark, as we argued above, instead of punishing managers randomly and unfairly, using the infra300 would reward those managers who invested skillfully in the relevant unlisted infrastructure market.**

Looking at APRA's Q2 2020 *Heatmap*, we see that the products that underperform in the SAA test do so on average by -0.63% (median -0.65%). This puts the small size of the mean impact on returns of switching infrastructure index in perspective: while the average effect is unlikely to change the test result, the more infrastructure plays a role in the product, the more relevant using the correct benchmark becomes and the more it makes a difference in the SAA test.

These finding are in line the intent of the 'Your Future, Your Super' legislation and demonstrates the importance of including a relevant, representative benchmark for unlisted infrastructure investment.

Using the infra300 in the APRA Heatmap and subsequent performance tests would not only be much more representative of the underlying investments made and risks taken by investors in unlisted infrastructure but also help identify those managers that actually create value through these investments.

Our Recommendations

Thus, our two recommendations to the Treasury and to APRA in the context of the reform of MySuper are to:

1. recategorise unlisted infrastructure as 50% defensive in the Simple Reference Portfolio (SRP) test of the APRA Heatmap, and to
2. use the infra300 index (Hegded-AUD) to proxy the unlisted infrastructure asset class in the Strategic Asset Allocation (SAA) test of the APRA Heatmap. This index is described on the EDHECinfra website (edhec.infrastructure.institute/infra300-index) and available on the EDHECinfra platform (indices.edhecinfra.com).

1. Introduction

This note is a contribution to the exposure draft consultation by the Australian Treasury on the "Your Future, Your Super" package put forward by the Australian government in its 2020-21 budget (Australian Treasury, 2020b).

In it, we do not comment on the general approach taken by the regulator to benchmark MySuper and other products, and solely focus on the choice of benchmarks for the unlisted infrastructure asset class. **We propose abandoning the use of listed equity indices to proxy investments made in the unlisted infrastructure equity asset class in the proposed performance tests of MySuper products. We argue that recent advances in data collection and innovation in asset pricing provide a robust and academically validated alternative to the currently proposed benchmark**, a listed equity index which we demonstrate to be wholly inadequate because it not representative of the universe and of the risks to which Superannuation products are exposed when investing in unlisted infrastructure.

This choice is pivotal to the validity of the proposed performance tests because benchmark selection is central to assessing a choice of asset allocation. For example, in a recent paper, looking at a large sample of pension plans, Broeders and de Haan (2020) find that in the cross-section of pension funds, asset allocation explains on average only 19% of the variation in pension fund returns while, benchmark selection dominates and explains 33% of cross-sectional returns.

As we highlight in this report, Superannuation funds have created significant allocations to unlisted infrastructure investments in their portfolios and products over the past decade, and this asset class is now an important contributor to the asset allocations of various products, including default products known as 'MySuper'. The choice of a good benchmark for these assets as long eluded the regulator, however.

The choice of a benchmark for the infrastructure asset class in Superannuation products was already addressed in a 2018 report by the Productivity Commission of Australia (Productivity Commssion, 2018). [1] This report aimed to define benchmark portfolios for Superannuation products and highlighted significant data issues when it comes to choosing an adequate benchmark for the infrastructure asset class.

"The Commission was unable to obtain an international unlisted infrastructure index, and thus benchmarked all unlisted property to an Australian index." (Productivity Commssion, 2018, p.25). In fact, several submissions to the report highlight the inadequacy of the only candidate at the time: the MSCI/IPD Unlisted Infrastructure Index, arguing that *"(t)he unlisted infrastructure benchmark is too high or not representative of investments in the system.*[2]. and that "*No international indexes are applied for unlisted infrastructure* (. . .)." [3] Indeed, in the assessment made in the Productivity Commission report, 78% of Superannuation schemes report performance below that of the proposed unlisted benchmark, including 100% of retail funds (Productivity Commssion, 2018, p.66-68). The authors of the report also highlight selection and survivorship bias in data sources that "only cover a subset of investment options in the system" (Productivity Commssion, 2018, p.25).

1 - The Productivity Commission is the Australian Government's principal review and advisory body on microeconomic policy, regulation and a range of other social and environmental issues.

2 - ASFA (sub. DR221); AustralianSuper (sub. DR222), mentioned in ibid p.26

3 - AustralianSuper (sub. DR150); Sunsuper (sub. DR197), mentioned in Productivity Commssion (2018, p.26)

In this context, one of the key aspect of the 2020 MySuper reform requires the Superannuation regulator (APRA) to conduct annual performance tests of MySuper and other products, trustees to notify members when products fail the test, and prohibit new member entry when a product fails performance tests in two consecutive years.

A first version of such performance tests has been published regularly by APRA since the end of 2019: The *Heatmap* reports individual product investment performance over medium to long-term time horizons and compares it with benchmark portfolios. In these tests, the net investment return of each MySuper product is measured against a Simple Reference Portfolio – a notional portfolio of passive, low cost and liquid investments – and a Strategic Asset Allocation benchmark portfolio – which reflect the choice of SAA of the provider. Both portfolios are product-specific and tailored to reflect the investment strategy and level of risk of the product. The returns on both the SRP and benchmark portfolio are calculated using asset allocation data reported to APRA on a quarterly basis (APRA, 2020a).

To build these benchmarks, APRA uses listed indices to assess the value generated through choices of investment strategy. Hence, a listed SAA benchmark portfolio is created using the reported SAA for each product, assuming investment in listed passive benchmarks for each asset class, reflecting the the objective of default products like MySuper to be cost-effective.

In the exposure draft provided for consultation in November 2020, the Treasury clearly states that the principles of the Heatmap will continue to apply to the next generation of performance tests, to be defined in regulation expected in 2021: the test should be about long-term investment returns net of fees for a product and minimum number of years of performance (Australian Treasury, 2020a, p.7). In the same document, it is also said about the proposed reform that "The amendments seek to ensure that superannuation products have their performance assessed against an objective, consistently-applied benchmark, giving greater transparency to beneficiaries and protecting beneficiaries from under-performing products." (Australian Treasury, 2020a, p.3)

In its information paper on the Heatmap, APRA says that "(t)he benchmarks chosen are considered to be representative of the investable market, appropriate for MySuper and relevant to an Australian superannuation investor" (APRA, 2020a, p.29).

However, when it comes to the unlisted infrastructure investments made by Superannuation funds, this is not the case: the proposed listed index to proxy the unlisted infrastructure market (the FTSE Developed Core Infrastructure Index) is not representative of the infrastructure market or risks to which Australian savers are exposed to via MySuper products.

In what follows, we argue that the **proposed use of listed indices to proxy the unlisted infrastructure asset class is unscientific and will fail to achieve the regulator's objective to punish underperformance** when it comes to investing in unlisted infrastructure

We show that Superannuation funds invest mostly in unlisted infrastructure that is located in Europe and Australia, primarily in the transport sector, while the FTSE Core Infrastructure index mostly covers North America and the energy sector.

We also show that, like all other listed infrastructure indices, the FTSE index does not correspond to a meaningful asset class and instead is just a subset of equity market to which investors are already exposed to. This is in line with previous peer-reviewed research on the same topic. In effect, the unlisted infrastructure asset class to

which MySuper products are exposed is mostly not available via listed equity markets.

A benchmark should capture the risks and returns of the asset class it aims to represent. While, we understand the regulator's desire promote low-cost passive alternatives to active management through listed index products, such product do not currently exist for private markets like infrastructure, as we show in this paper.

With the wrong benchmark, the objective of punishing under-performance will not be achieved since a good measure of financial performance should relate to the relevant measure of risk of the asset and available listed indices do not represent the unlisted infrastructure universe.

Misrepresenting the unlisted infrastructure asset class does not serve the interest of savers: it will provide a disincentive for infrastructure investors, who would probably not be able to display returns as strong as equities: what characterises infrastructure is an excellent Sharpe ratio, due notably to lower volatility relating to the more stable nature of revenues, and downside protection. The recent Covid-19 episode illustrates this points very well, as we show in this report using new data.

Moreover, because the proposed benchmark does not cover Australian infrastructure, the objective to channel long-term savings into national infrastructure projects, a policy championed by the Australian Treasury at home and internationally through its presence at the G20, will be greatly disincentivised. To increase their chances to pass the performance tests, investors would have to invest primarily in North American infrastructure companies in the energy sector.

Irrespective of the questions raised by the APRA Heatmap, this lack of adequate data has been a challenge for investors in unlisted infrastructure who need benchmarks for asset allocation, risk management and performance monitoring purposes. Over the past five years, EDHECinfra has collected data and developed asset pricing methods that address this challenge.

When this issue was first examined by the Productivity Commission in 2018, little data existed to could satisfactorily answer the question of which index should be used to benchmark the unlisted infrastructure asset class. Since then, **innovation in data collection and asset pricing have allowed the development of a new generation of indices for illiquid and unlisted assets like infrastructure equity**.

Since late 2019, representative, mark-to-market indices of the unlisted infrastructure equity universe exist that address the limitations of using inadequate listed proxies or absolute return benchmarks and can provide a fair representation of the asset class. One of these indices, the infra300, tracks the performance of a representative set of 300 unlisted investments in infrastructure in 22 countries. The infra300 is published quarterly (Bloomberg Ticker: infra300) and used by numerous investors around the world.

The rest of this note is structured as follows: in the next section (2), we describe how Superannuation funds have been investing in infrastructure so far, including what type of assets are included in their portfolios using the TICCS® taxonomy of infrastructure investments, a classification system based on the objective characteristics of private infrastructure companies and used by numerous investors in the asset class. To our knowledge such a complete picture of the Superannuation exposure to unlisted infrastructure was not readily available until now.

In Section 3, we look at the proposed listed infrastructure index (FTSE Developed Core Infrastructure) and examine its coverage using the TICCS taxonomy, as well as its financial characteristics. We conclude that it is not representative of the infrastructure investments made by Super-

annuation funds and exhibits very high levels of correlation with listed equities. We show that it is in fact undistinguishable from listed equities.

Section 4 introduces the approach and methodology used to produce the infra300 index and shows that it is representative of the investible universe and captures the risks of the asset class correctly. We show that it is possible to measure the performance of unlisted infrastructure investments without any return smoothing, thus reflecting market risks. We also discuss briefly the impact of the Covid-19 lock-downs on unlisted infrastructure, how the FTSE Core index does not capture this impact, while unlisted infrastructure is shown to be more defensive than what a listed equity index suggests.

Finally, Section 5 estimates the impact on the APRA performance test of using the infra300 index instead of the FTSE Core index. We consider the impact of categorising unlisted infrastructure as a more defensive asset class in the SRP test and that of using the infra300 as the infrastructure benchmark in the SAA test. We show that using a better, more representative benchmark, while it improves the robustness of the performance tests, does not undermine the objective of the regulator with the current reform of MySuper products.

2. How do Superannuation Funds Invest in Infrastructure?

In this section, we examine the composition of the unlisted infrastructure portfolios of the top 20 Australian Superannuation funds by region and industrial segment, before we consider the constituents of the FTSE Core Infrastructure Index in section 3. We find that Superannuation funds' current investments in unlisted infrastructure equity are:

1. Concentrated in the top 20 largest Superannuation schemes;
2. Mostly unlisted and owned indirectly through fund managers;
3. Mostly made in Europe and Australia;
4. Mostly made in the transport and utilities sectors.

Superannuation funds' investments in infrastructure include both listed and unlisted assets. Unlisted infrastructure assets, however, represent the bulk of their investments in infrastructure equity: over 76% of superannuation fund's investment in this asset class are unlisted as shown in table 1.

To show a more detailed picture of the type of unlisted infrastructure investments assets superannuation funds make, we compile by hand the detailed unlisted infrastructure holdings of the top 20 Superannuations funds by AUM.

As table 2 shows, these plans have the highest allocation to infrastructure in the country (above 7.5%), both higher than the average Superannuation fund (4.7%) and than the Australian investment sector as a whole (2.6%). Hence, the top 20 Superannuation investors, with USD57.1bn of unlisted infrastructure assets, provide us with a detailed picture of what the majority of infrastructure investments in the Super system look like.

We collect data for the top 20 superannuation funds for both direct and indirect infrastructure investments in the 25 most active markets in the world, as defined in the EDHECinfra Universe Standard i.e. following the IFRS guidelines, these are the 25 'principal markets' or markets in which the most active buyers and sellers of unlisted infrastructure equity can be found. These 25 most active principal markets make up the EDHECinfra universe, and are determined on the basis of a national-level index inclusion criteria, including their level of activity (number and frequency of transactions and market participants), relative size and also minimum data availability. These criteria were based on EDHECinfra's comprehensive study of the global investible infrastructure market, which includes 107 countries.[1]

In other words, these are the most relevant countries from which to build a global benchmark of the unlisted infrastructure asset class.

The data is then classified using The Infrastructure Company Classification Standard or TICCS®: a class-based taxonomy which consists of four pillars: business risk, industrial activity, geo-economic exposure and corporate governance. TICCS aims to be an exhaustive list of objective, real world, distinguishing characteristics i.e. a system to organise information about actual firms. For this section, we will focus on classifying existing Superannuation funds' infrastructure investments by industrial activity.[2]

1 - docs.edhecinfra.com/display/UN
2 - docs.edhecinfra.com/display/TICCS

Table 1: Share of listed and unlisted infrastructure equity investments made by Australia's superannuation funds

	Infrastructure Assets (USD Bn)	Weights
Listed	17.3	23.26%
Unlisted	57.1	76.74%
Total	74.4	100%

APRA (2020b)

Table 2: Share of Infrastructure Equity Investment in Australian and Superannuation AUM

	AUM (USD Bn)	Infrastructure AUM (USD Bn)	Exposure to Infrastructure
All Investors	5,337	136.9	2.56%
Superannuation Funds	1,589	74.4	4.7%
Top 20 Superannuation Funds	876.5	66	7.53%

Source: IPE Real Assets, Preqin, EDHECinfra, 2019

Table 3: Direct vs. Indirect Investments in Infrastructure by Superannuation Funds in 2019

Strategy	Weight by number of assets*	Weight by asset size (total assets)**	Weight by equity stakes***
Direct	16.05%	30.47%	13.44%
Indirect	83.95%	69.53%	86.56%

Source: Annual Reports, Orbis, EDHECinfra * based on 324 investments for which information was available ** based on 209 investments, *** based on 190 investments

TICCS is widely used by investors to classify the infrastructure investments in their portfolios and is the object of an annual market consultation and review by an independent committee.

We use this framework to analyse the superannuation sector exposure to unlisted infrastructure because it corresponds to the the vast majority of their assets and it provides a direct comparison with the infra300 index we introduce in section 4 as a potential benchmark for the unlisted infrastructure asset class in the APRA tests. The infra300 is built using the same reference universe and the same TICCS classification.

We collect data for 424 investments made by Superannuation funds still held at the end of 2019, 324 of which are in the 25 countries included in the EDHECinfra and infra300 universe, or more than 70% of the unlisted infrastructure investments currently held by these funds. A list of the countries included and excluded in this analysis is provided in appendix A.1.

Because size and equity stake data is not always available for each transaction, we present the distribution of the Superannuation funds unlisted, direct and indirect infrastructure investments by number (equal weights), total company size (total assets) and actual equity stake. Tables 3, 4 and 5 show the results for each of these metrics with respect to the difference between direct and indirect investments, the type of investment geography and of infrastructure industrial activity found in the unlisted infrastructure portfolios of the top 20 superannuation funds. The same tables also show the breakdown of the investible unlisted infrastructure universe for the 25 main global market. We see the following stylised facts:

1. As shown in table 3, most investments in unlisted infrastructure by Superannuation funds, by count or by size, are made indirectly via fund managers, with more than 80% of equity stakes held through funds. This is relevant when considering the role of fees in the relevant benchmarks. Fund manager fees are the most common case and discussed in section 3 and 5.

2. Table 4 shows a strong home bias, which is a frequent feature of large institutional investors. While Australia represents close to 12% of the global market, about a quarter of the AUM Superannuation funds dedicate to unlisted infrastructure go towards Australian-based assets.

Table 4: Superannuation Investments in Infrastructure by Geography in 2019

	Weight by number of assets*	Weight by asset size (total assets)**	Weight by equity stakes***	Unlisted Infrastructure Universe
Australia	38.58%	24.10%	26.05%	11.9%
Europe	32.72%	60.00%	47.55%	54.9%
USA	22.84%	13.59%	24.89%	13.7%
Others	5.86%	2.31%	1.51%	19.5%

Source: Annual Reports, Orbis, EDHECinfra, * based on 324 investments for which information was available ** based on 209 investments, *** based on 190 investments

Table 5: Superannuation Investments in Infrastructure by Industrial Activity in 2019

TICCS® Industrial Class	Weight by number of assets*	Weight by asset size (total assets)**	Weight by equity stakes***	Unlisted Infrastructure Universe
Data Infrastructure	3.09%	2.75%	0.75%	5.8%
Energy and Water Resource	9.26%	12.49%	18.99%	9.9%
Environmental Services	4.01%	2.52%	1.73%	2.3%
Network Utilities	7.72%	35.04%	32.06%	25.4%
Power Generation x-Renewables	8.95%	1.82%	0.91%	9.8%
Renewable Power	19.14%	4.37%	8.87%	16.4%
Social Infrastructure	20.37%	2.11%	2.60%	5.5%
Transport	27.47%	38.91%	34.08%	24.9%

Source: Annual Reports, Orbis, EDHECinfra, * based on 324 investments for which information was available ** based on 209 investments, *** based on 190 investments

3. Table 4 also shows that Superannuation funds also make about half of their infrastructure investments in Europe, which is in line with this region's share of the global market, and most of the remaining quarter in the United States. We return to this point in the next section when we review the geographic composition of the FTSE index which is highly concentrated on North America. In contrast, Superannuation funds make 70-80% of their unlisted infrastructure equity investments in Europe and Australia.

4. Superannuation funds also invest mostly in transport and utilities as shown in table 5. These two sectors represent around 70% of their unlisted infrastructure investments by size. By number, the proportion of social infrastructure and renewable energy is significant (about 40%) but these are typically smaller projects by with high levels of leverage hence the amount of equity capital deployed in these sectors is usually much smaller.

We see from these results that the unlisted infrastructure investments made by Superannuation funds span the entire breadth of the unlisted universe including a number of sectors such as social infrastructure or renewable energy companies which are seldom found in listed markets.

In terms of both geographic and sector distribution, the infrastructure portfolios of Superannuation funds are in line, albeit not similar, with the investible universe.

Next, in section 3, we consider the coverage and characteristics of the benchmark currently put forward to proxy the unlisted infrastructure asset class in the new MySuper regulation.

3. Is the FTSE Core Index Representative of Unlisted Infrastructure?

In the light of the findings of section 2, in this section, we examine the characteristics of the FTSE Developed Core Infrastructure Index, which is the proposed proxy to represent infrastructure in the MySuper performance tests.

We first consider its coverage relative to the unlisted infrastructure universe which it is expected to proxy, before examining its financial characteristics including whether it represents a meaningful asset class and whether it is just a subset of the equity market to which investors are already exposed.

3.1 Representativeness of the FTSE Core Infrastructure

As of 30 June 2020, the FTSE Developed Core Infrastructure Index had 140 constituents, with a total market capitalisation of AUD3.165 trillion or USD2.182 trillion, also representing aggregate total assets of AUD6.394 trillion or USD3.941 trillion. The index's top 10 constituents by market capitalisation are presented along with the corresponding TICCS classifications in table 6.

The breakdown of the index's coverage into TICCS classes, when applicable, can be found in table 7, allowing a direct comparison with the Superannuation portfolios described in section 2. Finally, table 8 examines the coverage of the unlisted universe by the FTSE Core Infrastructure Index by industrial activity. We see the following stylised facts:

1. The FTSE index corresponds to twice as few firms but 49 times as much market capitalisation than the unlisted infrastructure equity held by superannuation funds. This suggests that the type of firms found in the FTSE index differs from those Superannuation funds invest in. Indeed, the top 10 largest firms found in the FTSE index are very large telcos and energy firms that are closer to industrial conglomerates than infrastructure projects.

2. The FTSE index is extremely concentrated in Network Utilities which represent about half of the index weight. Moreover, 16% of the index by market capitalisation (18% by size) cannot be considered infrastructure under the TICCS taxonomy.

3. The FTSE Index is also underweight in key sectors of the unlisted infrastructure sector notably transport and social infrastructure, which are sectors in which Superannuation funds hold a significant part of their unlisted infrastructure investments, as shows in section 2. The FTSE index fails to represent entire segments of the unlisted infrastructure universe.

4. The high concentration of the FTSE Developed Core Infrastructure Index is also illustrated in table 9, which shows the effective number of constituents, industrial sector and country in the FTSE index, compared with the EDHEC infra300 and EDHEC Australia Unlisted Infrastructure indices (we introduce EDHEC*infra* indices in more details in the next section). These metrics provide a sense of the number of 'actual' drivers of the index performance given the different weights of each segment. We see that that the FTSE index, with 140 constituents, is in fact driven by about 49 stocks, in comparison with the infra300, which is equally weighted and truly represents the average performance of 300 infrastructure

Table 6: Top 10 Constituents in the FTSE Developed Core Infrastructure Index by Total Assets (as of June 2020)

Name	Industrial SuperClass	Market Cap (USD bn)	Market Cap weight	Total Assets (USD bn)	Total Assets weight
NextEra Energy Inc	Network Utilities	118	5.40%	121	3.10%
American Tower Corp	Data Infrastructure	115	5.30%	40.79	1.00%
Union Pacific Corp	Transport	115	5.30%	62.22	1.60%
Crown Castle International Corp	Data Infrastructure	69.74	3.20%	38.62	1.00%
Dominion Energy Inc	Network Utilities	68.13	3.10%	104	2.60%
Canadian National Railway Co	Transport	62.73	2.90%	32.73	0.80%
Enbridge Inc	Energy and Water Resources	61.4	2.80%	120	3.00%
Duke Energy Corp	Network Utilities	58.72	2.70%	160	4.10%
Southern Co/The	Network Utilities	54.81	2.50%	119	3.00%
CSX Corp	Transport	53.38	2.40%	38.83	1.00%

Source: Bloomberg, EDHEC*infra*, data as of June 2020

Table 7: FTSE Developed Core Infrastructure Index - TICCS Sector Breakdown

TICCS® Class	Count	Market Cap (USD bn)	Total Assets (USD bn)	Market Cap weight	Total Asset weight
Data Infrastructure	11	233.87	128.1	10.70%	3.30%
Energy & Water Resources	11	210.51	448.54	9.60%	11.40%
Network Utilities	66	996.18	2,303.86	45.70%	58.50%
Transport	14	392.82	355.1	18.00%	9.00%
Does Not Qualify TICCS	38	348.29	705.62	16.00%	17.90%
Total	140	2,181.67	3,941.22	100.00%	100.00%

Source: Bloomberg, EDHEC*infra* TICCS Industrial SuperClass classification.

Table 8: Unlisted Infrastructure Coverage of the FTSE Developed Core Infrastructure

Industrial SuperClass	Unlisted Infrastructure Universe	FTSE Developed Core Infrastructure	Under/Overweight
Power Generation x-Renewables	15.30%	0.00%	-100.00%
Environmental Services	2.00%	0.00%	-100.00%
Social Infrastructure	4.01%	0.00%	-100.00%
Energy and Water Resources	11.45%	11.38%	-0.60%
Data Infrastructure	7.32%	3.25%	-55.60%
Transport	20.84%	9.01%	-56.77%
Renewable Power	18.34%	0.00%	-100.00%
Network Utilities	20.74%	58.46%	181.85%

Source: Bloomberg, EDHEC*infra*. Under/Overweight is calculated by taking the difference in weightage and divided by the respective unlisted infrastructure universe superclass weightage.

Table 9: Effective Number of Constituents, Sector and Country of the FTSE and infra300 Infrastructure Indices

	FTSE Developed Core Infrastructure	EDHEC infra300	EDHEC Australia Unlisted Infrastructure
Constituents	49.1	300.0	66.0
Sector	3.5	5.8	4.9
Country	2.5	7.3	1.0

Source: Bloomberg, EDHECinfra. An approximation of the effective number of constituents (ENC) is the inverse of the Herfindahl-Hirschman Index (HHI) of the percentage weights in a given portfolio. HHI measures concentration as the sum of the squared percentage weights and is bound between zero and 10,000. An index with an infinitesimal weight on each of a large number of equities will have an HHI of near zero, and an index with only one equity position will have an HHI of 10,000. The HHI for SuperClass and Country are calculated based on the weights of the constituents grouped by SuperClass or Country.

companies. Even the EDHEC Australia Unlisted Infrastructure Index, which is weighted by market capitalisation, is less concentrated than the FTSE index. Likewise, the FTSE Core index exhibits a very low effective number of sector (less than 4) and even lower effective number of countries (less than 3). The EDHEC indices are also much less concentrated by effective number of sectors or country.

Thus, the FTSE Developed Core Infrastructure Index is not at all representative of the Superannuation fund portfolios described in section 2, which showed a certain concentration in the transport sector and a spread of investments over all other segments of the unlisted universe.

3.1.1 Overlap and Correlation with Listed Equities

The FTSE Developed Core Infrastructure Index exhibits strong correlation with listed equities, property and commodities. Looking at the correlation of total returns between the benchmarks proposed by APRA in table 10, we see that the FTSE Developed Core Infrastructure exhibits very high levels of correlation in the 70-80% at a very level of statistical significance with equities in and outside Australia (S&P/ASX 300, 67% correlated and MSCI All Country World Ex-Australia 73%) and Real estate (S&P/ASX 300 A-REIT, 77% and FTSE EPRA/NAREIT developed ex Australia 85%).

The constituent overlap between the FTSE Developed Core Infrastructure Index and the benchmarks proposed by APRA to cover International Equity (S&P/ASX 300) and Australian Equity (MSCI All Country World Ex-Australia Equities Index[1]) reveals one of the reasons for the strong observed correlations between the FTSE Core and equities. Comparing the constituents by ISIN as of 30 June 2020, 9 out of the 301 constituents in S&P/ASX 300, and 83 out of the 1,552 constituents in MSCI All Country World Ex-Australia are also found in the FTSE Developed Core Infrastructure Index.

In other words, **more than half the number of constituents in the FTSE Developed Core Infrastructure Index are found in other benchmarks**, translating to at least a 91% overlap in terms of market capitalisation for the FTSE Developed Core Infrastructure Index. The list of constituents found in both the FTSE Developed Core Infrastructure Index and Vanguard MSCI Index International Shares ETF can be found in the appendix.

In comparison, we note that the EDHEC infra300 and EDHEC Australia unlisted infrastructure indices exhibit significant correlation with fixed interest but not so much with listed equities. This highlights the difference of nature of the assets found in the listed and unlisted universe, with most unlisted infrastructure companies exhibiting very different characteristics to the listed benchmarks, in particular a significant exposure to interest rate risk.

3.1.2 Asset Class Characteristics

Finally, we test if the FTSE Developed Core Infrastructure Index corresponds to a meaningful asset class or whether it is just a subset of the equity market to which investors are already exposed by conducting mean-variance spanning tests i.e. we test the impact of adding the FTSE Developed Core Infrastructure Index to a reference portfolio using the 'spanning' tests of Huberman and Kandel (1987) and Kan and Zhou (2012). The reference portfolio is made of the indices proposed by APRA as benchmarks for all other asset classes in the Heatmap, besides infrastructure.

In summary, adding the FTSE Developed Core Infrastructure Index to the reference portfolio does not allow us to reject the null hypothesis that the asset classes in the reference portfolio already span the risk and returns of the FTSE Core index. In other words, the FTSE Developed

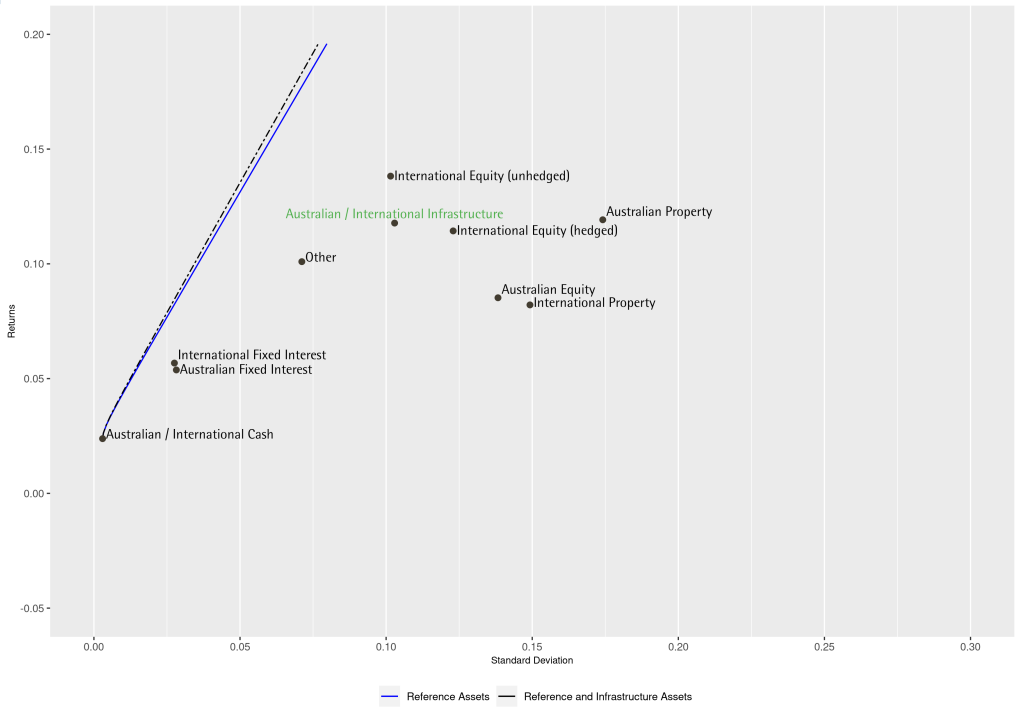
1 - Constituents are obtained from the Vanguard MSCI Index International Shares ETF

Table 10: Total Return Correlations Between Proposed APRA Benchmarks and the EDHEC infra300 and Australia Unlisted Infrastructure Indices

	S&P/ASX 300	MSCI ex-Aus (hedged)	MSCI ex-Aus (unhedge	S&P/ASX 300 A-REIT	FTSE EPRA/NAI (hedged)	FTSE Dev Core (hedged)	BBG Ausbond 0+	Bloomber Barclays Global	BBG Ausbond Bill	Other	EDHEC Aus Unlisted Infra	infra300 (AUD)
MSCI ex-Aus (hedged)	0.89***											
MSCI ex-Aus (unhedged)	0.65***	0.74***										
S&P/ASX 300 A-REIT	0.78***	0.71***	0.47**									
FTSE EPRA/NAREIT ex (hedged)	0.78***	0.73***	0.48**	0.89***								
FTSE Developed Core (hedged)	0.67***	0.73***	0.47**	0.77***	0.85***							
BBG Ausbond 0+	-0.22	-0.34*	-0.24	0.05	0.04	0.06						
Bloomberg Barclays Global	0.06	-0.06	-0.18	0.25	0.27	0.26	0.82***					
BBG Ausbond Bill	-0.05	0.03	0.08	0.12	0.14	0.18	0.33*	0.37*				
Other	0.86***	0.95***	0.89***	0.69***	0.72***	0.70***	-0.22	-0.01	0.07			
EDHEC Aus Unlisted Infra	-0.18	-0.26	-0.22	0.08	0.07	0.12	0.71***	0.66***	0.31	-0.17		
infra300 (AUD)	0.01	-0.16	-0.1	0.12	0.13	0.13	0.48**	0.49**	0.23	-0.07	0.78***	
infra300 (hedged-AUD)	-0.01	-0.14	-0.06	0.14	0.14	0.14	0.50**	0.55***	0.39*	-0.04	0.84***	0.92***

Correlation of quarterly returns taken from Sep 2011 to June 2020 to ensure complete information across all indices. MSCI ex-Aus (hedged) is MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD), MSCI ex-Aus (unhedged) is MSCI All Country World Ex-Australia Equities Index with Special Tax (unhedged in AUD), FTSE EPRA/NAREIT ex (hedged) is FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD, FTSE Developed Core (hedged) is FTSE Developed Core Infrastructure Index hedged to AUD, BBG Ausbond 0+ is Bloomberg Ausbond Composite 0+ Index, Bloomberg Barclays Global is Bloomberg Barclays Global Aggregate Index (hedged in AUD), BBG Ausbond Bill is Bloomberg Ausbond Bank Bill Index, Other is a composite index of 25% MSCI ex-Aus (hedged), 25% MSCI ex-Aus (unhedged) and 50% Bloomberg Barclays Global.

Figure 1: Already Spanned: Efficient Frontier Using the APRA SAA Test Benchmarks with and without the FTSE Developed Core Infrastructure Index



Core Infrastructure Index is not found to improve the diversification of the reference portfolio. The test results are presented in the appendix (see tables 18 and 19).

As figure 1 illustrates, adding the FTSE Core to the reference portfolio does not shift the mean-variance efficient frontier in a meaningful manner (the two frontier still touch at the minimum variance point). Hence, the FTSE Core index does not in fact represent a unique asset class when compared to the other benchmarks of the APRA Heatmap: it is already spanned.

Next, we consider the long-term risk and return characteristics of the FTSE Core Infrastructure index compared to other benchmarks.

3.2 Risk and Return Characteristics

The FTSE Developed Core Infrastructure Index is available from December 2005. In what follows, we compare annualised returns over five, 10- and 15-year windows until Q2 2020. Risk and return metrics are computed for the benchmarks proposed in the APRA Heatmap and for the EDHEC infra300 and the Australia unlisted infrastructure indices.

The methodology behind EDHECinfra indices is introduced in detail in the next section. At this stage, it is suffice to say that the infra300 index is designed to track the different TICCS segments of the unlisted infrastructure reference universe identified as the 25 national markets qualifying as 'principal' or most active markets in the world. The infra300 equity index represents the quarterly performance of 300 unlisted infrastructure companies. The index is equally weighted and restricted to 300 constituents to minimize the impact of a few large firms and better represent the market accessible to the average investor. Since inception, a total of 461 firms have been included in this index. Quarterly returns are available from June 2000.

Results are net of fees: for the ten Heatmap benchmarks, fees are taken from APRA. For the FTSE Core Infrastructure the fees used in the APRA computations are equivalent to low passive investment fees. We know from section 2 that most Superannuation fund infrastructure investment is unlisted and made through funds, hence the fees assumed in the Heatmap are unlikely to correspond to what members actually pay.

For the EDHEC indices, fees are derived by calculating a blended fee based on what typical unlisted infrastructure fund have been charging on gross returns, including carry, using fee information sourced from Preqin for infrastructure funds since 2010. Using this data, we assume an average annual fee rate of 2.5%.

Table 11 reports the indices' returns, volatility, Sharpe ratio, maximum drawdown and value-at-risk (VaR) for a five, 10- and 15-year window, up to Q2 2020 for the benchmarks relevant to the APRA Heatmap, which are mostly hedged to AUD to reflect investment practice amongst Superannuation funds. We report the following stylised facts:

1. Unlisted infrastructure is **more defensive** than the listed infrastructure would suggest: this is illustrated by the Value-at-Risk and Maximum Drawdown of the infra300 (hedged to AUD) and the FTSE Core Infrastructure (hedged to AUD) in panels A and B of table 11. While the listed infrastructure index exhibits a 99.5% one-year VaR in the 20-30% range depending on the horizon, the VaR of the infra300 ranges between 15-18%. Likewise, the maximum drawdown of the FTSE Core index is in the 16-29% range while the infra300 never exhibits drawdown greater than 10-12%.

   This confirms that unlisted infrastructure does exhibit drawdown protection characteristics. In the next section, we show that this finding

is not driven by any 'smoothing' of the infra300 returns but is instead the result of unlisted infrastructure companies being exposed to fundamentally different risks than the constituents of listed indices, including during the Covid-19 lock-downs.

This result suggests that unlisted infrastructure could be treated different in the 'simple reference portfolio' test conducted by APRA and categorised as more defensive than it currently is. We return to this in section 5.

2. Unlisted infrastructure exhibits **higher risk-adjusted returns** than listed proxies: the Sharpe ratio shown on Panel E of table 11 i.e. the return per unit of risk, is 0.7 in Q2 2020 for the infra300 but 0.5 for the FTSE Core Index. A similar difference exists for all investment horizons. This higher risk-adjusted return is what attracts Superannuation funds to the unlisted infrastructure asset class.

   It must be noted that this is not the result of 'alpha' over a listed equivalent. First, we have established above that the listed index is not representative of the unlisted universe. Second, the higher risk adjusted returns of unlisted infrastructure investments are the result of systematic risk exposures and rewards (we return to this in section 4).

   Proxying these risks in the context of the APRA SAA test requires using the right benchmark corresponding to the risks and rewards of the unlisted infrastructure asset class. We return to the impact of using the infra300 on the SAA test in section 5.

3. Listed and unlisted infrastructure indices follow **different return dynamics** due to their divergence in both coverage and risk exposures.

   Because of the difference of geographic universe coverage between the listed and unlisted infrastructure indices highlighted earlier, the impact of converting and hedging returns to Australian dollars is very significant: as shown on Panel C of table 11, the FTSE Core Index net 5-year returns in Q2 2020 stands at 7% in USD and 7.5% hedged to AUD. Over a longer period of 10 or 15 years, the same index net total returns are 9.9% and 7.8% in USD and 12.2% and 9.6% hedged to AUD. Unsurprisingly, these returns are quite close to the MSCI World x-Australia also hedged to AUD, since these two indices are very close, as we documented above.

   The infra300 index has historically had high returns that have decreased in recent years. We see that net USD infra300 annualised total returns have decreased from 9.5% over the decade to Q2 2020, to 3.7% (net) on a five-year basis. This is due to a secular decrease in the expected returns (and concomitant increases in valuations) of the unlisted infrastructure asset class, as well the negative impact of Covid-19 on unlisted returns in 2020, as well as the higher fees found in unlisted investment vehicles. We return to the impact of Covid-19 on listed and unlisted infrastructure indices in section 4.

   The AUD version of the infra300 index exhibits higher net returns due to the effect of foreign exchange. Still, it follows the same decreasing historical trend, with net, five-year returns in Q2 2020 slightly higher than 7%. The AUD-hedged version of the index exhibits even higher net returns due to the combination of foreign exchange and hedging effects and stands around 9% for five-year returns on the same date. This is in contrast with listed indices which have rebounded significantly in 2020.

4. Unlisted infrastructure has **higher dividend yields** compared to listed infrastructure.

Listed and unlisted infrastructure exhibit different characteristics in terms of dividend yields. As shown in table 12, the infra300 and EDHEC Australia Unlisted Infrastructure indices have higher means and medians, at 9.41% and 8.45% respectively for means, in comparison to the FTSE Core Index's mean dividend yield at 3.28%. Such a very significant difference in dividend yield, which is also one of the main reasons why investors are attracted to unlisted infrastructure, clearly shows that the underlying firms and risks of the FTSE Core and infra300 indices are completely different.

In conclusion, we see that the FTSE Core Infrastructure Index is completely inadequate to proxy the unlisted infrastructure portfolios or strategies of Superannuation funds:

1. It is not capturing the same universe or the same type of firms;
2. It is highly concentrated in a few firms that are not representative of the unlisted infrastructure universe in which the Superannuation funds invest;
3. It is highly correlated with other listed indices and in fact cannot be statistically distinguished from them as demonstrated by mean-variance spanning tests;
4. As expected, it exhibits risk and return characteristics that are very close to listed equity indices and is quite different from a global index of unlisted infrastructure equity (the infra300) which exhibits more defensive characteristics and different risk dynamics.

In the next section, we detail the design and robustness of the infra300 index before analysing its potential impact on the APRA tests in section 5.

Table 11: Net Performance and Risk Metrics for Heatmap and EDHEC Benchmarks - as of Q2 2020

Panel A: Value-at-Risk (VaR)	5-year	10-year	15-year
infra300 AUD-hedged	18.14	14.83	15.27
MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	44.02	31.66	31.66
FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	55.93	44.87	72.37
FTSE Developed Core Infrastructure Index hedged to AUD	30.23	20.65	26.75
Bloomberg Barclays Global Aggregate Index (hedged in AUD)	2.97	2.11	1.83
25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	13.17	8.16	8.16
Panel B: Maximum Drawdown	**5-year**	**10-year**	**15-year**
infra300 AUD-hedged	10.62	10.62	12.39
MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	20.88	20.88	20.88
FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	28.32	28.32	64.23
FTSE Developed Core Infrastructure Index hedged to AUD	15.98	15.98	28.91
Bloomberg Barclays Global Aggregate Index (hedged in AUD)	2.19	2.19	2.19
25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	6.94	6.94	6.94
Panel C: Total Returns	**5-year**	**10-year**	**15-year**
infra300 USD	3.69	9.53	9.31
infra300 AUD	7.39	13.19	10.58
infra300 AUD-hedged	9.24	18.57	17.94
MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	7.04	10.98	10.98
FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	3.08	9.54	3.37
FTSE Developed Core Infrastructure Index hedged to AUD	7.56	12.25	9.62
Bloomberg Barclays Global Aggregate Index (hedged in AUD)	4.66	5.9	6.3
25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	6.66	9.35	9.35
Panel D: Volatility	**5-year**	**10-year**	**15-year**
infra300 AUD-hedged	10.98	13.39	13.31
MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	16.77	14.01	14.01
FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	16.96	15.64	21.76
FTSE Developed Core Infrastructure Index hedged to AUD	11.99	10.44	11.54
Bloomberg Barclays Global Aggregate Index (hedged in AUD)	2.81	2.95	2.99
25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	6.56	5.79	5.79
Panel E: Sharpe Ratio	**5-year**	**10-year**	**15-year**
infra300 AUD-hedged	0.68	1.17	1.05
MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	0.32	0.61	0.61
FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	0.08	0.44	0
FTSE Developed Core Infrastructure Index hedged to AUD	0.49	0.91	0.51
Bloomberg Barclays Global Aggregate Index (hedged in AUD)	1.06	1.1	0.86
25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	0.75	1.19	1.19

Quarterly returns for EDHEC*infra*'s infra300 and the Australia unlisted infrastructure equity indices are obtained from EDHEC*infra*'s index platform; quarterly returns for the other indices are derived from Bloomberg's 'PX_LAST' field until June 2020. The risk free rate used in the computations is taken from Reserve Bank Australia's Interest Rates and Yields – Money Market – Monthly – F1.1: EOD 3-month Bank Accepted Bills/Negotiable Certificates of Deposit-3 month (Series ID: FIRMMBAB90). Volatility is the standard deviation of total returns. Sharpe Ratio is the ratio of excess returns to the standard deviation of returns. Value-at-Risk is the 99.5% Cornish-Fisher VaR. Max Drawdown is the maximum decline in the index value. Fees are included.

Table 12: Dividend Yields of the FTSE Core, infra300 and EDHEC Australia Infrastructure Indices - 2010-2020

Index	Mean	Median	Standard Deviation
FTSE Developed Core Infrastructure Index	3.28	3.26	0.21
infra300	9.41	9.54	0.59
EDHEC Australia unlisted infrastructure equity	8.45	8.53	0.27

Source: Bloomberg, EDHEC*infra*

4. Building a Representative Index of the Unlisted Infrastructure Asset Class

In this section, we describe how a better benchmark than the listed infrastructure index put forward to test the performance of MySuper products can be designed using a representative dataset and mark-to-market valuations that adequately capture the risks and returns of the unlisted infrastructure asset class. We focus on the infra300, an index of the international market for unlisted infrastructure equity and a selection of segments of the unlisted universe.

We first describe some frequent issues with private investment data and how they can be addressed to ensure representativeness and fair value, before using the case of the Covid-19 lockdowns to illustrate the point that it is possible to measure risk and performance of unlisted infrastructure equity without resorting to a listed proxy, which fails to capture the impact of the pandemic on unlisted infrastructure.

4.1 Addressing the issues found in private investment data

While a listed index is not adequate to capture the characteristics of the unlisted infrastructure asset class, until recently the only alternative was an index based on private appraisals like the ones published by MSCI/IPD (mentioned and rejected in the 2018 Productivity Commission report). Indeed, as the 2018 report highlighted, this type of data suffers from multiple issues and biases:

- Lack of representativeness: the constituents included in appraisal-based indices (which are typically not revealed) are not chosen according to any rule or logic other than being the data reported by certain investors at one point in time. The composition of such indices thus keeps changing randomly. Moreover, appraisal-based indices suffer from survivorship biases: only the investments of reporting funds are still present in the portfolio of the reporting investors, hence the index fails to include past bankruptcies and terminations that nevertheless exist in the universe (see Amenc et al., 2020, for a detailed analysis).

- No measure of risk: beyond the issue of survivorship bias, the net asset values used to compute appraisal-based indices exhibit very low return volatility and no return correlation with other asset classes because valuation methods rely on smooth time series of interest rates and the 'equity risk premium' to arrive at a discount rate that changes very little over time. If expected cash flows are indeed stable, then valuations barely change from one period to the next, even though market participants may be willing to pay very different multiples from one valuation date to the next. This 'smoothing' of the volatility of private asset returns is reflected in the significant serial correlation of returns reported in appraisal-based datasets (see Amenc et al., 2020).

Building a genuine alternative to listed benchmarks requires addressing the two major issues found in appraisal-based indices: representativeness and convincing measures of risk and value.

To address these issues, we proceed thus: first, we collect a representative dataset for the investible universe, and second, we estimate the performance of the assets in this representative sample on a fair value basis i.e. applying IFRS 13 guide-

lines and using the latest transaction data to update the estimate of the risk premia that applies to each investment.

4.2 A Representative Sample of the Universe

To build a representative view of the investible universe we follow a *scientific* approach to identify the relevant markets and pick the relevant constituents of a broad-market index.

- Data is collected and structured using TICCS®, an objective and consensus taxonomy that is the industry standard and was introduced in section 2;
- A universe is defined that corresponds to the 25 most active (principal) markets globally;
- The complete investible universe is identified in each country through market research, leading to a list of several thousands of private infrastructure companies and projects vehicles categorised by TICCS®. Figures 2a, 2b and 2c show the breakdown by size of the universe along the business risk, industrial activity and corporate governance pillars of the TICCS taxonomy;
- We obtain an investible universe of USD2.1Tr of total asset book value at the end of 2019;
- A representative sample of the universe is built that matches its characteristics over time in terms of each TICCS® segment (business risk, industrial activity, corporate governance).
- Each of the firms included in the sample must also meet a number of firm-level inclusion criteria including the availability of its detailed financials.[1]
- This sample is used to create the list of constituents of the infra300 index. As is also shown on figures 2a, 2b and 2c, the infra300 is a close match to the structure of the investible universe. It is not a perfect match due to limitations in the availability of the data.

Each firm included in the infra300 index is studied in detail by a team of financial analysts who collect, aggregate and validate their financials, understand their history and prospects and produce quarterly updated revenue forecasts on the basis of sector and company specific information.

Each year, the investible universe is updated and the sampling recalibrated. Each quarter, the broad-market index constituents are updated for new financial data, new business information and new revenue forecasts.

With this approach, we avoid two major pitfalls of contributed indices like the ones based on appraisals:

- We avoid selection bias since the constituents of the broad-market index are sampled from a well-defined and most relevant population of investments and based on the structure of the market at each point in time.
- We also avoid any survivorship bias since there is no backfilling of the broad-market constituents, instead we 'fill forward' as new infrastructure companies become investible or have to leave the index. This is well illustrated by the number of adverse events in the history of the sampled universe: in the 630+ companies tracked in the EDHECinfra broad market universe, over the past 20 years we observe more then 150 events of default or dividend lock-up, several dozen events of bankruptcy and more than a dozen events of termination by the public sector. These defaults and bankruptcies are typically found in companies that are exposed to the economy because they have a 'merchant' business model (e.g. after a recession) or because of structural shifts affecting an entire industrial sector (e.g.

1 - See the EDHEC*infra* Universe Standard at docs.edhecinfra.com/display/UN

electricity market prices permanently lower than the marginal production cost of older power plants).

Thus, we can build a representative set of investible unlisted infrastructure companies in all the major markets where investors like Superannuation funds are active. Next, we examine how we can capture performance on the basis on the risks and fair value of each one of these investments.

4.3 Measuring Performance in Private Markets

4.3.1 The importance of fair value

The importance of assessing illiquid asset like infrastructure at their fair market value is often underestimated.

Some investors might ask why they should aim to mark illiquid assets like unlisted infrastructure at their 'fair market value' since there is no liquid market to observe frequent transaction prices, and they intend to hold them to maturity. Indeed, one of the reasons for investing in infrastructure is to generate income rather than capital gains, perhaps with a long-term liability matching objective. Hence the frequent buy-and-hold stance taken by long-term investors in infrastructure like large asset owners.

However, if the reason for holding these investments is to collect revenue over long periods, then the present value of these future flows matters. The longer the investment/holding period the more important it becomes to know how to discount these cash flows to their present value. Since these future cash flows are also dividends and therefore uncertain, their discounting requires knowing what the adequate risk premia should be. Any financial instrument that is purchased to receive cash flows in the future can only be valued by computing the present value of these future cash flows in a manner that incorporates both time value of money and the risk of not receiving these flows.

Moreover, if these future cash flows are used to match liabilities that are themselves discounted to their present value, not discounting the assets at the appropriate rate is not only inconsistent from an economic and accounting perspective, but also leads to an inadequate understanding of the asset-liability position of the investor.

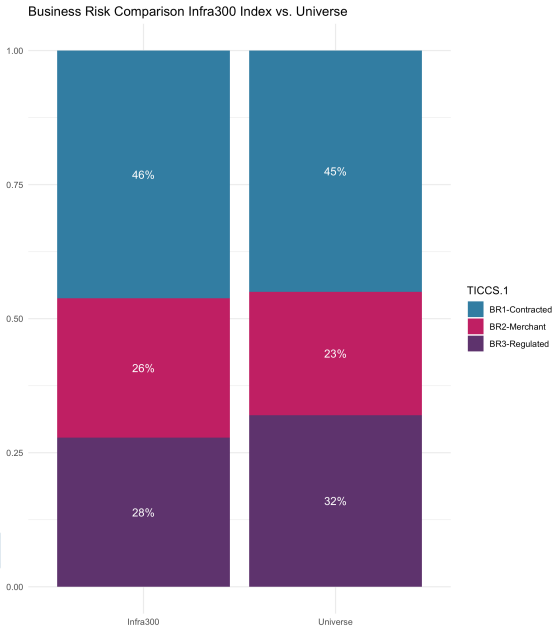
For instance, say the risk-free rate used to discount liability side of the balance sheet was to decrease – leading to an upward revaluation of the liabilities – not discounting the cash flows of future infrastructure income used to match liabilities on the asset side with equivalent market rates leads to the wrong assessment of the asset-liability position. In effect, this obviates the liability matching (or hedging) role of infrastructure assets.

Whether it involves dividends or coupons, equity or debt, infrastructure assets needs to be valued at their fair value, whatever the liquidity or strategy. The idea that an asset conserves its historical value because it is difficult to sell does not make sense from a financial point of view.

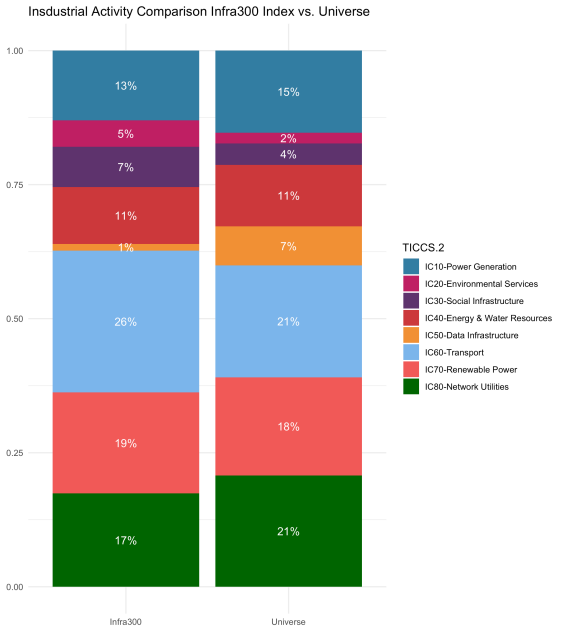
We can draw a very valid comparison with fairly illiquid assets such as corporate bonds. When valuing such instruments, investors refer to a credit spread and the rate of interest to discount future cash flows. It would not occur to long-term investors not to value their corporate bond portfolio at their fair market value. The same logic applies to unlisted infrastructure.

In the context of using the correct benchmark for unlisted infrastructure in Superannuation funds, the same logic must apply: the performance used to assess the investment performance of each MySuper product provider should reflect the current fair market value of unlisted infrastructure assets, not their historical value. This is especially important in a system where savers

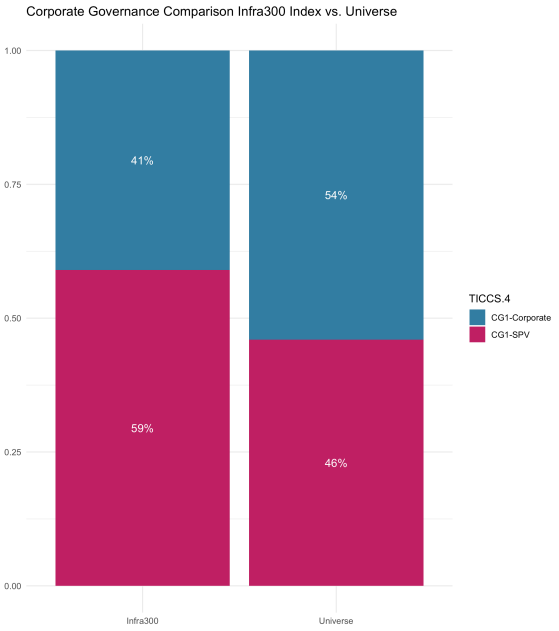
Figure 2: Investible Universe and infra300 Equity Index Weights



(a) by TICCS® Business Risk Segment



(b) by TICCS® Industrial Activity Segment



(c) by TICCS® Corporate Structure Segment

are allowed to withdraw part of their savings as a lump sum before or at retirement,[2] which creates an important need for transparency with regard to the value of illiquid assets in MySuper products.

4.3.2 Pricing very illiquid assets at the end of each quarter

Still, pricing hundreds of unlisted companies at the end of each quarter in a very illiquid market where few transactions occur in each quarter is not a straightforward task.

In private asset classes like real estate, it is possible to use comparable transactions to assess the evolution of the market of specific types of property. In the unlisted infrastructure space there are no such 'comps': infrastructure companies are very different from one another and it is hard enough to find an airport that looks like the one that has to be priced, let alone one that traded in the past three months. To use use 'comps' as one does in real estate, one would probably need to have more transaction data than there are comparable assets in the world.

However, this does not mean that the valuation of infrastructure companies is not driven by common factors. Simply because each company is quite different from the next, this does not imply that all aspects of its market value are determined by its idiosyncratic features. This is a very fundamental point which is often lost to a more 'naive' understanding of the value of private assets: the belief that they are somehow 100% idiosyncratic that is, market neutral, and can be benchmarked using an absolute rate of return. This is, of course, wrong. In fact, the impact of the Covid-19 pandemic on infrastructure businesses, which we discuss below, reminded many investors that these companies do not exist in a vacuum and are exposed to a range of risks.

2 - See for example the COVID-19 early release of superannuation: www.ato.gov.au/individuals/super/withdrawing-and-using-your-super/early-access-to-your-super/

Instead, we approach the valuation of the same illiquid, unique and heterogeneous infrastructure companies from the point of view of modern finance: while we cannot use comparable transactions to estimate their latest valuation ratios, it is possible to reduce the number of dimensions of the problem and to estimate the price of such assets for the average buyer or seller by **pricing a few systematic risk factors** that are found in each transaction, irrespective of their idiosyncratic characteristics.

In other words, while infrastructure companies are different from each other, they belong to a category of assets that have common valuation factors and these factors are what drives the formation of prices in the market.

At the end of each quarter, the fair market value of any unlisted infrastructure equity investment is a function of three components: a future stream of dividends (cash flows), the term structure of risk free rates at the relevant horizon (e.g. some investment have payoffs 20 years into the future, others 35 years, etc.) and a risk premia.

Given a stream of expected cash flows (which can come from the asset owner), and a term structure of rates (which can be built using the yield of risk-free bonds at the relevant horizons), the fair value of illiquid infrastructure assets requires measuring an equity risk premia for each firms.

Next, the fair risk premia applicable to any infrastructure investment at one point in time can be estimated in three steps.

First, using the a series of secondary market transaction prices, an expected return can be inferred and, using the risk-free curve, a deal risk premia can be extracted for each transaction. For example, if we observe a secondary market transaction for the equity of infrastructure company j, we have,

$$P_j = \sum_{t=1}^{T} \frac{D_{j,t}}{(1 + r_t + \gamma_j)^t}$$

where T is the investment's expected life, r_t is the risk-free rate at each point in time until date T and γ is the deal's risk premia.

Using a numerical solver, the value of γ_j is obtained and represents the equity risk premia required by investors in transaction j, given expected cash flows D_j, the term structure of rates r_t with $t = 1 \ldots T$, in the relevant country at the time of the transaction and the price paid P_j.

Second, each observation of a new γ_j is used to calibrate a risk factor model of the risk premia. We can write:

$$\gamma_j = \beta_1 \times \lambda_1 + \beta_2 \times \lambda_2 \cdots + \omega = \sum_{k=1}^{K} \beta_{j,k} \times \lambda_k + \omega$$

where β_k represents the exposure of company j to risk factor k at the time of the transaction and λ_k is the price or risk premia associated with factor k at that time and ω is a stochastic process representing the idiosyncratic 'noise' in transaction prices.

The risk factor exposures or β_k of each company are based on observable firm financials (e.g. size, leverage, etc. we return to this below) or other observable characteristics and the price of each risk factor are re-estimated each time a new transaction takes place.

Before observing each transaction, the set of risk factor prices obtained from the previous transaction is used as the prior value for each λ_k and the value of each risk factor price is then updated using the new information (formally, this is known as Bayesian inference and technically as a Kalman filter).

If the model provides a robust explanation of the variance of observed risk premia in actual secondary market transactions, then it can be said that the K factors provide a good model of the systematic price of risk in these transactions. To obtain a quarterly factor price for each risk factor, the average price implied by each deal of the quarter is used.

Finally, once the price of each risk factor is known at the end of each quarter, all that remains is to multiple the risk factor exposure of any infrastructure company for which we seek a fair equity value, by the price of each risk factor, so that the estimated equity risk premia $\hat{\gamma}_i$ of company i is given by:

$$\hat{\gamma}_i = \sum_{k=1}^{K} \beta_{i,k} \times \hat{\lambda}_k$$

where $\hat{\lambda}_k$ is the estimated price of risk factor k at the time of valuation. Each firm-specific market risk premia estimated at the end of each quarter is then combined with the term structure of risk-free rates that matches the horizon of the investment and therefore its duration, in the country and on the date of the valuation.

Hence, the quarterly valuations of asset i is obtained by discounting teach future dividend at time t at the marked-to-market discount factor $(1 + r_t + \hat{\gamma}_i)^t$.

Several years of research into the determinants of expected returns in unlisted infrastructure companies have led to the selection of several key factors that are found to explain observed transaction prices and their implied expected returns (Bessembinder et al., 2019; Bartram and Grinblatt, 2018; Blanc-Brude and Tran, 2019). We have established that the most relevant, robust and persistent risk factors that explain transaction prices in unlisted infrastructure transactions are:

1. Leverage (Senior liabilities over total assets)
2. Size or total assets
3. Profitability (Return on Assets before tax)
4. Investment (Capex over total assets)
5. Country risk (Term spread])
6. A range of control variables including business model and industrial activities according to the TICCS® taxonomy of infrastructure companies.

Note that these factors are in line with fundamental concepts in asset pricing and corporate finance. For example, higher leverage should

increase the cost of equity as per the Modigliani and Miller theorem, and the size, profits and investment are well established risk factors in modern equity valuation since Fama and French. It is also important to note that such an approach rigorously follows the IFRS 13 guidance on measuring fair value in unlisted investments, from focusing on principal markets, to using contemporaneous market inputs and, crucially, calibrating valuations to market inputs at the time of valuation.

These results are also robust. For the calibration of the risk premia of infra300 constituents we process the data for more than 1,000 transactions since Q1 2000 and we find that:

1. The residuals of the risk premia model $\hat{\gamma}_j - \gamma_j$ have zero mean and a symmetrical distribution i.e. white noise, indicating that any part of the risk premia observed in secondary market transactions prices that is not explained by our risk factors model is the idiosyncratic part and only relevant to individual buyers and sellers but not a driver of the average market price;

2. Out-of-sample (before the fact), the average pricing error of actual secondary market prices is in the +/- 5% range.

Thus, using a DCF-based valuation approach for hundreds of unlisted infrastructure companies implemented at the end of each quarter, total return indices of unlisted infrastructure equity investments can be computed.

The infra300 index, tracks the performance of 300 infrastructure companies and approximately USD200bn of market capitalisation worldwide (Bloomberg® ticker: infra300). Each quarter, EDHEC*infra* computes several hundred indices of performance and risks of its broad market universe that correspond to the different TICCS® segments of the market (accessible at indices.edhecinfra.com).

As well as producing a representative index relative to the different segments of the universe, we avoid the other major issues of contributed indices that rely on appraisals:

- There is no more smoothing in the returns and a proper measurement of the variance of returns is possible. This is confirmed by the absence of serial correlation in the infra300 returns compared to the often used Preqin (appraisal-based) unlisted infrastructure index as shown in table 13;

- We estimate much more realistic risk and risk-adjusted returns levels as shown in table 14.
- Likewise correlations with other asset classes are found to exist as we showed in section 3 e.g. the infra300 is correlated with fixed income returns.

Figure 3 shows the average marked-to-market discount rate of the constituents of the infra300 index. In equilibrium, market discount rates are the equivalent of expected returns. The figure shows that expected returns have decreased significantly from double digit levels ten years ago to single digits (around 8%) today. Note that discount rates increased in early 2020 with the onset of the Covid pandemic and its impact on infrastructure but risk-free rates decreased in many countries so that the discount rates stabilised quickly. Also note that, beyond their secular trend towards lower yield, expected returns vary with the evolution of risk factor prices and of interest rates, which is an important contributor to the variance of returns in unlisted infrastructure.

Table 14 shows the risk and returns of the infra300 index and several segments of the investible universe. We note that risk and performance levels are consistent with the *ex ante* characteristics of each segments: Contracted infrastructure, has lower returns and lower risk than merchant infrastructure, while project finance vehicles (which make up most of the

Table 13: Test of the Autocorrelation (Smoothing) of Total Returns in the infra300 and Preqin infrastructure indices

	infra300 Index	Preqin Unlisted Infrastructure Index
Autocorrelation	0.0201	0.39***
Box-Ljung test (p-value)	0.887	0.006

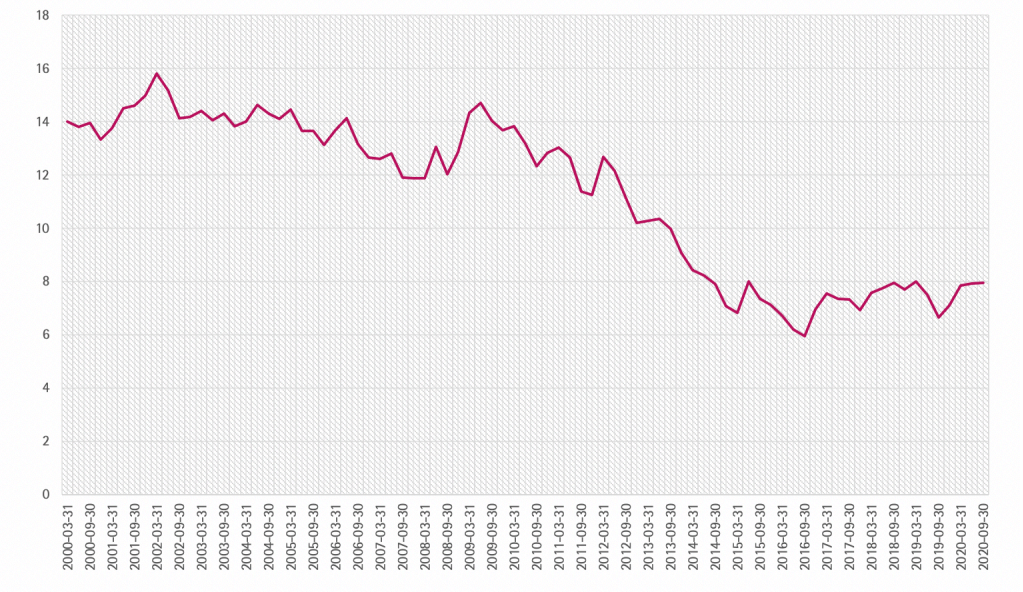
Source: EDHECinfra, Preqin. The Ljung-Box test is a type of statistical test of whether any of a group of autocorrelations of a time series are different from zero. *** indicates statistical significance at the 1% confidence level.

Table 14: A Granular View of Unlisted Infrastructure Performance: Gross Local Currency Total Returns and Risk Metrics of the Unlisted Infrastructure Asset Class and Selected TICCS® Segments

Indices	TICCS® filters	Q3 2020 total return	12-m total return	10-y total return	10-y volatility	99.5% one-year VaR	Maximum drawdown	Duration
infra300	n/a	1.84%	-7.75%	13.70%	12.50%	18.10%	13.75%	9.18 years
Contracted infrastructure	BR-10	1.6%	-2.66%	14.9%	11.2%	12.1%	10.4%	7.46 years
Merchant infrastructure	BR-20	5.4%	-6.41%	15.3%	14.2%	24.3%	21.6%	10.17 years
Merchant Road companies	BR-20, IC6050	10.8%	-1.17%	15.4%	18.5%	37.1%	30.9%	13.74 years
Airport companies	IC6010	-2.4%	-16.13%	14.3%	16.5%	31.2%	23.2%	15.76 years
Project finance SPVs	CG-10	1.4%	-1.95%	12.4%	11.0%	17.8%	10.7%	8.8 years

Source: EDHECinfra

Figure 3: A Secular Shift in Expected Returns: infra300 Index Average Market Discount Rate (%) - Q1 2000 to Q3 2020



Source: EDHECinfra

Table 15: Impact of Covid-19 on Infrastructure: Gross Quarterly Total Returns of Public Equities, FTSE Core Infrastructure Index and the infra300 Index

Index	Currency	Q4 2019	Q1 2020	Q2 2020	Q3 2020	YTD 2020
ASX	AUD	0.71%	-23.41%	16.79%	-0.06%	-10.6%
MSCI x-Australia	AUD	4.68%	-9.35%	5.91%	4.01%	-0.1%
MSCI x-Australia	AUD Hedged	7.72%	-20.85%	17.65%	6.66%	-0.7%
FTSE Core	USD	3.46%	-16.83%	8.50%	4.21%	-6.0%
FTSE Core	AUD Hedged	2.38%	-15.92%	7.11%	3.16%	-7.1%
infra300	local curr.	-2.63%	-3.91%	-3.19%	1.84%	-5.3%
infra300	USD	-2.26%	-3.27%	-6.00%	7.69%	-2.1%
infra300	AUD	-1.47%	-2.32%	-1.86%	-2.63%	-6.7%
infra300	AUD Hedged	-2.42%	-3.78%	-2.95%	2.00%	-4.7%

Source: EDHECinfra, Datastream. Gross total returns.

unlisted infrastructure by number of assets) also have a very different profile than airport corporates for example, with lower exposure to interest rate risk and more often than not a contracted business model.

These results confirm that it is possible to produce granular, highly consistent results using the methodology described above.

Next, we discuss how the validity and relevance of measuring risk properly in the unlisted infrastructure asset class is highlighted by Covid-19 lock-downs.

4.4 Covid-19: A test of the Relevance of Listed Indices as Proxy of Unlisted Infrastructure

The Covid-19 crisis was a reminder of the risks of the infrastructure asset class for investors, including Superannuation funds which had invested significantly in transport infrastructure as we showed in section 2.

Table 15 shows the quarterly total returns of listed equities (Australia and World x-Australia), the FTSE Core Index and the infra300, from Q4 2019 to Q3 2020, thus including the impact of the Covid-19 crisis on listed markets and on unlisted infrastructure. The table shows that the FTSE Core Listed Infrastructure index is not a good proxy of unlisted infrastructure as represented by the infra300 index of unlisted infrastructure companies:

1. In Q4 2019, while listed equities including the FTSE Core show positive returns, the infra300 exhibits negative quarterly returns. Indeed, in Q4 2019, in the key countries where unlisted infrastructure can be found, interest rates increased by 40 to 50 basis points on average and this led to a fall in the mark-to-market valuations of numerous unlisted infrastructure assets due to their significant exposure to interest rate risk, as shown in table 14.

2. In **Q1 2020**, with the first wave of Covid-19 lock-downs all listed equities, including the FTSE Core index, show very negative quarterly returns. This is due to their significant exposure to the market beta. Note that while the FTSE Core is mostly dominated by energy and telecom companies, as shown above, which were not immediately impacted by Covid-19 lock-downs, the FTSE Core index exhibits -16% returns. In comparison, the infra300 shows smaller negative returns in this quarter. Indeed, while the index includes numerous transport companies that were affected by the lock-downs, it also includes many more 'contracted' infrastructure businesses which did not see their cash flows impacted by the Covid-19 lock-downs. infra300 Q1 2020 returns are negative because the risk premia increased for almost all assets (as shown on figure 3) but in aggregate the impact on the unlisted infrastructure sector was less dramatic than for listed equities, despite sectors like airports having strong negative returns. The FTSE Core Index clearly fails to capture this effect.

3. In **Q2 2020**, with the spread of the pandemic and the economic impact of the lock-downs, more infrastructure sectors began to be affected negatively such as utilities and roads. We see in table 15 that the infra300 continues to exhibit negative returns in this quarter but listed benchmarks including the FTSE Core Index returned to strong positive quarterly returns as a result of the strong rebound in capital markets. Once again, we see that the unlisted and listed indices follow very different dynamics and that the FTSE Core does not represent what happens to the unlisted infrastructure asset class.

4. In **Q3 2020**, the infra300 returns to positive territory as the unlisted infrastructure

market risk premia stabilises (figure 3) and some infrastructure sectors exhibit a strong rebound in revenues such as toll roads. The FTSE Core index was also positive but not for the same reasons since it is exposed to different risks and does not include significant exposure to transportation assets, one of the main types of unlisted infrastructure held in superannuation products.

5. On a **YTD basis in 2020**, we see that the FTSE Core exhibits -7% returns in AUD hedged terms whereas unlisted infrastructure has proven more resilient and is down -4.7% globally, despite the larger losses experienced in the most exposed merchant transport sectors. Clearly, as a benchmark of how the unlisted infrastructure performed during the Covid-19 pandemic, the FTSE Core is a poor proxy of the unlisted infrastructure sector, given that the infra300, which is build directly from measures of the fair market value of a representative set of unlisted infrastructure companies, shows the actual impact of higher risk premia, lower cash flows and lower interest rates on unlisted infrastructure NAVs.

Thus, while the FTSE Core Index was shown in previous sections to be wholly inadequate as a proxy for unlisted infrastructure, in particular in terms of coverage and representativeness of the investments made by Superannuation funds, it is possible to build and produce a fair benchmark of the unlisted infrastructure asset class.

The infra300 is designed to be a bias-free, representative view of the 'principal' market i.e. the main markets in which buyers and sellers of unlisted infrastructure companies are the most active, including Australian Superannuation funds. It is based on a mark-to-market asset pricing technology that captures the risks inherent to the asset class and produces robust, realistic results that can serve as the basis for benchmarking the investments made in MySuper products, as the example of the Covid-19 crisis demonstrates.

In the next section, we discuss the impact of using the infra300 as the benchmark of the unlisted infrastructure asset class instead of the FTSE Core Index on both the Simple Reference Portfolio and the Strategic Asset Allocation performance tests of MySuper by APRA.

5. Impact of Switching Infrastructure Benchmark on APRA tests

In this section, we look at the two performance tests that APRA currently produces for the Heatmap: the Simple Reference Portfolio test (SRP test) and the Strategic Asset Allocation test (SAA test) and consider how they may be impacted by switching the benchmark of the unlisted infrastructure asset class from the listed FTSE Core index to the infra300 index of unlisted investments in infrastructure equity described in detail in the previous section.

The *Heatmap* reports individual product investment performance over medium to long-term time horizons and compares it with benchmark portfolios. In these tests, the net investment return of each MySuper product is measured against a Simple Reference Portfolio (the SRP test) – a notional portfolio of passive, low cost and liquid investments – and a Strategic Asset Allocation benchmark portfolio (the SAA test) – which reflects the choice of SAA of the provider. Both portfolios are product-specific and tailored to reflect the investment strategy and level of risk of the product. The returns on both the SRP and benchmark portfolio are calculated using asset allocation data reported to APRA on a quarterly basis (APRA, 2020a).

We examine two potential evolutions of the treatment of unlisted infrastructure in the APRA performance tests:

1. The impact on the SRP of classifying unlisted infrastructure as more defensive than it currently is, given the evidence provided by the infra300 on the defensiveness of the asset class, which is not captured by the FTSE Core benchmark currently used (as shows in section 3)
2. The impact on the SAA test of using the infra300 instead of the FTSE Core Index, in particular, whether it would support the regulator's objective to 'punish underperformance' in MySuper products.

5.1 Tweaking the Simple Reference Portfolio Test

The SRP test uses a mix of passive, low cost and liquid investments based on a simplified 'Growth' vs. 'Defensive' portfolio profile determined for each MySuper product. This is akin to the frequent categorising of portfolios by relative stock and bonds mix e.g. 60/40, 20/80 etc.

To perform the test, APRA first determines the split between 'Growth' and 'Defensive' assets of the relevant MySuper product. This simple profile is determined using a list of 12 standard asset classes categorised as either 'Growth' or 'Defensive' (see table 20 in the Appendix). Some asset classes, like unlisted infrastructure, may be split between the two.

Once the Growth/Defensive mix of a MySuper product is determined, APRA calculates the returns of the reference portfolio by combining the Growth/Defensive profile of each product with the returns of two benchmark portfolios for the Growth and Defensive styles. The Growth and Defensive style benchmarks are built using a combination of liquid asset classes described in table 21 available in the Appendix. The SRP return of each product is then compared to the reported returns of the product in question. All returns are net, annualised five-year returns.[1] Those products

1 - APRA is aiming to increase this horizon to a longer period.

that generate lower returns than the SRP are identified as 'under-performing'.

In this context, unlisted infrastructure is considered to have a 75% Growth and 25% Defensive profile. In other words, any allocation to unlisted infrastructure in a MySuper product will contribute for 75% to the allocation to the 'Growth' reference portfolio and 25% to the 'Defensive' one. We note that in this framework APRA treats unlisted infrastructure differently than its listed counterpart since it considers the latter to be 100% 'Growth'. Hence, APRA implicitly acknowledges that listed and unlisted infrastructure investments can be expected to have different risk-return profiles.

In the light of the findings shown in sections 3 and 4, we argue that unlisted infrastructure should be considered more defensive since it possess properties that help protect portfolios in downside markets like lower VaR and lower maximum drawdown. We also showed in section 3 that the infra300 index exhibits significant correlations with both international fixed income and Australian fixed income, asset classes that are considered defensive in the APRA classification, and lower correlations to listed equities.

On this basis, **we propose 'tweaking' the classification of unlisted infrastructure in the SRP test: based on the reported and highly significant 50% return correlation with fixed income, we argue that unlisted infrastructure should be considered 50% growth and 50% defensive.**

To conduct this analysis, we use the MySuper asset allocations for the 138 single strategy products obtained from the Quarterly MySuper statistics.[2]. We use single strategy (non-lifecycle) products to keep the analysis simple but see no reason to believe that the results would be fundamentally different using the relevant data for life-cycle funds.

We make the following calculations:

1. The SRP is first calculated using the standard APRA formula. We use the same indices to create the Growth and Defensive portfolios for each product. The proportion of unlisted infrastructure and unlisted property is assumed to be stable amongst products, and is the average of each funds allocation to unlisted infrastructure and property as described in the Quarterly superannuation performance statistics.
2. We then make the same calculation using a 50-50 split between growth and defensive for unlisted infrastructure. We find that increasing the defensive classification of unlisted infrastructure from 25% to 50%, decreases the SRP for funds who invest in infrastructure from 7.227% to 7.165%. This is normal since the defensive style can be expected to have lower returns but the change is clearly marginal, thus *making the test equally robust from the point of view of the regulator* but better at reflecting the defensive characteristics of the unlisted infrastructure asset class in individual cases.

Thus, we recommend this change to the SRP test: **unlisted infrastructure should be considered 50% defensive.**

Next, we consider the direct impact of changing the unlisted infrastructure benchmark used in the asset allocation test of MySuper product to the infra300 index.

5.2 Using the infra300 in the Strategic Asset Allocation Test

The SAA test assesses the value that investment managers add through the selection of underlying investments. Taking the asset class allocations reported for each product or life-cycle strategy's stage, realised returns are compared to the returns of a 'model' portfolio using the same

2 - Quarterly MySuper statistics: Table 1a

Table 16: Impact of Using the infra300 instead of the FTSE Core in the APRA SAA Test in 63 Single Strategy MySuper Products

	Products with no change	Products with lower performance	Products with better performance
By Number	10	39	14
By Percentage	15.8%	61.9%	22.2%

Source: EDHECinfra

Table 17: Summary statistics of the impact of Using the infra300 instead of the FTSE Core in the APRA SAA Test in 63 Single Strategy MySuper Products. Mean, standard deviation, maximum and minimum are the summary statistics comparing each product's 5-year return if the infra300 index is used instead of the FTSE Core Index.

Average Impact	Standard Deviation	Minimum	Maximum	Average Allocation to Infrastructure
0.007%	0.5086%	-1.873%	1.486%	5.609%

Source: EDHECinfra

asset class weights (asset allocation) combined with pre-determined benchmarks for each asset class.

The indices currently employed for the Heatmap test are described in table 22 in the appendix and include the FTSE Core Listed Infrastructure Index as the proxy of unlisted infrastructure.

As we argued in previous sections, the treatment of unlisted infrastructure is based on a proxy that is not representative of how superannuation funds invest in unlisted infrastructure. In the context of the SAA test, the use of the wrong proxy results in making incorrect conclusions as to how much value is added by managers. Implementing the SAA test with listed benchmark assigned to proxy unlisted infrastructure would lead to random, unscientific and fundamentally unfair outcomes:

- In some periods the listed market exhibits much stronger returns than unlisted infrastructure, which is characterised by its defensive attributes and attractive risk-adjusted returns. In this case, investors in unlisted infrastructure would be unjustly punished by the SAA test.
- In other periods, listed markets may have lower returns than private assets and investors would benefit from an 'apparent' alpha just by allocating finds to unlisted infrastructure but without exhibiting any skills while doing so.
- In the long run, it may also tend to make asset managers pick assets that are closer to the benchmark so they are more likely to meet the performance test.

Using a representative index like the infra300 (hedged-AUD) would solve this problem. As shown in previous sections, the infra300 is much closer to the investment strategy of Superannuation funds in unlisted infrastructure and also designed to be representative of the unlisted infrastructure equity universe.

To determine what the impact of using the infra300 in the SAA test instead of the FTSE Core Index would be, we make a similar comparative analysis between 63 Single Strategy MySuper products and **report how many products achieve or fail the APRA SAA test using the infra300 instead of the FTSE Core**.

We adopt the same methodology as APRA, calculating the five-year annualised return of the SAA portfolio as of Q2 2020 (for the Q2 2015 to Q2 2020 period), and only for single strategy products. We use the asset allocation data from the Quarterly MySuper Statistics for the period September 2013 - September 2020 i.e. seven years. Asset allocation data is updated annually

but computations made quarterly. Thus the SAA data is lagged and assumed to be constant until it is updated in the previous periods. Asset allocation weights are multiplied by the returns of the different asset classes to obtain the SAA test benchmark returns each quarter. Fee assumptions are consistent with APRA for all asset classes. Fee assumptions for the infra300, which are consistent with private investment costs, are the same as the ones detailed in section 3. A few more standard assumptions have to be made that are detailed in the appendix A.3.

Given the results shown in Chapter 3, we know that replacing the FTSE Core Index with the infra300 which exhibits higher five-year returns as of Q2 2020 than the FTSE Core Index could, on average, make beating the SAA benchmark slightly harder for products that invest in infrastructure. Any finding of out-performance driven by the infrastructure allocation could then reasonably be attributed to skilled management.

Table 16 shows that adopting the infra300 as the unlisted infrastructure benchmark, because it uses the actual performance of unlisted infrastructure assets, leads to a re-assessment of the performance of a number of products, with some exhibiting a lower SAA returns, whilst others show a better performance. We find that:

1. 14 out of 63 products, score better than the SAA benchmark when using the infra300 instead of the FTSE Core index.

2. 39 products score less well than they would using the FTSE index.

3. 10 products fare the same irrespective of the choice of infrastructure benchmark, mostly because they invest very little or not at all in this asset class.

4. A single product actually switches from outperforming its SAA benchmark to underperforming it because of the change of infrastructure benchmark from the FTSE Core to the infra300.

Thus, **using the infra300 index as the proxy of unlisted infrastructure does not overturn the results of existing SAA tests and preserves the regulator's objective of applying a robust market test to Superannuation products. Because it would uses the correct benchmark, as we argued above, instead of punishing managers randomly and unfairly, using the infra300 would reward those managers that invested well, in the relevant unlisted infrastructure market.**

Table 17 shows that the change in five-year returns of each product is, on average, quite small but significant for some products. Looking at APRA's Q2 2020 *Heatmap*, we see that the products that outperform in the SAA test do so on average by 0.71% (median 0.52%), whilst firms that underperform in the SAA test do so on average by -0.63% (median -0.65%). This puts the size of the mean impact on returns of switching infrastructure index in perspective: while the average effect is unlikely to change the test result, as we report above, the more infrastructure plays a role in the product, the more relevant using the correct benchmark becomes and the more it makes a difference in the SAA test.

These finding are in line the intent of the 'Your Future, Your Super' legislation and demonstrates the importance of including a relevant, representative benchmark for unlisted infrastructure investment.

Using the infra300 in the APRA Heatmap and subsequent performance tests would not only be much more representative of the underlying investments made and risks taken by investors in unlisted infrastructure but also help identify those managers that actually create value through these investments.

A. Appendix

A.1 Index Coverage Data

List of countries where Superannuation funds invest that are not included in the chapter 2 analysis because they do not meet the IFRS criteria of the 'principal market' in the EDHECinfra Universe Standard: Argentina, Belgium, Bolivia, China, Colombia, Costa Rica, Croatia, Czech Republic, Ecuador, Egypt, El Salvador, Estonia, Greece, Guatemala, Guernsey. Honduras, Hong Kong, Hungary, India, Indonesia, Jamaica, Japan, Lithuania, Luxembourg, Mexico, Panama, Peru, South Korea, Switzerland, Taiwan, Thailand, Turkey, Vietnam.

List of countries where Superannuation funds invest that are included in the chapter 2 analysis: Australia, Austria, Brazil, Canada, Chile, Germany, Spain, Finland, France, United Kingdom, Hungary, Ireland, Italy, Malaysia, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Russia, Singapore, Slovakia, Sweden, USA

List of Constituents found in both FTSE Developed Core Infrastructure Index and Vanguard MSCI Index International Shares ETF: Auckland International Airport Ltd (NZAIAE0002S6), ONEOK Inc (US6826801036), East Japan Railway Co (JP3783600004), PPL Corp (US69351T1060), West Japan Railway Co (JP3659000008), Pinnacle West Capital Corp (US7234841010), Central Japan Railway Co (JP3566800003), Cellnex Telecom SA (ES0105066007), American Tower Corp (US03027X1000), Atmos Energy Corp (US0495601058), Kyushu Electric Power Co Inc (JP3246400000), Canadian National Railway Co (CA1363751027), Public Service Enterprise Group Inc (US7445731067), Hong Kong & China Gas Co Ltd (HK0003000038), FirstEnergy Corp (US3379321074), Edison International (US2810201077), Ameren Corp (US0236081024), MTR Corp Ltd (HK0066009694), Chubu Electric Power Co Inc (JP3526600006), Southern Co/The (US8425871071), Pembina Pipeline Corp (CA7063271034), Crown Castle International Corp (US22822V1017), Cheniere Energy Inc (US16411R2085), Sempra Energy (US8168511090), National Grid PLC (GB00BDR05C01), American Electric Power Co Inc (US0255371017), Union Pacific Corp (US9078181081), CK Infrastructure Holdings Ltd (BMG2178K1009), Canadian Pacific Railway Ltd (CA13645T1003), Xcel Energy Inc (US98389B1008), Toho Gas Co Ltd (JP3600200004), Tohoku Electric Power Co Inc (JP3605400005), Evergy Inc (US30034W1062), Kansai Electric Power Co Inc/The (JP3228600007), SES SA (LU0088087324), OGE Energy Corp (US6708371033), Williams Cos Inc/The (US9694571004), Kansas City Southern (US4851703029), WEC Energy Group Inc (US92939U1060), CSX Corp (US1264081035), CMS Energy Corp (US1258961002), Infrastrutture Wireless Italiane SpA (IT0005090300), Alliant Energy Corp (US0188021085), Naturgy Energy Group SA (ES0116870314), Consolidated Edison Inc (US2091151041), Aeroports de Paris (FR0010340141), Atco Ltd/Canada (CA0467894006), Dominion Energy Inc (US25746U1097), American Water Works Co Inc (US0304201033), Aena SME SA (ES0105046009), Duke Energy Corp (US26441C2044), TC Energy Corp (CA87807B1076), Entergy Corp (US29364G1031), United Utilities Group PLC (GB00B39J2M42), Kinder Morgan Inc (US49456B1017), Red Electrica Corp SA (ES0173093024), Elia Group SA/NV (BE0003822393), NextEra Energy Inc (US65339F1012), SBA Communications Corp (US78410G1040), Enagas SA (ES0130960018), Terna Rete Elettrica Nazionale SpA (IT0003242622), Osaka Gas Co Ltd (JP3180400008), Canadian Utilities Ltd

(CA1367178326), Snam SpA (IT0003153415), Atlantia SpA (IT0003506190), CenterPoint Energy Inc (US15189T1079), Fortis Inc/Canada (CA3495531079), Enbridge Inc (CA29250N1050), Fraport AG Frankfurt Airport Services (DE0005773303), Getlink SE (FR0010533075), Essential Utilities Inc (US29670G1022), Inter Pipeline Ltd (CA45833V1094), Chugoku Electric Power Co Inc/The (JP3522200009), Severn Trent PLC (GB00B1FH8J72), Tokyo Electric Power Co Holdings Inc (JP3585800000), CLP Holdings Ltd (HK0002007356), Tokyo Gas Co Ltd (JP3573000001), Emera Inc (CA2908761018), NiSource Inc (US65473P1057), Power Assets Holdings Ltd (HK0006000050), Norfolk Southern Corp (US6558441084), Eversource Energy (US30040W1080), Keyera Corp (CA4932711001)

A.2 Mean-Variance Spanning Tests

The null hypothesis of the Huberman and Kandel (1987) is that the mean-variance frontier with the addition of the new asset or index can be replicated by the existing mean-variance frontier without adding the new asset or index. If the null is rejected, the addition of the new index provides greater diversification benefit to the portfolio. The two-stage test by Kan and Zhou (2012) further investigates the reason behind the rejection of the Huberman and Kandel (1987) null hypothesis, where the first stage tests the null hypothesis where the addition of the new asset or index does not change the tangency portfolio; the second stage tests the null hypothesis where the addition of the new asset or index does not change the global minimum variance portfolio. Thus, if the Kan and Zhou (2012) null hypotheses are rejected, the addition of the new index provides greater diversification benefits to the portfolio by changing the tangency and global minimum variance of the portfolio.

A.3 SRP and SAA Test Inputs and Assumptions

Tha stylised SAA analysis done with publicly available information assumes that the MySuper fund asset allocations are a good indications of all defined contribution superannuation funds and products. Also note that to make these computations, using the available APRA data on SAA, we have to make a number of assumptions:

- Cash returns = Cash - Benchmark asset allocation (prior period) × Average (Australian Cash returns, International Cash returns) - 50% split between international and domestic;
- Fixed income = Fixed Income - Benchmark asset allocation (prior period) × Average (Australian Fixed Income returns, International Fixed Income returns) - 50% split between international and domestic
- Australian equity = Australian listed equity - Benchmark asset allocation (prior period) × Australian equity returns
- International equity = International listed equity - Benchmark asset allocation (prior period) × Average(International hedged equity returns, International unhedged equity returns)
- Property = Property - Benchmark asset allocation (prior period) × Average (Australian property returns, International property returns)
- Infrastructure FTSE = Infrastructure - Benchmark asset allocation (prior period) × Average (Australian Infrastructure returns, International Infrastructure returns)
- Infrastructure EDHEC = Infrastructure - Benchmark asset allocation (prior period) × Average (EDHEC*infra* Australian Unlisted Infrastructure Equity, EDHEC*infra*300 Index Hedged to AUD)
- Other = (Other investments - Benchmark asset allocation (prior period) + Commodities - Benchmark asset allocation (prior period)) × 25% International Equity (hedged), 25% Inter-

Table 18: Mean-Variance Spanning Test - Quarterly Returns

Statistic	value
H&K	2.255318
p-value	0.124965
Stepdown 1	1.195737
p-value	0.284204
Stepdown 2	3.291041
p-value	0.080787

Table 19: Mean-Variance Spanning Test - Monthly Returns

Statistic	value
H&K	2.847416
p-value	0.062853
Stepdown 1	2.7573
p-value	0.100041
Stepdown 2	2.885785
p-value	0.092537

Table 20: Growth/Defensive Classification of Asset Classes used in the SRP Test

SAA Asset Class	Growth/ Defensive classification
Equity, Listed Property, Listed Infrastructure, Unlisted Equity, Equity (listing and/or domicile not specified)	100% Growth
Unlisted Property, Unlisted Infrastructure	75% Growth, 25% Defensive
Commodities, Other	50% Growth, 50% Defensive
Fixed Interest, Cash	100% Defensive

Source: APRA Information Paper Heatmap - MySuper products [pg 14]
https://www.apra.gov.au/sites/default/files/Information%20paper%20-%20Heatmap%20-%20MySuper%20products.pdf

Table 21: Reference Growth/Defensive Portoflios used in the SRP Test

Growth Portfolio	%	Defensive portfolio	%
Australian equity	50	Australian fixed interest	
International equity (hedged)	25	International fixed interest	40
International equity (unhedged)	25	Australian Cash	20

Source: APRA (2020a, p.14)

Table 22: APRA Heatmap Asset Allocations, Indices, Fees and Tax Assumptions

Asset Class	Index	Fee Assumption	Assumed effective tax rate
Australian Equity	S&P/ASX 300	0.05%	0.00%
International Equity (hedged)	MSCI All Country World Ex-Australia Equities Index with Special Tax (100% hedged to AUD)	0.11%	14.00%
International Equity (unhedged)	MSCI All Country World Ex-Australia Equities Index with Special Tax (unhedged in AUD)	0.09%	14.00%
Australian Property	S&P/ASX 300 A-REIT Index	0.12%	14.00%
International Property	FTSE EPRA/NAREIT developed ex Australia rental hedged to AUD	0.22%	14.00%
Australian Infrastructure	FTSE Developed Core Infrastructure Index hedged to AUD	0.26%	14.00%
International Infrastructure	FTSE Developed Core Infrastructure Index hedged to AUD	0.26%	14.00%
Australian Fixed Interest	Bloomberg Ausbond Composite 0+ Index	0.10%	15.00%
International Fixed Interest	Bloomberg Barclays Global Aggregate Index (hedged in AUD)	0.10%	15.00%
Australian Cash	Bloomberg Ausbond Bank Bill Index	0.04%	15.00%
International Cash	Bloomberg Ausbond Bank Bill Index	0.04%	15.00%
Other (assets categorised as Other / Commodities)	25% International Equity (hedged), 25% International Equity (unhedged), 50% International Fixed Interest	As per the underlying asset classes	

Source: APRA (2020a, p.29)

national Equity (unhedged), 50% International Fixed Interest

- Unlisted equity = Unlisted equity - Benchmark asset allocation (prior period) × average(Australian equity returns, International Equity (hedged), International Equity (unhedged))

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