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2019 Global Infrastructure Investor Survey

Benchmarking Trends and Best Practices

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Executive Summary



Executive Summary

The 2019 EDHEC*infra* / Global Infrastructure Hub survey of infrastructure investors focused on the role of benchmarks and revealed a number of key findings about the benchmarking practices in the unlisted-infrastructure-investment space for asset allocation, performance monitoring and risk management.

Although it is often neglected, the choice of benchmark is a foundational element in the investment process. First, it is an essential source of both the risk and the returns of a portfolio. Previous studies have shown that more than 90% of the variability in portfolio returns over time is explained by the initial asset allocation.

Second, portfolio out-performance and its measurement also depends on the choice of benchmark. The use of inadequate benchmarks can lead to an incorrect evaluation of the manager's performance.

Finally, in the case highly illiquid asset classes like infrastructure, managers and investment teams are given the dual objective of delivering a portfolio in line with the investment strategy (building it deal by deal, sometimes over a decade), and to outperform the average implementation of this strategy (deliver alpha). Representative benchmarks are thus absolutely necessary to determine managers' success with respect to these two goals.

In effect, without adequate benchmarks, the development of a global infrastructure asset class, which is one of the objectives of the

G20, is necessarily limited, if not compromised.

The results of this survey highlight the need to use better-defined benchmarks that measure risk and can help investors make better informed asset-allocation, monitoring and risk-management decisions.

The Largest, Most Representative Survey of Infrastructure Investors Ever Done

This publication presents the results of the largest survey ever undertaken of asset owners and managers active in the infrastructure space, with more than 300 respondents, including 130 asset owners representing USD 10 trillion in assets under management (more than 10% of global AUM). The survey is representative of the views of large, sophisticated investors.

With regards to the use of benchmarks, several key findings can be highlighted.

Investors Mostly Use Absolute-Return Benchmarks, but Less than 10% Think They Are Good Enough

Three-quarters of equity investors use benchmarks based on the risk-free or inflation rate.

But more than 90% agree that such benchmarks are not adequate.

Executive Summary

At least 50% said that these benchmarks are not representative, do not measure risk, and do not allow asset-liability management.

Current absolute-return infrastructure equity benchmarks are not ambitious and not hard to beat. Most investors use a spread over real or nominal rate of 400 to 500 basis points.

In a low-rate environment, this is less than annualised stock market returns, which is surprising given the illiquidity and opacity of unlisted infrastructure the asset class.

When Investors Use Relative Benchmarks, They Fall Back on “Fake Benchmarks”

In 50% of cases, the preferred relative infrastructure benchmarks are listed infrastructure indices, which have been shown to have 100% correlation with broad equity indices by academic research. As a result, these investors in unlisted infrastructure are likely to misrepresent the risks they take. What is more, the majority of investors reported not investing in listed infrastructure, despite using such indices as benchmarks.

In 25% of cases, investors use “industry peers” as a relative benchmark, despite the well-known issues encountered with valuation and return smoothing in private markets, as well as the difficulty of making direct comparisons because each investor in infrastructure is exposed to an *ad hoc* segment of the universe.

With Current Benchmarking Practices, Investors in Infrastructure Equity Cannot Understand Their Risk and Define Their Strategy

The practices described by investors correspond more to the definition of a hurdle rate than a benchmark.

Despite the lack of adequate risk measures in all the reported practices, most investors declared using the same benchmarks for their asset allocation, performance monitoring, and risk management of infrastructure investments. Still, these benchmarks cannot be used to identify systematic rewarded risks, monitor risk-adjusted performance, or set risk budgets.

Debt Investors Face Similar Issues but Are More Ambitious in Terms of Performance

Two thirds of infrastructure debt investors declared using absolute benchmarks. The spreads they reported are much closer to current market rates in the private debt space.

Still, they face the same issues as equity investors in terms of risk measurement.

Relative credit benchmarks used by debt investors are also more relevant, at least for infrastructure corporate debt. They fail, however, to capture the characteristics of project-finance debt.

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ESG is Increasingly a Matter of First Principles

Since the 2016 edition of this survey, the proportion of investors who said they would be willing to forsake returns in exchange for better ESG (environmental, social, and governance characteristics) in their portfolio has more than doubled and now includes one-third of respondents.

The consensus about the impact of ESG on returns is also evolving, with a majority of investors now reporting that they expect ESG to decrease returns since it is also expected to reduce short- and long-term risks.

In 2016, such beliefs were different. One-third of respondents consistently reported that they do not know if there is any relationship between ESG and financial performance.

Investor Appetite Remains Strong

Respondents reported consistent intentions to continue investing more in infrastructure, including in emerging markets.

Respondents' choices of preferred markets have not changed much and continue to reflect the reality of the global investable-infrastructure sector (i.e., large economies that have historically favoured the privatisation of infrastructure services, such as the UK or Australia, are the markets into which investors can be expected to deploy capital).

In emerging markets, perceptions of future needs matter more, irrespective of current investment opportunities or recent difficulties. Hence, India, China and Brazil remain at the top of the list of investors' preferred markets.

1. Introduction



1. Introduction

This paper presents the findings of the third EDHEC*infra* / Global Infrastructure Hub survey of infrastructure-investor preferences and perceptions.

The 2019 edition of the survey drew the largest group of respondents so far, with more than 300 individuals taking part. The largest group of respondents was asset owners, who numbered more than 130 different organisations representing in excess of USD 10 trillion of assets under management (i.e., approximately 12% of the global AUM at the end of 2018).

This year's survey focuses on a central aspect of investors' relationships with infrastructure investment: benchmarking.

We asked infrastructure-asset owners and managers as well as lenders and consultants a series of questions about the type of benchmarks they use for asset-allocation, performance-monitoring, and risk-management purposes.

We also asked respondents to evaluate the quality and usefulness of the benchmarks they use in relation to infrastructure investment.

Infrastructure equity or debt are fairly new entries in the list of asset classes that investors may add to their investment set.

As with most new alternative asset classes, historical track records and direct proxies can be hard to come by.

As a result, both asset owners and managers have made choices with regards to benchmarking that they inherited from other alternative asset classes, including hedge funds, real estate, and private equity.

However, respondents themselves acknowledged the numerous limitations of their current options for benchmarking infrastructure-investment allocation, track record, and exposure.

This survey is the opportunity to highlight these issues and suggest a number of ways forward.

A benchmark is defined as a portfolio of reference and, consequently, it is supposed to be representative of the risks of the managed portfolio. It is widely accepted that the choice of benchmark plays an important role in portfolio performance.

Benchmark construction allows objectives to be fixed in terms of the portfolio's systematic risk exposure, which is reflected in the choice of strategic asset allocation. Benchmarks also serves to evaluate portfolio performance.

In this respect, it matters to highlight the difference between indices and benchmarks (Amenc et al., 2008).

An index is a portfolio that is representative of one or more risk factors. For example, a geographic index aims to be representative of the risk of the stock market of the country under consideration, while a style index and

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a sector index are representative of the risks of a particular investment style or industry sector.

However, the terms 'indices' and 'benchmarks', while they are often used as synonyms, do not in fact mean the same thing. An index is representative of the market as a whole or of a certain segment of the market, while a benchmark must be representative of the risks chosen by an investor over the long term.

Instead of simply choosing an index as their benchmark, investors can choose to use a combination of indices or any portfolio. Therefore, even though an index can be used as benchmark, **the adequate benchmark is not necessarily an index**. And using a benchmark in the investment process does not necessarily mean resorting to passive or indexed management.

An important question then is whether a given index can be considered to be good benchmarks. Since, a benchmark must be representative of the risks the portfolio is exposed to during the analysis period, if managers aim to track an index closely, and only deviates to make specific bets, then this index can be considered appropriate.

On the other hand, if managers obtain their performance from a choice of systematic risk factors that are different from those inherent to the proposed index, then the latter will not make a good benchmark.

The characteristics of an appropriate benchmark are now well-known (see Bailey 1992): A benchmark must be unambiguous, investable, measurable, and appropriate. In addition, it must reflect the investor's current investment views, and it must be specified in advance.

To respect these conditions, asset owners and managers must define a benchmark for which the risk exposure is truly reflective of the intended focus of their portfolio over a given period.

Hence, a broad market infrastructure index would seldom reflect the characteristics of a given portfolio, and is unlikely to be suitable for asset allocation or evaluating performance since the investor's infrastructure portfolio has an exposure to systematic risk factors that differs from that of the index.

In effect, broad market indices are not neutral choices of risk factors: in the case of infrastructure, they are the result of a several decades of public procurement and privatisation of infrastructure and as such encapsulate various geographic and industrial tilts.

Infrastructure style indices, can be envisaged to reflect the growth of specialisation in infrastructure fund management e.g. renewables only, and would better reflect the characteristics of portfolios that are managed according to a specific style.

Still, given the lumpiness and uncertainty about the timing of transactions

1. Introduction

that characterises infrastructure, **the construction of customised benchmarks appears to be the best way of providing asset owners and managers with a benchmark suited to the style of their infrastructure portfolio.**

Although it is often neglected, the choice of benchmark is a foundational element in the investment process. First, it is an essential source of both the risk and the returns of a portfolio. In a famous study, Brinson et al. (1991) conclude that more than 90% of the variability in portfolio returns over time is explained by the initial asset allocation.

Second, portfolio out-performance and its measurement also depends on the choice of benchmark. The use of inadequate benchmarks can lead to an incorrect evaluation of the manager's performance.

In effect, without adequate benchmarks, the development of a global infrastructure asset class, which is one of the objectives of the G20, is necessarily limited, if not compromised.

Infrastructure investors need risk-adjusted benchmarks of unlisted infrastructure equity and debt in order to determine the size of their allocation to infrastructure, monitor the implementation of their investment policy decisions, and manage the risks associated with creating exposures to such long-term illiquid assets.

We believe that much progress is possible in this area: from better fair-value estimates

of performance to proper measures of portfolio risk, diversification, and drawdown, infrastructure-investment benchmarking remains in its infancy.

In this survey, we also query investors' intentions and perceptions of global infrastructure markets, in particular their evolving views of infrastructure investment in emerging markets and the role of ESG in their portfolio.

The rest of this paper is structured thus: Chapter 2 presents the survey respondents by organisation type and investor focus.

In chapter 3, we begin by examining respondents' view on how to achieve diversification and ask a simple question: is infrastructure investment always active?

In chapters 4, 5, and 6, we review the responses to questions relative to the use of benchmarks for asset allocation, performance monitoring, and portfolio risk management.

Chapter 7 looks at the top infrastructure markets selected by respondents. We discuss the evolution of the infrastructure-investment sector, including changing views toward emerging markets as well as the impact of monetary policy and foreign-exchange risk on infrastructure investment.

Chapter 8 focuses on asset owners and how they define their infrastructure-investment

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mandates as well as their ability to compare asset managers.

Lastly, chapter 9 compares attitudes to ESG investing in infrastructure since the first EDHEC/GIH survey of 2016.

Chapter 10 summarises our findings and concludes.

2. Respondents



2. Respondents

This survey is the largest ever undertaken of asset owners and managers active in the infrastructure space.

It includes the answers of more than 300 respondents, including 130 representing asset owners with an aggregate USD 10 trillion in assets under management (i.e., in excess of 12% of global AUM at the end of 2018).

Survey questions were sent to infrastructure-investment practitioners identified by EDHEC*infra*, including CIOs, investment directors, heads of infrastructure, or sector specialists working for asset owners and managers, banks, and major consultancies. Data for this survey was collected through an online form and telephone interviews.

The survey responses represent the views of large asset owners and managers that have, for the most part, already invested billions of dollars in the unlisted infrastructure equity or debt asset classes.

In this chapter, we describe survey respondents by type of organisation, assets under management, and investment focus.

2.1 Respondent Types

The 300+ respondents can be split into four categories: The two largest are asset managers, or GPs (comprising infrastructure-fund managers and asset-management firms), and asset owners, or

LPs (pension funds, insurance companies, and sovereign wealth funds).

Responses from banks have been classified under a third category, which includes investment and development banks engaged in project financing. The fourth category includes investment consultants.

Figure 1 shows the number of respondents by organisation type. Asset owners is the largest category, representing about 43% of respondents.

Asset managers represent 33% of responses, while commercial and multilateral development banks and investment consultants make up 13% and 11% of respondents, respectively.

Figure 2 shows the AUM of asset owners involved in the survey. The survey is representative of the views of large, sophisticated investors, with 50% of respondents reporting more than USD 25 billion AUM and 30% reporting more than USD 50 billion AUM.

Note that in the rest of this survey we report aggregate results as well as breakdowns for different types of organisations.

However, when different groups of respondents provided essentially similar answers, results are only presented in aggregate in the interest of parsimony.

2. Respondents

Figure 1: Survey respondents by organisation type

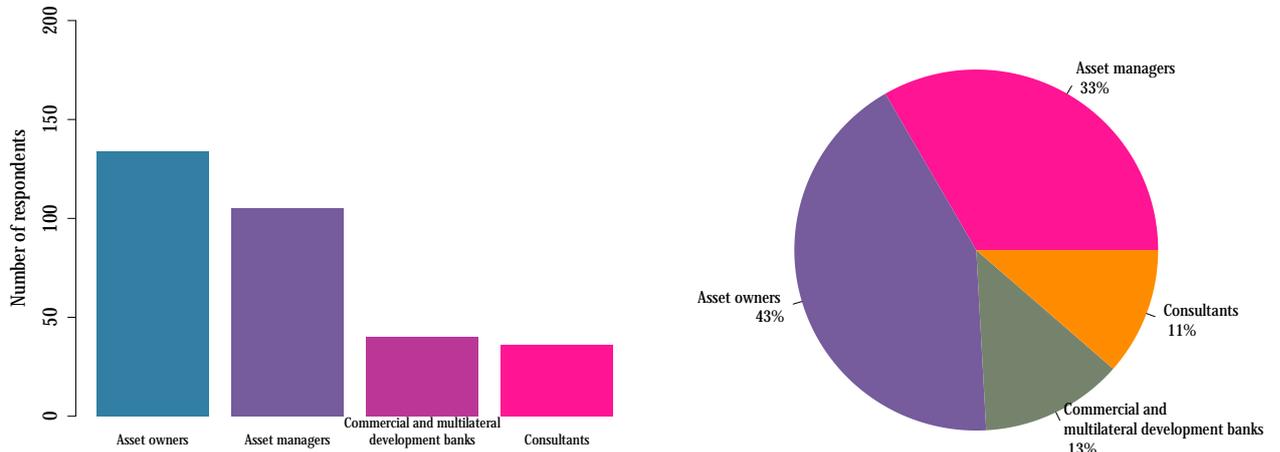
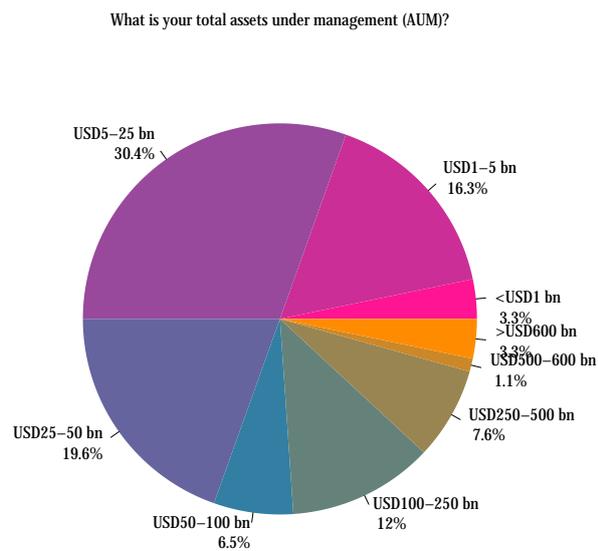
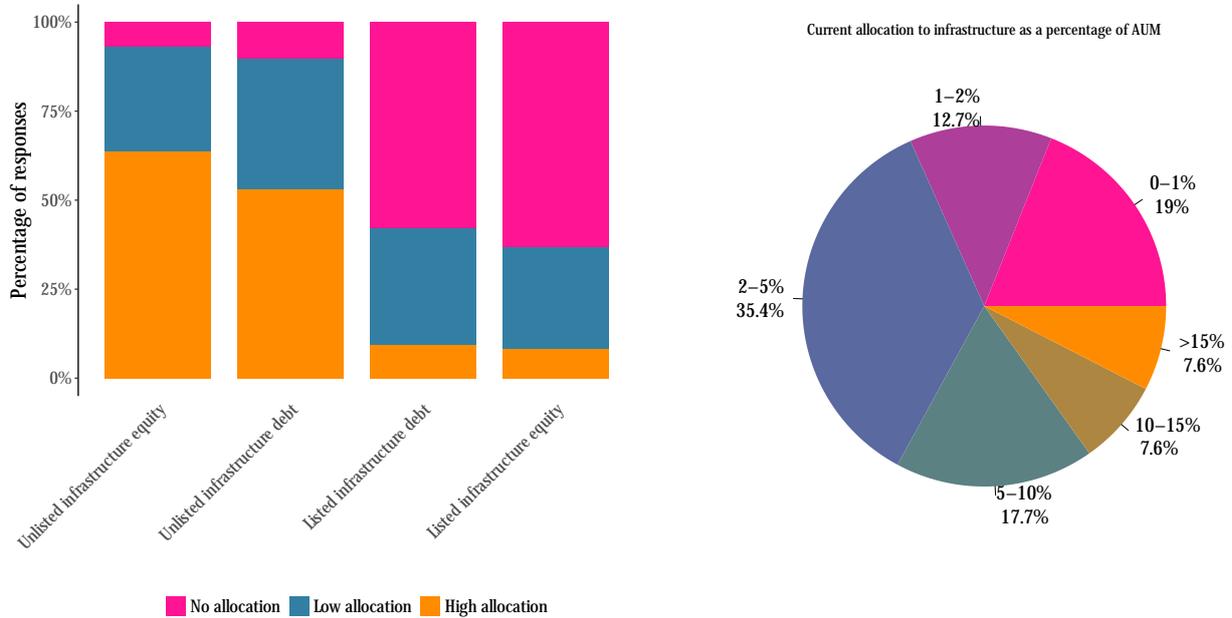


Figure 2: Assets under management (AUM) for asset-owner respondents



2. Respondents

Figure 3: Respondents' investment focus and allocation to infrastructure



2.2 Investment Focus

We also asked respondents to what extent infrastructure played an important role in their respective institution's total portfolio.

Of the respondents that said they focused on unlisted infrastructure equity, almost 70% said they had a high allocation.

Meanwhile, of the respondents who said they invest in unlisted infrastructure debt, over 50% reported having a relatively high allocation.

This is reflected in figure 3 (right panel), which shows respondents' allocation to infrastructure as a percentage of total AUM (asset owners only). This confirms that respondents to this survey are mostly among the largest and most "historical" investors in the sector, who have built

significant positions in (mostly) unlisted infrastructure.

The majority of asset owners surveyed (68%) allocate up to 5% of AUM to infrastructure, while 33% allocated between 5-15%, or greater, of AUM to infrastructure.

We also note that close to 90% of respondents have a low or no allocation to listed infrastructure debt or equity (figure 3, left panel). We return to this finding in the next chapter, when discussing investors' choices of relative investment benchmarks.

3. Is Infrastructure Always an Active Strategy?



3. Is Infrastructure Always an Active Strategy?

For asset managers and asset owners that choose to invest directly, building a substantial exposure to unlisted infrastructure can take a long time and require significant amounts of capital.

Each transaction takes time (often more than 12 months) and unlisted equity investments in particular can be very lumpy, with ticket sizes often in the hundreds of millions or billions of dollars. This naturally leads to risk concentration in infrastructure portfolios, especially during the first decade of their development.

Not only is trading time uncertain but the possibility to invest can also be partly unknown: most infrastructure is public and such investments are the object of government procurement and privatisation processes that can be uncertain and sometimes reversed.

As a result, rather than picking the best deals, infrastructure investors are often left doing the deals they can, when they can, if they can.

Achieving sufficient diversification within the infrastructure portfolio should thus be an source of concern and monitoring.

Portfolio diversification matters because financial markets remunerate systematic risk. Indeed, even if a degree of idiosyncratic or company-specific risk is remunerated in highly illiquid and segmented markets like unlisted infrastructure (which remains an empirical question) remunerated systematic

risk remain at the heart of the risk-return trade-off which should characterise any financial investment decision.

For self-declared long-term investors wishing to take buy-and-hold positions in unlisted infrastructure, only systematic risk factors should matter and be expected to deliver risk premia at a medium- to long-term horizon.

Hence, ensuring that infrastructure investments not only create diversification benefits within the total portfolio but are themselves well diversified is not a trivial question.

Survey respondents were asked how many assets they think are required to have a well-diversified portfolio of unlisted infrastructure investments.

Since private infrastructure investments are known to be lumpy and highly leveraged, which suggests non-Gaussian returns, the achievement of sufficient diversification is likely to require a large number of assets.

Still, figure 4 shows that the majority of respondents believe that less than 20 assets are sufficient to have a 'well-diversified' portfolio of unlisted infrastructure investments. This is believed to be the case by more than 60% of asset managers.

Respondents' views are likely to be anchored in the reality of infrastructure investing: respondents tended to report a number of assets in line with the average number

3. Is Infrastructure Always an Active Strategy?

of investments made by unlisted infrastructure funds or asset owners that practice direct investment. Larger portfolios cannot be easily achieved by a single fund or direct asset owner.

These results suggest that the diversification of unlisted infrastructure assets is not given much serious thought by asset owners and managers.

Respondents' views on diversification may arise from a common misconception based on studies reporting that a portfolio of 20-30 stocks can achieve adequate diversification (Statman, 1987; Evans and Archer, 1968).

These results may hold *on average* but not any random set of 30 stocks. Moreover, these papers mainly cover US stocks. More-recent studies covering global stocks find that even 100 stocks may not be enough to achieve full diversification, particularly in periods of stress (Domian et al., 2007; Alexeev and Tapon, 2012).

Likewise, research on real-estate investment has found that when returns are not Gaussian, portfolios may need up to 250 assets to achieve high levels of diversification (Callender et al., 2007).

It seems likely that several dozens – and perhaps hundreds – of infrastructure investments are required to achieve significant portfolio diversification, even though such high numbers of individual assets

are unattainable in today's institutional portfolios.

This first finding thus begs the question: **is infrastructure investment always active?** To what extent can investors expect managers or their own investment team to deliver outperformance relative to an asset class benchmark if they cannot access the systematic characteristics of the asset class itself?

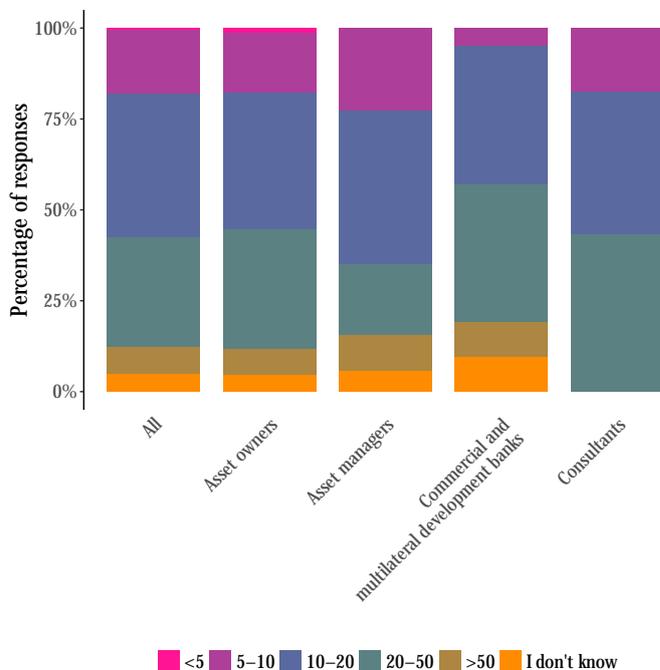
As long as most investors in infrastructure find themselves exposed to a (mostly) *ad hoc* portfolio of (relatively) small number of lumpy investments, their understanding of their own risks and how to benchmark them should be different than if they could reliably invest in a well-diversified portfolio of unlisted infrastructure equity or debt.

Still, even with a portfolio of one asset, any investor in unlisted infrastructure is both exposed to systematic risk factors that can be proxied with a representative benchmark (e.g. a benchmark with the same factor loadings than the one asset) and can in principle assess its own alpha (positive or negative) relative to this benchmark.

The compensation of the manager responsible for building this imaginary single-asset portfolio should then depend mostly on this alpha since any other manager making any other infrastructure investment with the same characteristics would *on average* have delivered an exposure the same remunerated risk factors.

3. Is Infrastructure Always an Active Strategy?

Figure 4: Number of assets required to have a well-diversified portfolio of unlisted infrastructure investments



Hence, even if limited diversification is possible and infrastructure investment is an active strategy, **benchmarking remain relevant and even central in the investment process.**

In the following chapters, we review investors' uses of benchmarks for asset allocation, performance monitoring and risk management and discuss the role that risk-adjusted benchmarks can play in improving the investment process for investors in unlisted infrastructure.

4. Benchmarks for Strategic Asset Allocation



4. Benchmarks for Strategic Asset Allocation

In what follows, we first discuss the role of strategic asset allocation benchmarks in institutional portfolios and then review the responses to the questions asked about the benchmarks used by infrastructure equity and debt investors for this purpose.

4.1 Role of Strategic Asset Allocation Benchmarks

Asset-allocation or policy benchmarks are meant to capture the broad characteristics of individual asset classes in order to determine the size of each allocation in the total portfolio.

Policy benchmarks reflect a long-term risk allocation choice with regards to the relevant asset class and may be a combination of sub-indices representing an investor's preferred opportunity set. For instance, in the case of infrastructure, one might want to gain exposure to a combination of contracted infrastructure investments in project vehicles in the transport and renewable energy sectors, or focus on regulated infrastructure companies exclusively.

Thus, strategic allocation to unlisted infrastructure equity or debt can involve multiple tilts defined in terms of business risk, industrial activity, geo-economic exposure, and corporate governance (see The Infrastructure Company Classification Standard, or TICCS, on the EDHECinfra website for more details).¹

This policy benchmark is the basis for strategic asset allocation exercises because it provides investors with measures of performance but also risk and correlation with other asset classes.

In the most advanced cases, policy benchmarks can be designed to reflect a choice of risk allocation defined in terms of individual risk factors, which may also be *common* risk factor exposures across asset classes e.g. infrastructure investments are exposed to interest rate risk (duration) due to their long term nature, and they share this risk factor with other asset classes such as bonds.

An intuitive manner to highlight the role of the asset allocation benchmark is the so-called core-satellite approach to portfolio management (see Amenc et al., 2008, for a full discussion), by which any investment in a given asset class can be divided into two parts:

- the 'core' represents the risk-return profile of the average investment in a representative portfolio of the targeted asset class (e.g. an investor might favour a combination of contracted infrastructure projects and merchant power projects in the OECD) and sets the absolute level of risk (and expected returns) chosen by the investor. In the listed equity space, it would be an index fund. In the unlisted infrastructure space, it is likely to be a non-investible benchmark capturing the characteristics of an investors' infrastructure investment strategy;

¹ <http://edhec.infrastructure.institute/indices-2/investible-universe/ticcs/>

4. Benchmarks for Strategic Asset Allocation

- the 'satellite' portfolio(s) are invested by active managers or internal investment teams and defined in terms of their tracking error relative to the core. In the listed space, this can be defined as a 'portable alpha' fund, excluding the effect of exposure to the index from the assessment of the active strategy. In the unlisted infrastructure space, if the core portfolio is not investible directly, managers must deliver both core and satellite exposures together, but the contribution of each part is made explicit (we return to this in section 5 for a discussion of performance monitoring benchmarks).

A core-satellite approach to active asset management has multiple benefits:

1. allowing active managers to deviate significantly from the benchmark leads to a better use of the manager's skills;
2. in the case of infrastructure, because building portfolios and achieving a degree of diversification takes time (see Chapter 3), the manager's tracking error can be set dynamically to reflect the implementation of the infrastructure investment strategy: a younger portfolio can have a larger tracking error relative to the long-term asset allocation benchmark, but the gradual implementation of the strategy should lead to a closer tracking of the policy benchmark;
3. allowing a clear distinction between the value added by the design of the strategic asset allocation represented by

the benchmark (core portfolio) and the out-performance generated by active portfolio management.

This last point highlights the importance of selecting the correct benchmark, both to deliver the desired risk exposure and to determine the contribution of the manager or investment team.

With unlisted infrastructure investment because of illiquidity and the difficulty to access the next transaction, the manager's contribution consists of both creating the core portfolio (transaction by transaction) and improving on the core portfolio expected performance.

In what follows, we review the respondents' answers to a first set of questions about their choices of benchmarks for the purpose of asset allocation.

4.2 Equity Investors

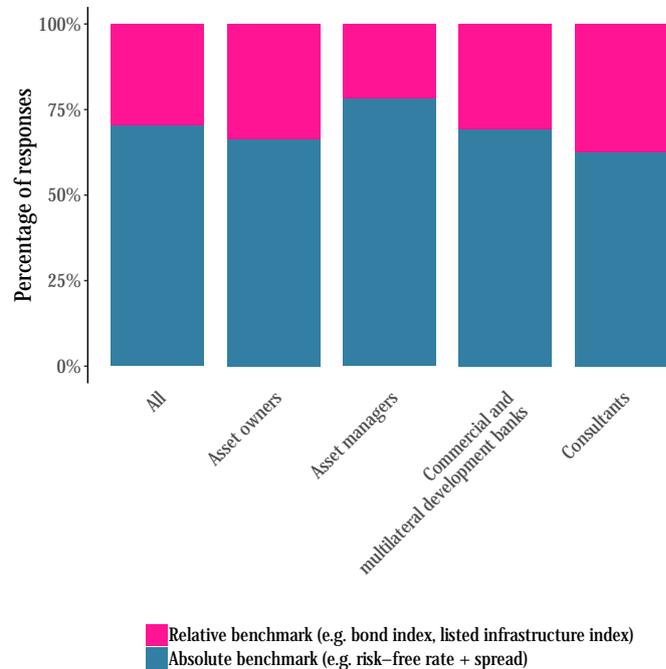
4.2.1 Absolute or Relative Benchmark?

When picking benchmarks, investors face a fundamental choice between so-called absolute or relative benchmarks.

We asked respondents who declared investing in infrastructure equity to report whether their institution uses absolute benchmarks (e.g., risk-free rate + spread) or relative benchmarks (e.g., bond index, listed infrastructure index) for asset-allocation purposes.

4. Benchmarks for Strategic Asset Allocation

Figure 5: Benchmark used for infrastructure equity investments - asset allocation



Respondents overwhelmingly picked the former.

Absolute benchmarks were made popular by hedge funds to compare a range of alternative strategies (Liang, 1999; Gregoriou, 2003). Absolute returns are, by definition, independent from any benchmark and are often presented as an improvement on 'index-hugging' investment strategies that do not add value through management skills.

From the point of view of a defined-benefit pension plan or an endowment, absolute returns may represent a target aggregate return or surplus performance in line with the plan's liabilities (i.e., distribution obligations). However, there are multiple issues with using such benchmarks for asset

allocation, which respondents overwhelmingly acknowledged in this survey.

Because they ignore the risks inherent in underlying investments, absolute-return benchmarks are ill-suited to be asset-allocation benchmarks. Indeed, asset allocation requires, above all, taking into account the *covariance* of returns between asset classes.

Figure 5 shows that absolute benchmarks are the most popular among unlisted infrastructure equity investors, be they asset owners, managers, or consultants, with 70% of respondents reporting using such benchmarks to make strategic asset-allocation decisions.

This high reliance on absolute-return benchmarks suggests that investors are

4. Benchmarks for Strategic Asset Allocation

restricted to making investment and allocation decisions based solely on target returns rather than taking the risks involved in infrastructure investments into account.

Meanwhile about 30% of investors surveyed reported relying on relative asset-allocation benchmarks.

4.2.2 Choice of Absolute Benchmarks

Respondents who picked absolute-return benchmarks were asked to define their choice in terms of base rate and preferred spread (i.e., target absolute excess return).

Figure 6 shows that risk-free-rate- and inflation-based benchmarks are the most popular for asset allocators in unlisted infrastructure equity.

In almost 55% of cases, required excess return is below 500 basis points. We note that a small proportion of investors, especially asset managers, require quite low excess returns.

Thus, excess returns required by infrastructure investors at the allocation stage are often lower than the equity-risk premium found in public markets.² Assuming that investors include a liquidity premium in their required spread, this implies that they view infrastructure as a very low-risk investment.

However, as mentioned above, absolute-return benchmarks do not measure or take into account the underlying risk (unless the investment is to be considered risk-

free and with an alpha of 5%!) and thus partly defeat the point of using an asset-allocation benchmark, which is fundamentally an exercise about return covariance between asset classes or risk factors.

4.2.3 Choice of Relative Benchmarks

Unfortunately, current choices of relative benchmarks are also reportedly inadequate according to survey respondents.

Of those respondents who preferred using relative benchmarks for strategic asset allocation to unlisted infrastructure equity, the majority of respondents said they rely on a listed infrastructure index or industry peers.

Figure 7 shows that almost 50% of asset owners use a listed infrastructure index as their infrastructure-allocation benchmark, despite the majority of them not investing in listed infrastructure, as we reported in chapter 2.

Moreover, previous research has shown that listed infrastructure indices make for a poor proxy of the unlisted infrastructure asset class. Blanc-Brude et al. (2017) apply mean-variance spanning tests to all major listed indices and show that they do not add diversification benefits to an investor's portfolio.

Bianchi et al. (2017) show that the returns of listed infrastructure indices are also easily explained away for a standard Fama-French factor model. In Amenc et al. (2017) Listed infrastructure strategies are found to have a market beta of one and zero alpha.

² - Ibbotson and others report a long-run equity-risk premium of 5 to 7%.

4. Benchmarks for Strategic Asset Allocation

Figure 6: Absolute benchmark used for equity investments - asset allocation

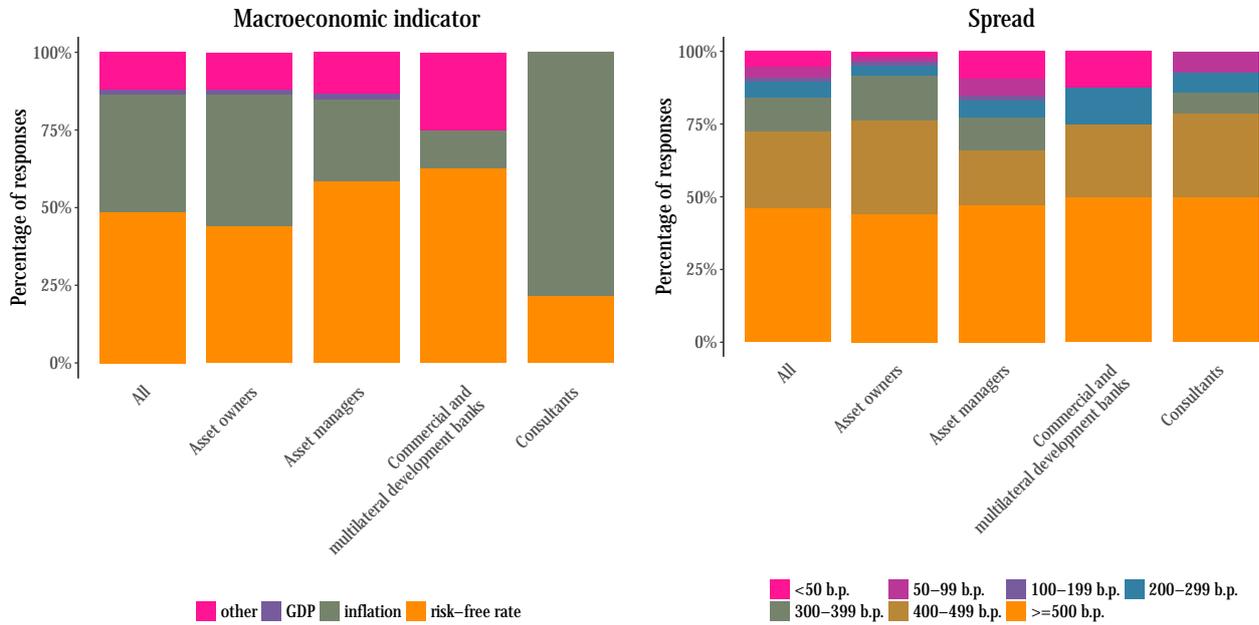
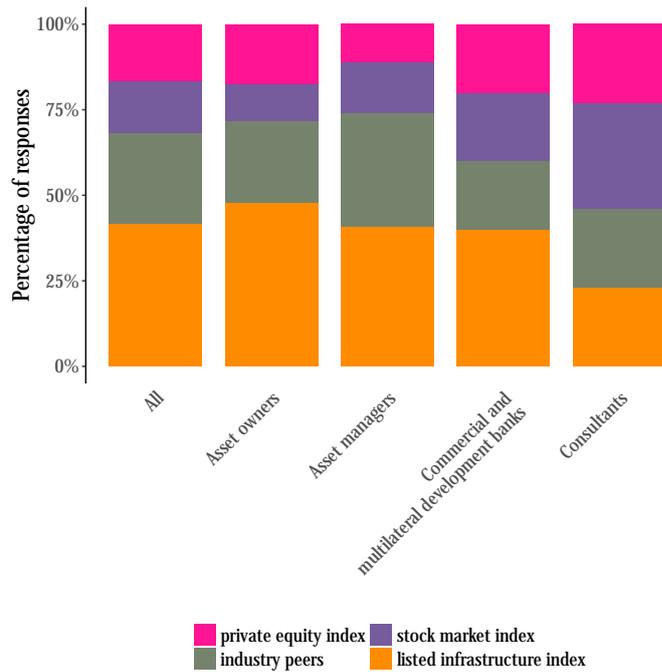


Figure 7: Relative benchmark used for equity investments



4. Benchmarks for Strategic Asset Allocation

Hence, using listed infrastructure indices as benchmarks for unlisted infrastructure is not very different from using the broad equity market as an infrastructure benchmark, perhaps with a couple of factor tilts.

It is unclear how investors make asset-allocation decisions on this basis, since most optimisers would then recommend either no infrastructure allocation or entirely replacing public equity with infrastructure in the portfolio.

The other main type of relative benchmark used for asset allocation is "industry peers," in the case of approximately 25% of investors.

Such peer benchmarks are created by aggregating reported infrastructure funds' IRRs, and they face their own series of methodological issues.

First, the classic issues of stale valuations and return smoothing found in private markets precludes any measure of risk using such indices (see Amenc et al., 2008, for a detailed discussion of similar issues with real estate indices).

Second, in such contributed indices, constituents are neither representative of the market nor of the strategy of any given investor, making direct comparisons difficult.

4.2.4 Challenges with Current Asset Allocation Benchmarks

Figure 8 reveals, perhaps unsurprisingly, that more than 90% of respondents said that the benchmarks they currently use for strategic asset allocation are not adequate.³

Almost 75% of respondents said that the aforementioned benchmarks are not representative of the overall relevant infrastructure market.

Over 50% said that these benchmarks do not allow for defining a strategy by subcategories such as business model and sector.

Around 50% of respondents acknowledged that these benchmarks do not allow for the measurement of risk or correlations with other asset classes.

Hence, infrastructure investors, be they asset owners or managers, are fully aware of the fact that the benchmarks they use are not representative of the infrastructure market or of their own strategies or portfolios and that these benchmarks convey very little information about the factors driving their required risk premia.

4.3 Debt Investors

Similar questions were asked to respondents involved in private infrastructure debt investment.

3 - Note that figure 8 is not split by respondent type because all types essentially reported the same issues in comparable proportions.

4. Benchmarks for Strategic Asset Allocation

Figure 8: Reported challenges

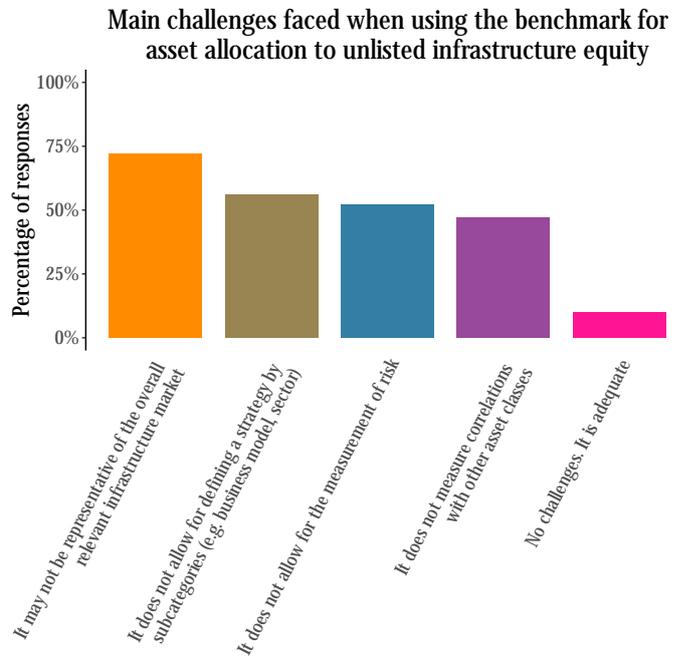
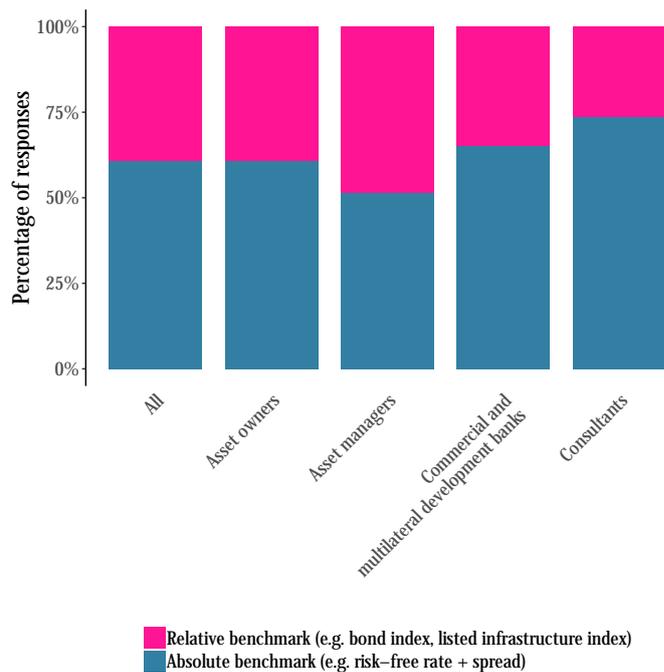


Figure 9: Benchmark used for debt investments



4. Benchmarks for Strategic Asset Allocation

4.3.1 Absolute or Relative Benchmark?

A greater percentage of unlisted infrastructure debt investors use relative benchmarks for strategic asset allocation compared to unlisted infrastructure equity investors.

Still, the majority of respondents use absolute benchmarks. As shown in figure 9, around 40% of investors rely on relative benchmarks, with consultants being the least likely to do so and asset managers the most.

4.3.2 Choice of Absolute Benchmark

The immense majority of respondents use the risk-free rate as the base rate for the absolute infrastructure debt benchmark, as shown in figure 10.

Clearly, debt investors face the same issues as equity investors in term of risk measurement when using absolute benchmarks.

When asked about the spread required over a real or nominal rate for unlisted infrastructure debt, around 50% of respondents reported requiring a spread of 200-400 basis points, with another quarter of respondents requiring between 100 and 200 basis points of excess returns.

These spreads can seem more in line with the recent market-credit spreads for private debt (see, for example, Blanc-Brude and Yim (2019)) than the required excess returns expressed by equity investors above.

It remains that absolute benchmarks fail to reveal or control for the risks taken by investors, unless excess returns were calibrated using a market index of credit spreads, which would make it a relative (floating rate) benchmark.

4.3.3 Choice of Relative Benchmark

The majority of respondents who picked a relative infrastructure debt benchmark reported using an investment-grade bond index.

Asset managers in particular favour bond indices, both investment grade (IG) and non-investment grade, with over 50% of asset managers using IG benchmarks and close to 30% using non-IG benchmarks.

In comparison, just over 40% of asset owners use an IG corporate-bond index for strategic asset allocation to infrastructure debt.

Banks prefer industry peers for asset-allocation purposes. Such benchmarks are essentially time series of credit spreads at origination and face multiple bias issues, as reported in Blanc-Brude and Yim (2019): they represent the recent deal flow but not necessarily the asset holdings of investors who acquired private infrastructure debt on a hold-to-maturity basis. Conversely, if investors use origination vintages, they fail to capture the evolution of the market price of credit risk.

Relative credit benchmarks used by debt investors appear more relevant than their

4. Benchmarks for Strategic Asset Allocation

Figure 10: Absolute benchmark used for debt investments

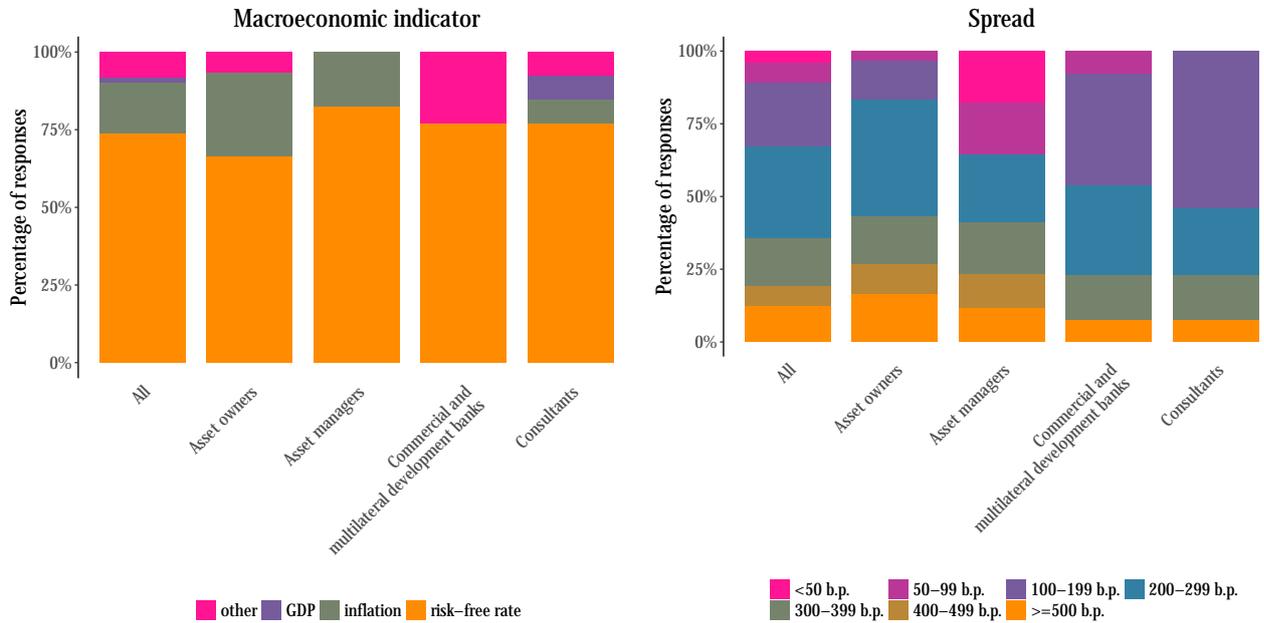
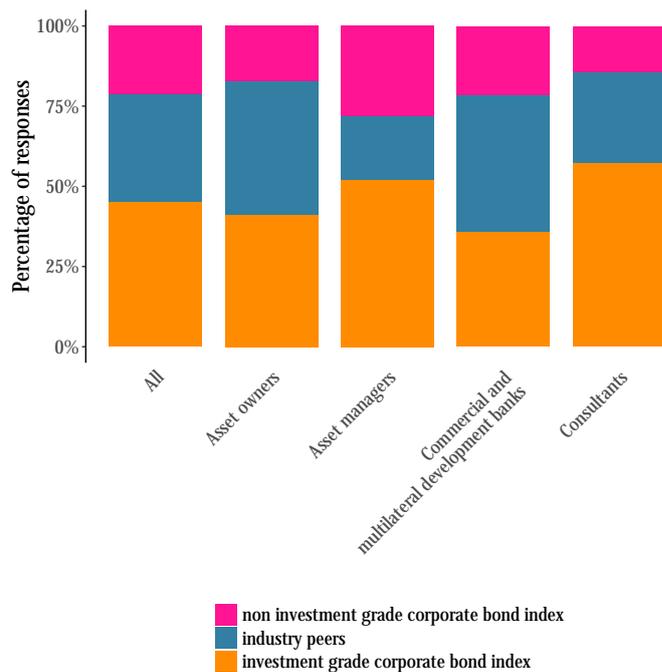


Figure 11: Relative benchmark used for debt investments



4. Benchmarks for Strategic Asset Allocation

equity equivalents, at least for infrastructure corporate debt.

However the underlying loans found in corporate debt indices can be very different than the ones found in private infrastructure debt. In particular, they fail to capture the characteristics of project finance debt, which has been shown to be priced differently than corporate debt, while representing the largest share of private infrastructure debt financing (see for example Blanc-Brude and Ismail, 2013).

4.3.4 Reported Challenges

As with unlisted infrastructure equity, the majority of respondents investing in private infrastructure debt said that the benchmarks they currently use for strategic asset allocation are not adequate.

Figure 12 shows that 75% of investors think that the benchmarks they use are not representative of the overall relevant infrastructure market.

Over 50% of infrastructure debt investors said that these benchmarks do not allow defining a strategy by subcategories such as business model and sector.

Around 50% of respondents said that the aforementioned benchmarks do not allow for the measurement of risk.

And over 50% of respondents said that these benchmarks do not measure correlations with other asset classes.

It is thus clear that respondents are not satisfied with their current choice of benchmarks for strategic asset allocation.

4.4 Conclusion: The Trouble with Asset Allocation

These results show that most investors reported relying on absolute benchmarks to determine their allocation to infrastructure in multi-asset-class portfolios for both unlisted equity and private debt.

This implies that, with the exception of investors using a corporate bond index as the relevant benchmark, all such allocation decisions must be completely *ad hoc* and, in all likelihood, highly suboptimal.

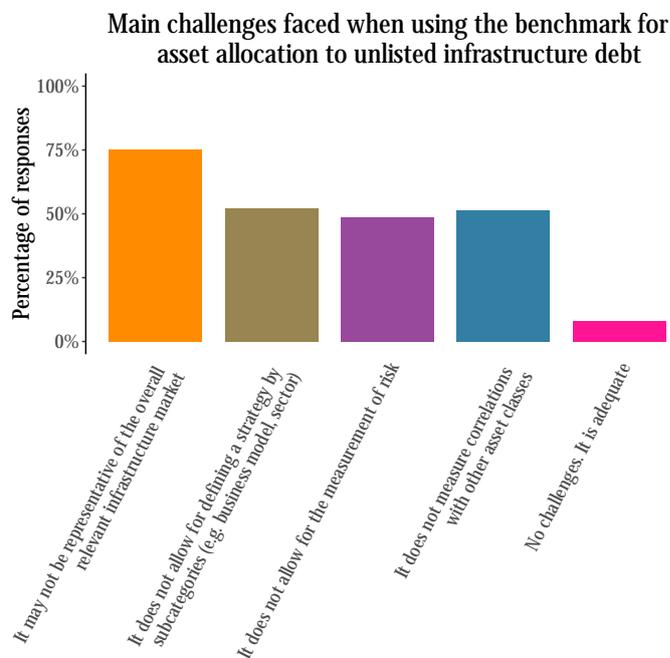
Without a reasonable measure of return variance, applying even the simplest portfolio-construction tools, which require measuring covariance between asset classes, is not straightforward.

Indeed, infrastructure investors acknowledged this situation in their responses to this survey, highlighting the many flaws of their current practices.

In order to make the best strategic allocations to infrastructure, investors need a customised benchmark of unlisted infrastructure investments – be they equity or debt investments – that is representative of their investment strategy and preferences, provides a measure of risk-adjusted returns, and allows the measurement of correlations with other asset classes.

4. Benchmarks for Strategic Asset Allocation

Figure 12: Challenges of using the benchmark



Such indices and benchmarks are being developed by EDHEC*infra* using a methodology that ensures the representativeness of index constituents in both time and space and the calibration of expected returns to available transaction data in all principal markets in which this information can be observed, ensuring that such indices reflect the fair value and the risks.

5. Benchmarks for Performance Monitoring



5. Benchmarks for Performance Monitoring

Having determined what target proportion of the portfolio should be allocated to infrastructure on the basis of a broad-market, implementation-agnostic index, investors need a different benchmark to evaluate their or their managers' actual *ex post* performance.

Performance-monitoring benchmarks differ from the asset-allocation benchmarks discussed in the previous chapter insofar as they should represent actual investment choices made when implementing a fund's investment policy.

Monitoring benchmarks aim to represent as best as possible the investments that were actually made.

In the case of infrastructure, the difference between policy and performance-monitoring benchmarks is all the more significant in that the ability to implement any given style or tilt is itself uncertain: infrastructure markets are notoriously illiquid and in part driven by public procurement and other policy decisions that are not easily predicted.

The implementation of a broad policy allocation to infrastructure may take multiple incarnations: different levels of geo-economic, industrial, or business-risk exposures are likely to require dedicated suballocations and will be fully known only after the fact. For instance, the high degree of specialist industrial knowledge required to make investments in any infrastructure sector usually militates for individual

substrategies or mandates (we return to the definition of mandates in chapter 8).

Perhaps even more importantly, building large, well-diversified positions in any segment of the unlisted-infrastructure space remains very difficult today, given the average time and size of individual transactions (see Chapter 3).

As a direct result, while policy benchmarks focus on long-term rewarded risks, **performance-monitoring benchmarks may require being tailored to an investor's or their manager's actual portfolio**, and achieving sufficient granularity is very important to benchmark the investments made fairly and accurately.

As discussed in Chapter 4, in a core-satellite context, investors can monitor and manage the performance of asset managers and investment teams by defining a core portfolio which is representative of the expected behavior of a given infrastructure investment style or strategy and a satellite portfolio defined in terms of its tracking error relative to the core.

In the case of highly illiquid asset classes like unlisted infrastructure in which a well-defined 'core' is not directly investible, this distinction gives investors a way to monitor the dual objective given to asset managers: to deliver the core strategy (deal by deal) and to outperform the average as captured by the core benchmark.

5. Benchmarks for Performance Monitoring

An implementation of this approach to monitoring unlisted infrastructure managers can make use of the tracking error given to a manager as a representation of the construction of the infrastructure portfolio: the younger the portfolio, the larger the tracking error. As a portfolio of infrastructure debt or equity increases in size and representativity, the tracking error should be reduced to only represent the space within which the manager can deliver alpha.

In this chapter, we review investors' reported use of benchmarks to monitor the performance of their infrastructure investments.

These questions followed the question about asset-allocation benchmarks reported in chapter 4, and respondents were given the option to respond that they defined such benchmarks in exactly the same way they do for asset allocation.

Indeed, 50% of respondents declared using the same benchmarks for performance monitoring as they do for strategic asset allocation.

5.1 Equity Investors

5.1.1 Absolute or Relative Benchmark?

As shown in figure 13, around 75% of infrastructure equity investors reported using absolute benchmarks for performance monitoring.

In light of the comments above, this is highly problematic. While absolute benchmarks are a good indicator of the target return achieved, in order to monitor performance adequately investors should use a benchmark that represents their choice(s) of investment policy explicitly defined in terms of risk profile.

In effect, the practices described by investors in this survey correspond more to the definition of a hurdle rate rather than a benchmark.

5.1.2 Choice of Absolute Benchmark

As in the previous chapter on asset-allocation benchmarks, figure 14 shows that the majority of investors that prefer absolute benchmarks use the risk-free or inflation rates as a base.

The proportion of respondents using absolute benchmarks that reported requiring excess equity returns of up to 500 basis points was 55%, while about 25% of respondents said they use a spread of less than 400 basis points.

Again, these spreads can seem fairly low for highly illiquid assets when compared to the public equity risk premium. They imply a low risk profile, but in the absence of actual risk measures it remains difficult to determine how adequate these expectations are on the part of investors.

Likewise, any reported out-performance relative to such benchmarks is very difficult

5. Benchmarks for Performance Monitoring

Figure 13: Benchmark used for equity investments

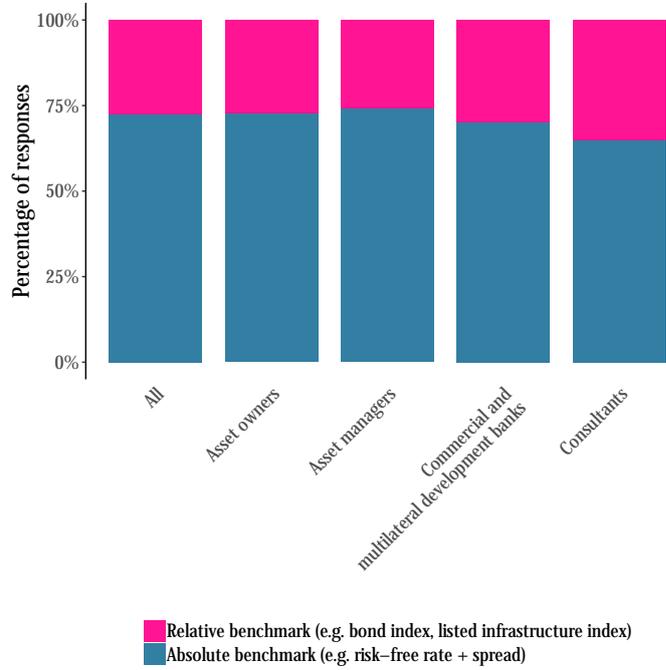
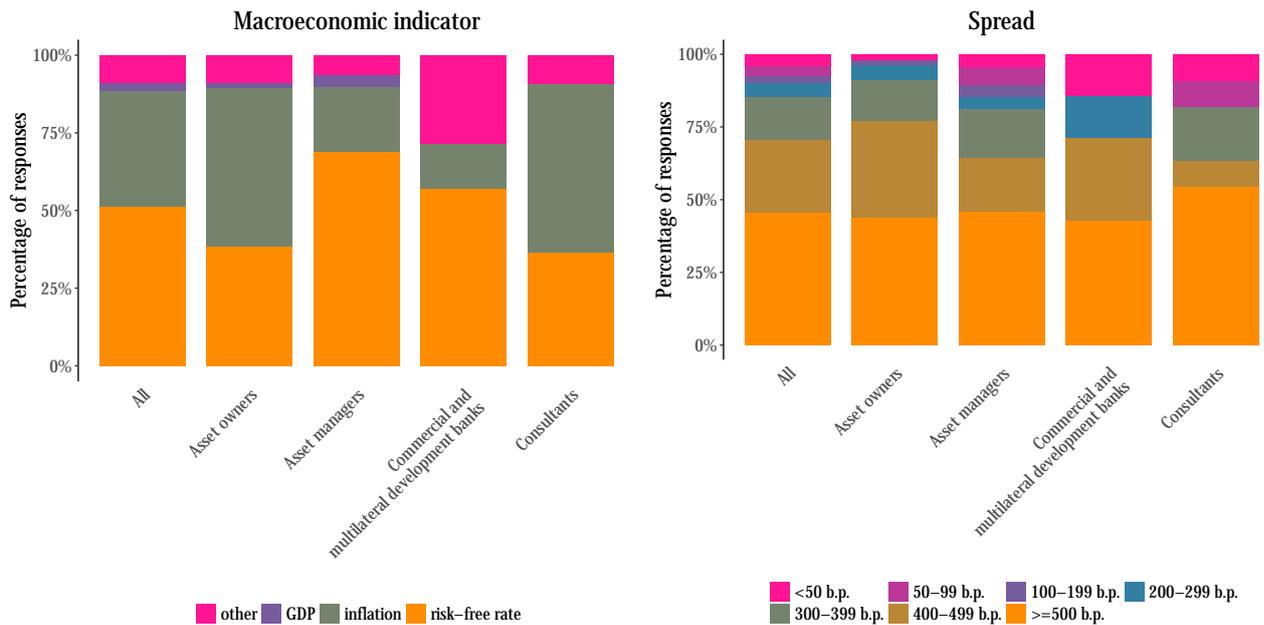


Figure 14: Absolute benchmark used for equity investments



5. Benchmarks for Performance Monitoring

to assess, given the absence of explicit risk characteristics of the strategy or index.

5.1.3 Choice of Relative Benchmark

Once again, as shown in figure 15, the majority of respondents using relative performance benchmarks rely on listed infrastructure indices or industry peers.

As discussed in chapter 4, listed infrastructure indices are hard to distinguish from public equity markets in general. In the case of asset allocation, their very high correlation with broad market stock indices made them rather inadequate choices.

When it comes to performance monitoring, the choice of listed infrastructure as a benchmark implies that the underlying stocks offer a representative basket of securities to be compared with or used as a proxy for what is primarily unlisted infrastructure equity (see chapter 2 on investment preferences).

While this may be the case in certain cases, it is unlikely to be the most-common case. Listed infrastructure, to the extent that it can be clearly identified, is a small subset of the stock market (approximately 100 firms worldwide today) with significant geographic, corporate-governance, and industrial-sector tilts.

While such benchmarks could in theory capture the various risk factors found in infrastructure companies, except for the absence of liquidity, in practice they are too biased and often too ill-defined to

provide investors with a representative, risk-adjusted view of the performance of their unlisted infrastructure investments.

Figure 15 also shows that about 20% of relative-benchmark users prefer private equity indices. Whether this is a suitable proxy is also open to discussion, but it can seem even more delicate than in the case of listed infrastructure.

Closely linked to the issues surrounding performance monitoring using listed infrastructure or PE indices is that of asset valuation: very often unlisted infrastructure equity is valued using discount rates built from a simple capital-asset-pricing model (CAPM) including a consensus estimate of the equity risk premia and a market beta built using the same listed infrastructure indices.

This again raises the question of the low representativity of listed infrastructure with respect to the infrastructure equity universe in general. This has been addressed in previous research on listed infrastructure (see, for example, Blanc-Brude et al., 2017) but is also confirmed by the answers to this survey reported next.

5.1.4 Reported Challenges

Next, we asked respondents about the main challenges they faced when using the aforementioned benchmarks for the performance monitoring of unlisted infrastructure equity.

Figure 16 shows that 70% of respondents acknowledged that the benchmarks they

5. Benchmarks for Performance Monitoring

Figure 15: Relative benchmark used for equity investments

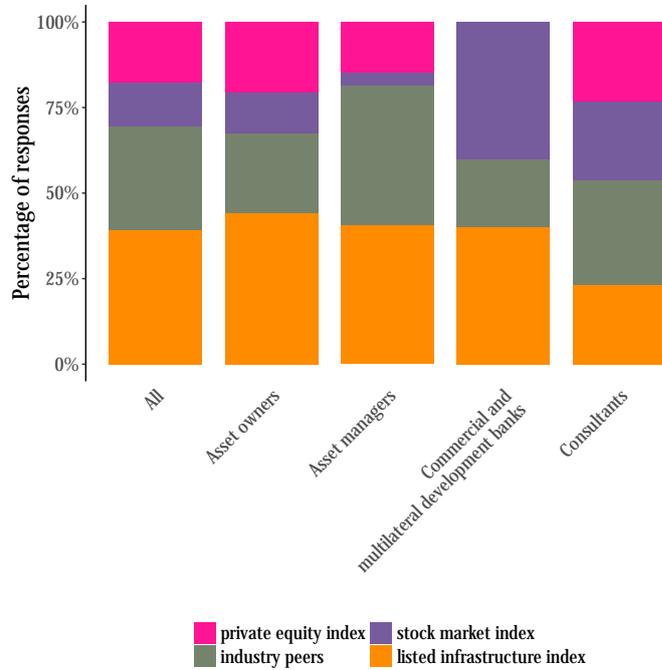
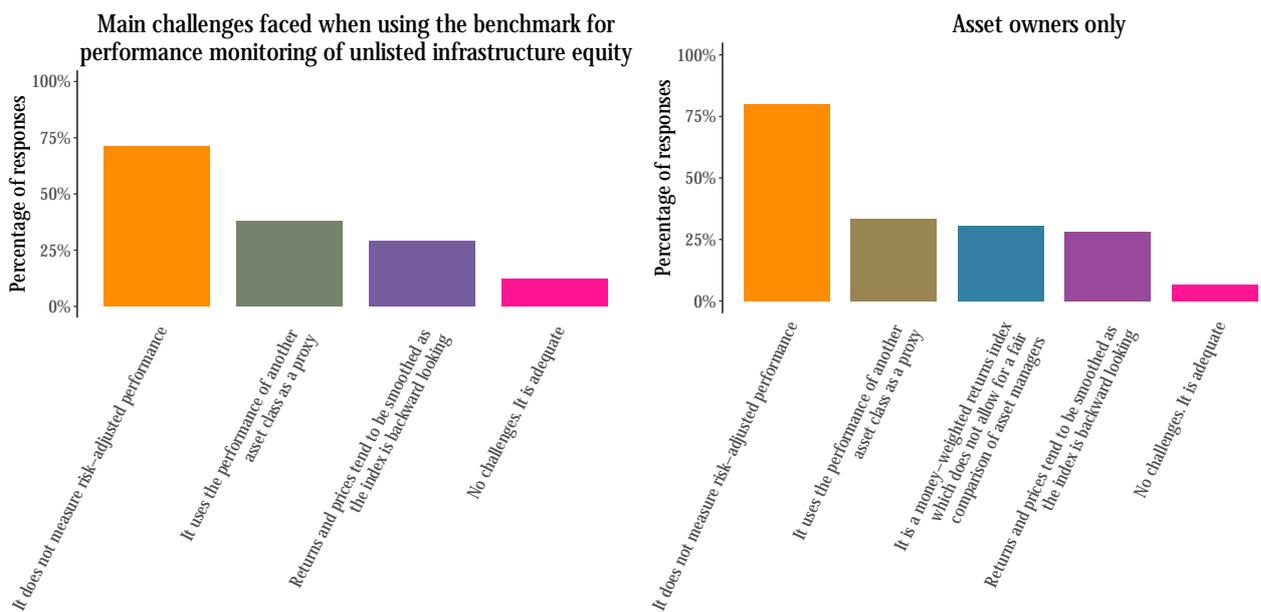


Figure 16: Challenges of using the benchmark



5. Benchmarks for Performance Monitoring

use for performance monitoring do not allow investors to measure risk-adjusted performance. When the same question was asked to asset owners only, more than 75% of respondents reported similar concerns.

Almost 40% of respondents also agreed that the use of another asset class as a proxy for unlisted infrastructure equity is a challenge.

Close to 30% of respondents also acknowledged that current private benchmarks tend to report smoothed returns.

Figure 16 also shows that around 30% of asset owners said that current industry-peer, money-weighted benchmarks do not allow for a fair comparison of asset managers.

Indeed, such indices are sensitive to the timing of cash flows, which can vary across fund managers and can even be manipulated to achieve higher returns.

5.2 Debt Investors

Next, we asked similar questions with regards to the performance monitoring of private infrastructure debt investments.

5.2.1 Absolute or Relative Benchmark?

Figure 17 shows that almost 65% of respondents use an absolute benchmark for performance monitoring of unlisted infrastructure debt investments, while around 35% use a relative benchmark.

Yet most respondents have concerns that both the absolute and relative benchmarks used do not allow investors to measure the risk-adjusted performance of unlisted infrastructure debt investments.

5.2.2 Choice of Absolute Benchmark

When asked which type of absolute benchmark they use for the performance monitoring of private infrastructure debt, most respondents said they use the "risk-free rate + spread" type of benchmark.

Figure 18 shows that almost 75% of respondents use a spread of less than 300 basis points, while about 10% use a spread of more than 500 basis points.

As previously mentioned, compared to unlisted infrastructure equity investors, debt investors used spreads closer to current market rates in the private-debt space.

5.2.3 Choice of Relative Benchmark

With regard to relative benchmarks, private infrastructure debt investors mostly reported using corporate-bond indices, with a preference for investment-grade benchmarks, as shown in figure 19.

This is consistent with the expected risk profile of senior infrastructure debt reported in previous studies (see Blanc-Brude et al., 2017).

5.2.4 Challenges

Despite better-defined expected returns, the main challenges faced when using the

5. Benchmarks for Performance Monitoring

Figure 17: Benchmark used for debt investments

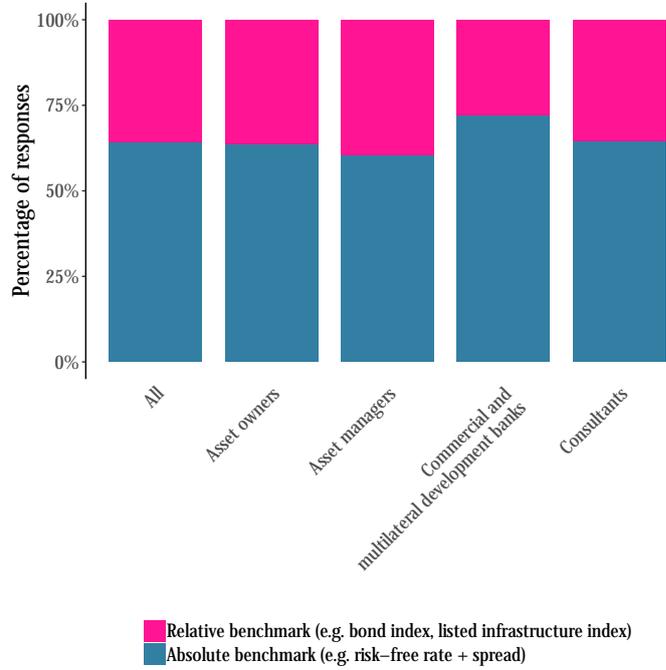
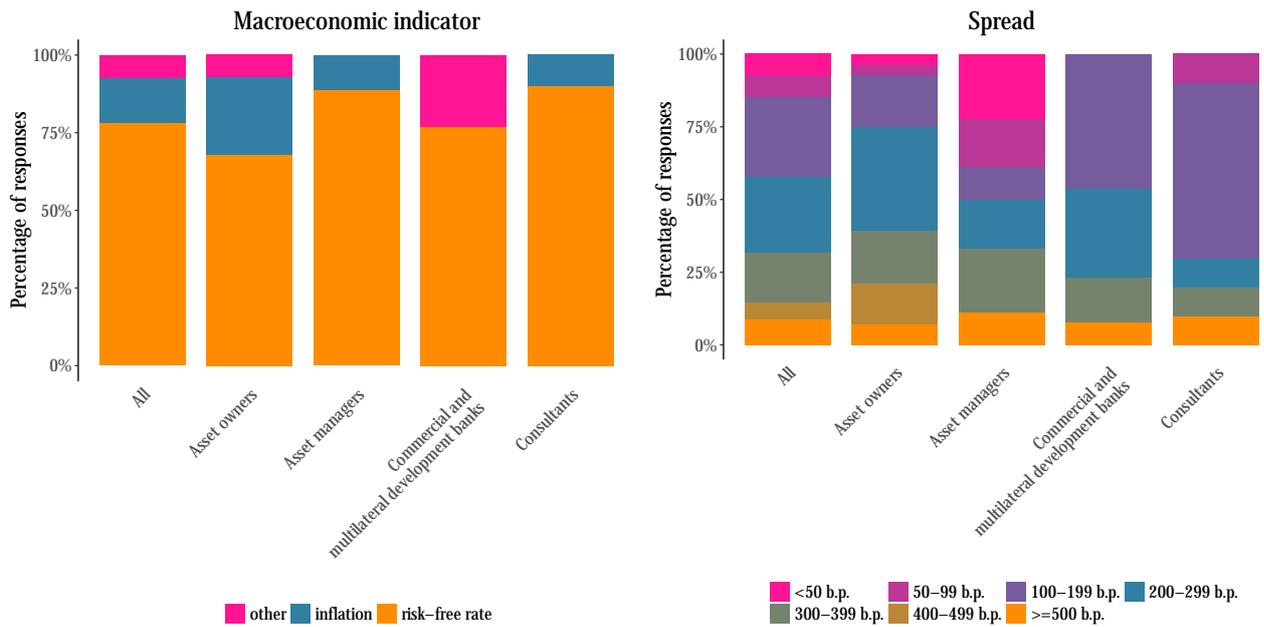


Figure 18: Absolute benchmark used for debt investments



5. Benchmarks for Performance Monitoring

Figure 19: Relative benchmark used for debt investments

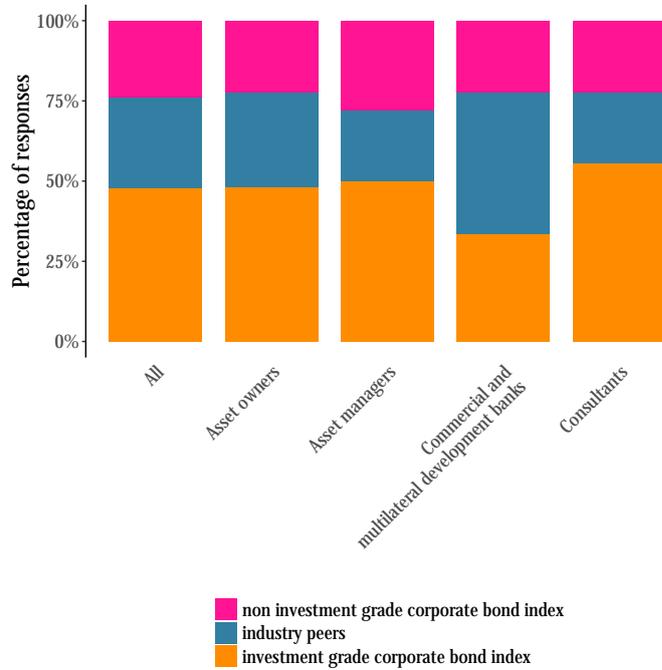
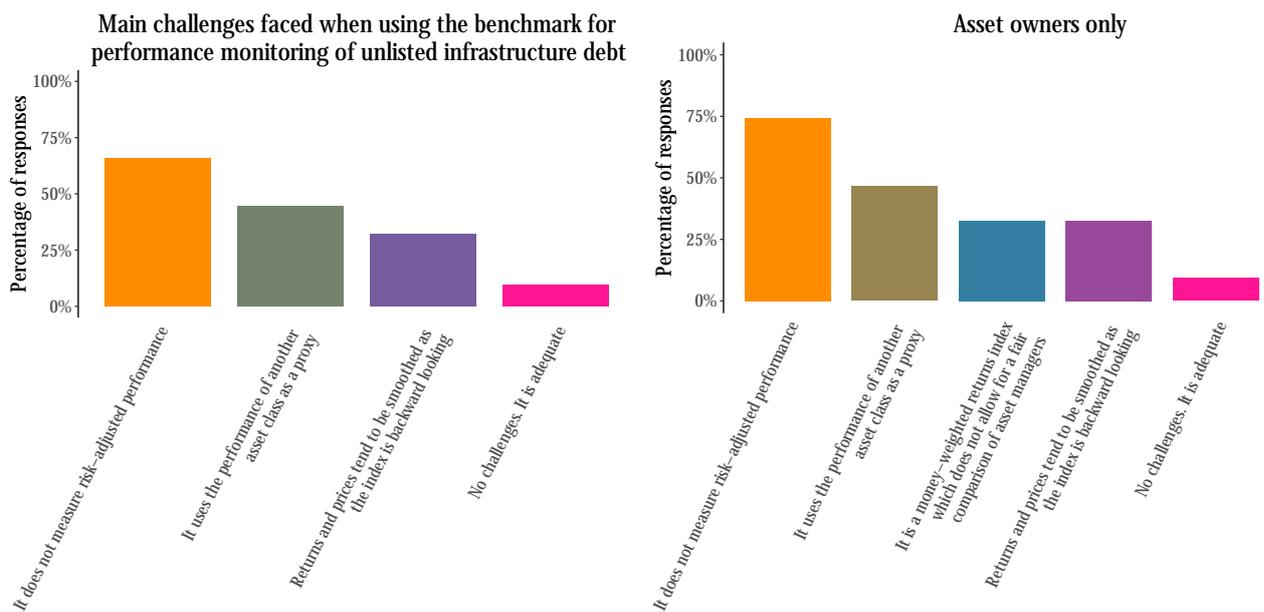


Figure 20: Challenges of using the benchmark



5. Benchmarks for Performance Monitoring

aforementioned benchmarks are similar to that of equity investors.

Figure 20 shows that roughly 70% of respondents said the benchmarks they use do not allow measuring risk-adjusted performance. The group of asset owners alone gave the same answer in close to 75% of cases.

Almost 50% of respondents agree that the use of another asset class as a proxy for unlisted infrastructure debt is a challenge. As with equity, around 30% of asset owners said that the current relative benchmarks used for the performance monitoring of private infrastructure debt do not allow for a fair comparison of asset managers.

5.3 Conclusion: Performance Monitoring Requires Fair Value

Responses to this survey highlight significant issues with regard to performance monitoring in unlisted infrastructure investment.

Because infrastructure-investment strategies are likely to represent significant sector, geographical, and business-risk tilts due to the lumpiness and illiquid nature of investments, performance-monitoring benchmarks should be highly tailored to represent actual investment portfolio, which will often only be known *ex post*.

However, half of investors in infrastructure reported using their policy or asset-

allocation benchmark for performance monitoring.

Moreover, and partly as a result, reported performance-monitoring benchmarks exhibit all the flaws reported in the previous section: they do not offer any insight into risk-adjusted return, and they are not representative.

At the heart of the question of performance monitoring is also that of the fair valuation of unlisted infrastructure investments, be they equity or debt instruments. As long as private assets like infrastructure debt and equity are valued using ill-suited proxies (e.g., listed infrastructure), monitoring performance is essentially impossible for investors.

This fact was reflected in the answer to a question asked in the 2016 EDHEC/GIH survey. To the question "Do you trust the asset valuations reported by infrastructure asset managers," half of asset owners answered that they did not or did not know if they could trust such valuations.

Much progress remains to be made by focusing on measuring fair value in infrastructure, that is, aiming to explicitly represent the impact of the risks priced by market participants when investing in infrastructure.

Combined with a representative sample of the investable universe, a modern approach to measuring fair value in unlisted infrastructure equity and private debt can deliver

5. Benchmarks for Performance Monitoring

benchmarks for performance monitoring that are both representative of well-defined tilts (e.g., business risk or geography) and explicitly take into account the systematic risks found in each portfolio.

6. Benchmarks for Risk Management



6. Benchmarks for Risk Management

Beyond asset allocation and performance monitoring, a third use for benchmarks in the investment process is risk management. In what follows, we first discuss the risk management process in the context of infrastructure investing, before reviewing the survey responses about which benchmarks are currently used for this purpose.

6.1 Infrastructure Investment Risk Management

6.1.1 Risk Factors and Management

In a portfolio context, risk management aims to control and optimise the amount of risk taken by investors per unit of expected reward (excess return or spread). As such it revolves around the sources of remunerated risk found in various securities i.e. the factors that explain and predict the price and therefore the returns of these securities.

Priced risk factors are the result of fundamental economic and financial mechanisms but are usually proxied by observing these characteristics of the investments made, be they firms or credit instruments, that *systematically* explain or drive asset values. This implies that a robust statistical model of expected returns can be calibrated using observable and predictable inputs.

For instance, most asset values are impacted by movements in interest rates, hence, these assets are all exposed to interest rate risk (often referred to as 'duration'). Not all assets are equally exposed to interest rate risk however: depending on their maturity and expected payouts, asset values are more

or less influenced by movement in the rates of interest i.e. various assets *load* more or less on the duration risk factor.

Hence, each asset is characterised by a series of factor 'loadings' or exposures and each factor by a price or premium.

Formally, the relationship between expected returns and $k = 1 \dots K$ factors is written:

$$E(R_{i,t}) = P_0 + \beta_{i1}P_1 + \dots + \beta_{iK}P_K$$

where P_j is the price of risk or risk premium for the j^{th} risk factor and β_{ik} is the factor loading of asset i for factor k . P_0 represents the risk-free asset. That is, expected returns are the sum of the amount of risk j times its price for all risk factors to which asset i is exposed.

A complete version of this model of *ex post* excess returns (commonly referred to as the Arbitrage Pricing Theory (see Ross, 1976)) is written:

$$r_{it} - P_0 = \beta_{i1}[P_1 + f_{1t}] + \dots + \beta_{iK}[P_K + f_{Kt}] + \varepsilon_{it}$$

Where f_{jt} is the *ex post* realisation of factor j at time t .

With N assets ($i = 1, \dots, N$), the statistical estimation problem is to obtain the N values of P_j and the $N \times K$ values of β_{ij} .

In the case of unlisted infrastructure investments, defining the most relevant factors is not straightforward and requires detailed asset-level data to measure the factor loadings of each investment and estimate the factor premia of all relevant risk factors over time.

6. Benchmarks for Risk Management

The choice of relevant factors can vary but must be justified economically and be implementable and robust statistically.

Formally, the asset betas are written

$$\beta_{i,k} = \frac{\text{Cov}_{i,k}}{\sigma_k^2} = \rho_{i,k} \frac{\sigma_i}{\sigma_k}$$

that is, the beta of asset i relative to factor k is a direct function of the ratio of the volatility of asset i and factor k , to the extent that i and k returns are correlated.

In the case of company-level factors, factor loadings are by definition perfectly correlated with the asset (e.g., industrial sector classification, business model, size, leverage, etc.) and easily known *ex ante*. $\rho_{i,k} = 1$ and we can determine factor prices in each period directly by observing the cross-sectional variance of factor returns (σ_k) in the relevant period to estimate the P_k factor prices or premium. Blanc-Brude and Hasan (2018) provide a detailed exposition of a modern approach to asset pricing using priced factors applied to unlisted infrastructure.

In the case of macro-level factors such as inflation or economic growth, individual asset exposures are not straightforward to use because the correlations $\rho_{i,k}$ are not known *ex ante*. As a result, in the case of infrastructure investments more robust and stable factor models rely on asset-level factor loadings. Again, this requires high quality, representative data to be available. Since 2016, EDHEC*infra* has built the largest database of asset-level infras-

tructure investment data in the world for this purpose.

6.1.2 Using Risk Factors for Infrastructure Investment Risk Management

An important issue with using benchmarks for managing risks in infrastructure investment is the necessity to accurately and persistently capture the underlying risk exposure of a given infrastructure investment strategy or mandate.

As discussed earlier, the construction of an infrastructure portfolio can be a lengthy process and the uncertainty that characterises trading time as well as the type of available investment over time mean risk exposures can be expected to evolve significantly overtime.

Infrastructure investors also face changing risk exposure at the universe level: the underlying investible universe keeps changing as new countries embrace infrastructure privatisation, or others turn their back on certain types of concession contracts, etc. Likewise, the energy transition towards low-carbon power production is happening on a global scale, creating new industrial and geographic exposures within the “power generation” investment style.

This is reminiscent of the sub-optimality issues found in cap-weighted market indices: standard stock indices exhibit both sector and style biases (concentrations) that make them either relatively inefficient or

6. Benchmarks for Risk Management

relative unstable in terms of risk exposures (Amenc et al., 2006). Moreover, these biases tend to change over time, making standard cap-weighted indices unsuitable as benchmarks since their implicit risk exposures drift in the long-run in a manner that investors cannot control.

The solution to this issue is to build benchmarks that have constant sector and geographic weights or, even better, target a constant exposure to certain risk factors.

We identified earlier that, for infrastructure investors, a choice of strategic benchmark effectively embodies two challenges: 1) creating the core portfolio to which the benchmark refers and 2) to provide out-performance relative to this benchmark.

A decomposition of risk exposures by factors creates more flexibility to build the infrastructure portfolio (since factor exposures are present in all investments) and also allows considering the optimisation of the reference benchmark/portfolio in order to achieve the desired risk exposure determined at the strategic level.

Moreover, to the extent that risk factors are found within multiple asset classes, investors' total portfolio risk is also partly determined by the dependencies between assets classes created by common risk factor exposures.

For instance, interest rate or credit risk can be expected to be present in multiple asset classes like fixed income and also infras-

tructure, including infrastructure equity, since leverage is typically high in infrastructure companies and repayment period very long. As a result the current value of any stream of future dividends to equity investors is partly driven by the movement of interest rates (discount rates) and the possibility of being "wiped out" by a default.

Understanding how each asset-class component of the portfolio loads on various cross-asset-class risk factors is essential in the risk-measurement and management process.

Next, we review responses relative to infrastructure benchmarks for risk management purposes. As for performance monitoring benchmarks, respondents were given the option to answer that they used the same index as the one they reported in previous questions.

Indeed, more than 50% of investors declared using the same benchmarks for risk management as they do for strategic asset allocation and performance monitoring.

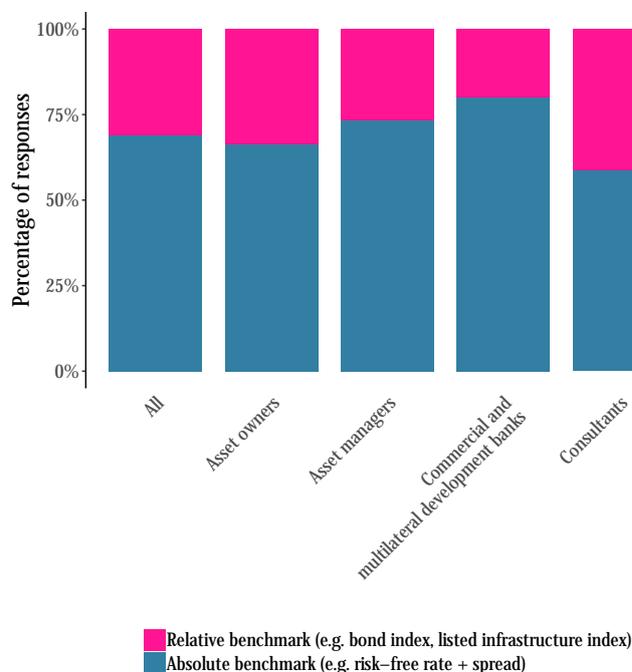
6.2 Equity Investors

6.2.1 Absolute or Relative Benchmark?

Figure 21 shows that nearly 70% of investors in unlisted infrastructure continue to use absolute-return benchmarks for the purpose of risk management.

6. Benchmarks for Risk Management

Figure 21: Benchmark used for equity investments



This suggests that the infrastructure portfolio risk management function is very limited among most investors.

6.2.2 Choice of Absolute Benchmark

Figure 22 shows that, as before, most respondents use either the risk-free rate or an inflation-linked benchmark.

Likewise, almost 75% of respondents said they require excess returns of at least 400 basis points, and 50% required north of 500 basis points.

6.2.3 Choice of Relative Benchmark

Of the roughly 30% of respondents who prefer relative benchmarks, over 50% also use either a listed infrastructure index or a stock market index for risk management (see figure 23).

6.2.4 Challenges

Despite the fact that over 10% of respondents said that their choice of benchmark is adequate for risk-management purposes, there is a consensus amongst respondents that current practices present a number of challenges.

Figure 24 shows that over 50% of respondents are concerned that the aforementioned benchmarks do not allow for measurement of diversification indicators such as effective number of factors/constituents.

50% worry that the benchmarks do not measure exposure to traditional risk factors such as size and momentum, which are likely to be found in multiple asset classes involving equity investment.

6. Benchmarks for Risk Management

Figure 22: Absolute benchmark used for equity investments

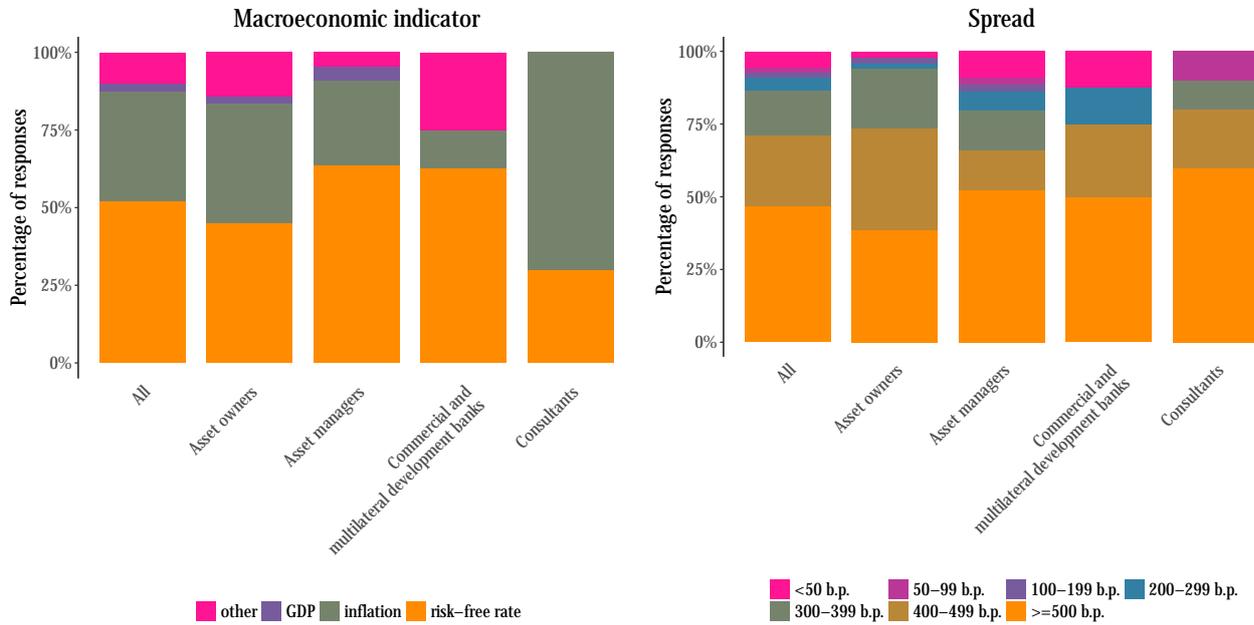
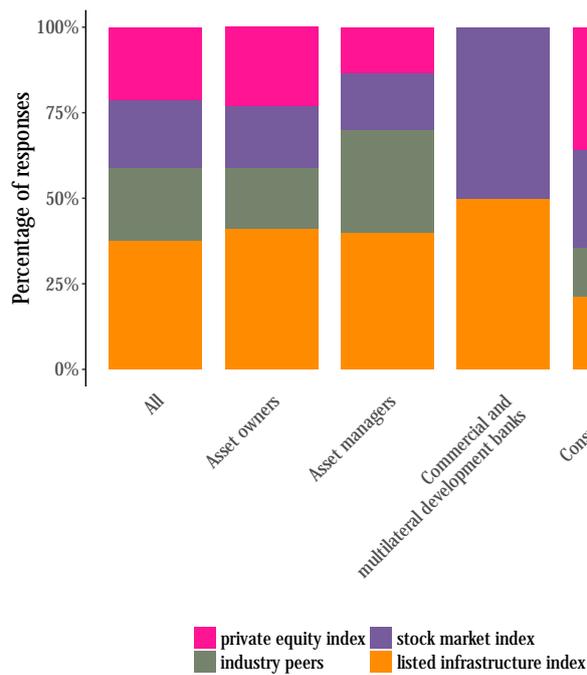
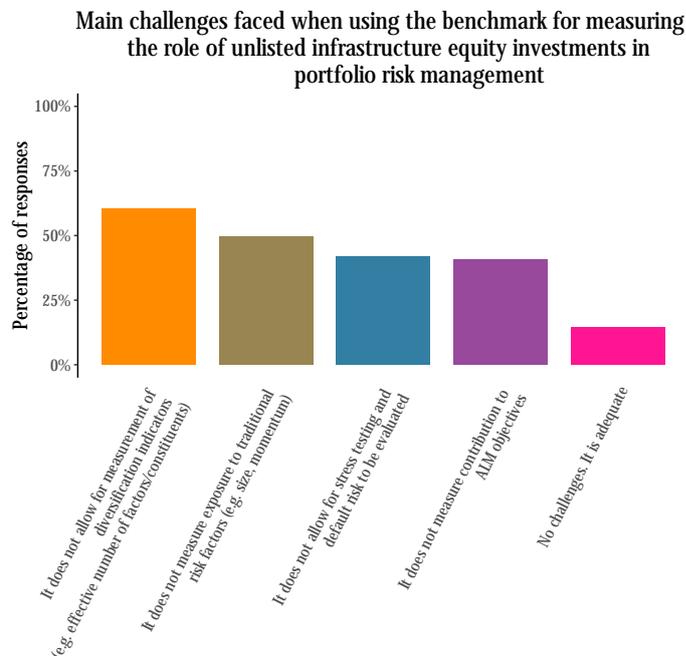


Figure 23: Relative benchmark used for equity investments



6. Benchmarks for Risk Management

Figure 24: Challenges of using the benchmark



Likewise, around 40% of equity investors said that current benchmarks do not allow for stress testing or default risk mapping, nor do they measure contributions to asset-liability-management (ALM) objectives.

6.3 Debt Investors

6.3.1 Absolute or Relative Benchmark?

With regards to the choice of benchmarks for risk management in the private infrastructure debt space, respondents are roughly equally split, with just over 50% using an absolute benchmark and the remainder using a relative benchmark, as shown in figure 25.

6.3.2 Choice of Absolute Benchmark

Respondents who picked absolute benchmarks overwhelmingly prefer using the risk-free rate as a base, as shown in figure 26.

The spreads required over the risk-free rate for private infrastructure debt risk management are wider than for strategic asset allocation or performance monitoring. Most respondents require less than 300 basis points.

6.3.3 Choice of Relative Benchmark

Those respondents who expressed a preference for relative benchmarks use a corporate-bond index as a relative benchmark in 75% of cases, with the majority favouring an investment-grade corporate-bond index.

6. Benchmarks for Risk Management

Figure 25: Benchmark used for debt investments

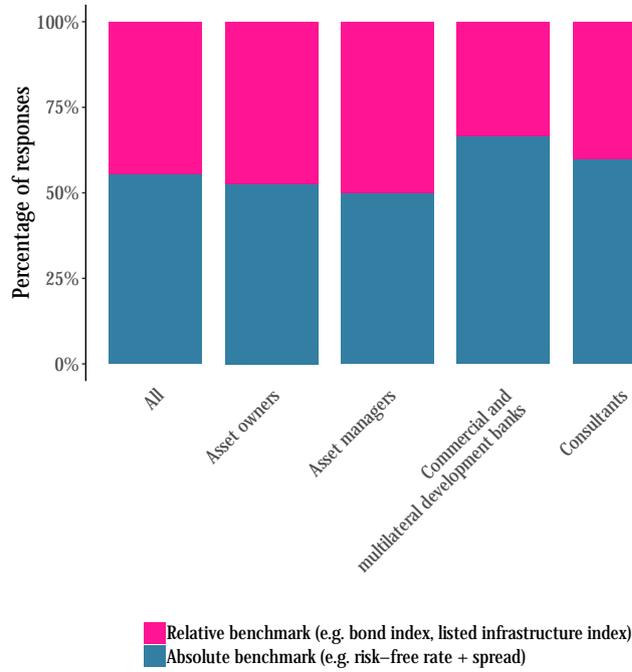
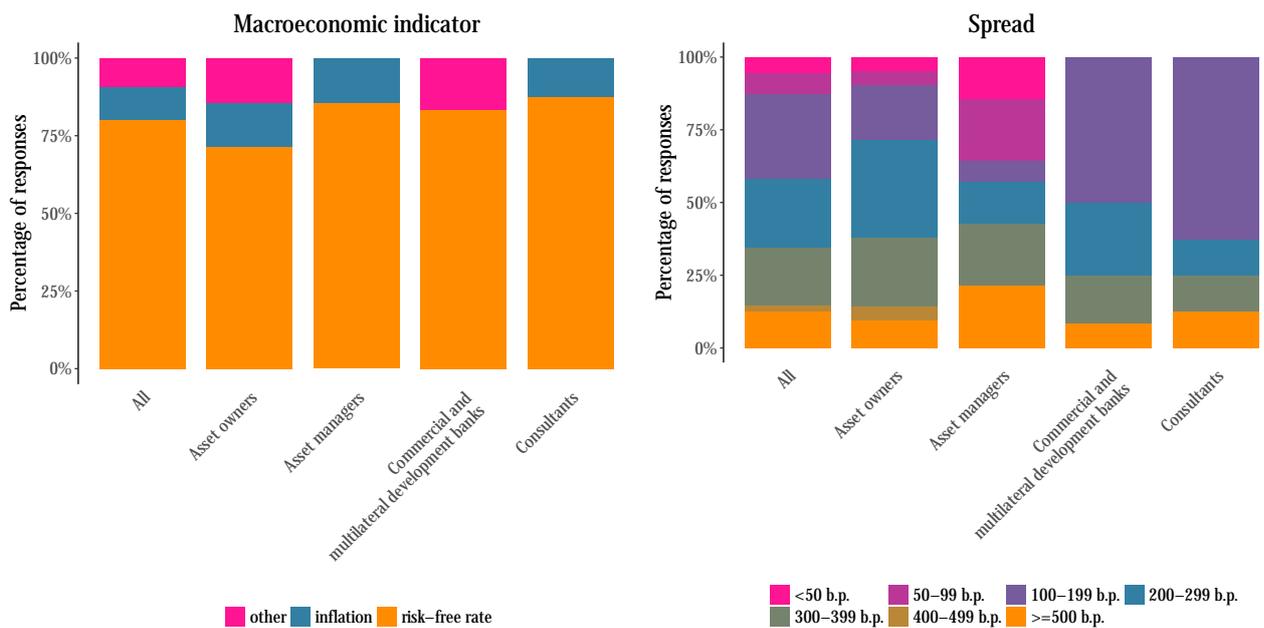


Figure 26: Absolute benchmark used for debt investments



6. Benchmarks for Risk Management

Figure 27: Relative benchmark used for debt investments

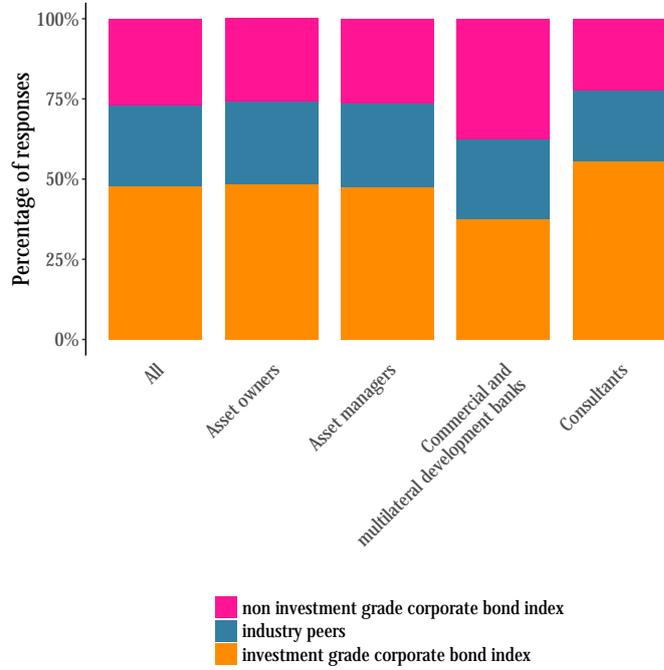
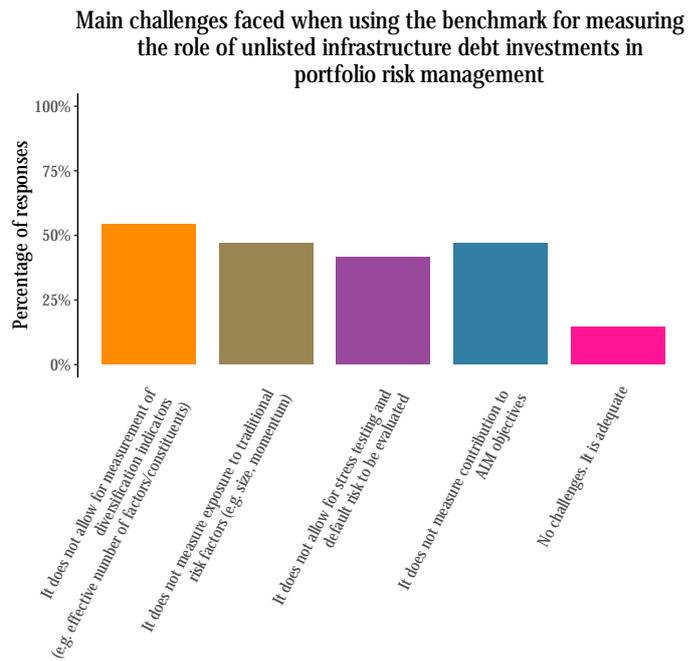


Figure 28: Challenges of using the benchmark



6. Benchmarks for Risk Management

6.3.4 Challenges

As for equity investment, investors in private infrastructure debt acknowledged a number of issues with current practices.

As shown in figure 28, over 50% of respondents said the current benchmarks used for risk management in private infrastructure debt do not allow for the measurement of diversification.

And almost 50% of respondents acknowledged the aforementioned benchmarks do not allow for stress testing and default risk to be evaluated.

Almost 50% of investors also said that the current benchmarks do not measure the contribution of infrastructure debt investments to ALM objectives.

Investors increasingly seek to use infrastructure investments for ALM. However, absolute benchmarks based on risk-free rates can only allow for the monitoring of a portfolio against liabilities. Without an understanding of exposure to interest rates, infrastructure investments cannot be used to construct a portfolio that matches liabilities.

6.4 Conclusion: Infrastructure Investors Do not Manage Their Risks

Survey respondents reported sometimes perplexing choices for their infrastructure risk-management benchmarks. Mostly, respondents acknowledged that little risk

management can take place in the current state of benchmarking of the asset class.

Respondents also highlight the lack of measurement of risk factors at all, let alone across asset classes.

Finally, they all lament the lack of understanding of infrastructure investments' potential contribution to asset-liability management, including the difficulty of using long-term infrastructure assets as liability-hedging instruments.

It seems, therefore, that today's infrastructure investors create risk exposures that they cannot easily optimise nor control and may be creating unknown dependencies in their portfolios, for example, by adding more interest-rate risk than they are aware of or able to measure.

As stated earlier, the measurement of risks in the unlisted infrastructure asset class can be improved, including through more adequate valuation methods (since risk is only the variance of asset value) that better use market inputs and capture market prices on an ongoing basis while avoiding inadequate proxies that are not representative of the infrastructure sector.

7. Market Trends



7. Market Trends

A recurrent section of this survey examines investors' intentions with regard to infrastructure allocations and investments in the near to medium term.

7.1 Investment Intentions

Table 1 shows the evolution of respondents' intentions in 2019 compared to their 2017 responses, when they were first asked the same questions. It should be noted that the evolution of the sample size and its composition between the two survey dates does not guarantee an exact, like-for-like comparison. The 2017 survey included approximately 190 respondents and a slightly higher proportion of asset managers.

Still, despite a slightly greater dispersion of the responses toward the "less infrastructure investment" part of the spectrum, the general picture is largely the same over the considered time period.

Investors continue to increase their exposure to infrastructure investments, either creating new allocations or deploying already allocated capital, with one-third of respondents aiming to invest significantly more (usually starting from a low base) and half of investors planning to invest "somewhat more" in the near future.

Figure 29 provides further insights into the more-recent set of responses: the proportion of respondents who intend to increase investments significantly is twice as high among managers and consultants as it

is among asset owners. This suggests that a significant share of new investments will be made on the basis of existing asset allocations.

The high proportion of lenders who declared wanting to invest more also highlights the ongoing development of infrastructure debt as an asset class.

7.2 Growth Markets

Next, we asked respondents for their views about the most promising national infrastructure markets over the next five years.

In advanced economies, as shown in figure 30, the main markets flagged remain the same as the ones that were flagged by investors in 2017. Mostly they are the largest, most active markets in which investors can hope to deploy capital.

We note that most countries identified in the EDHEC*infra* list of 25 "principal infrastructure markets," which is used to define the global investable universe of EDHEC*infra* indices, are also in the list of countries chosen by respondents to this survey.

EDHEC*infra* principal markets must cover at least 0.5% of the cumulative global-transaction volume since 2000 and have a secondary-to-primary transaction ratio of at least 20% (See EDHEC*infra* Index Methodology Standard⁴).

The United States remains a market with immense potential for private infrastructure

7. Market Trends

Figure 29: In the next 3-5 years, you intend to: invest in / advise investing in infrastructure . . .

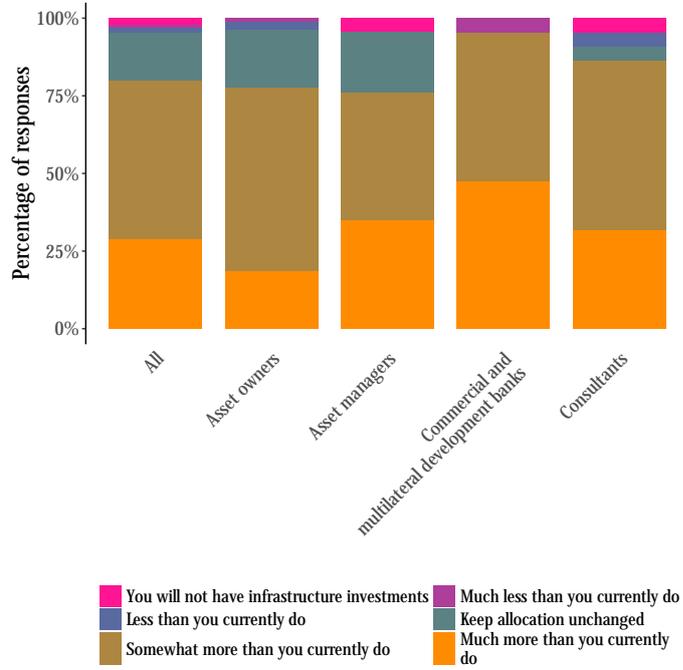
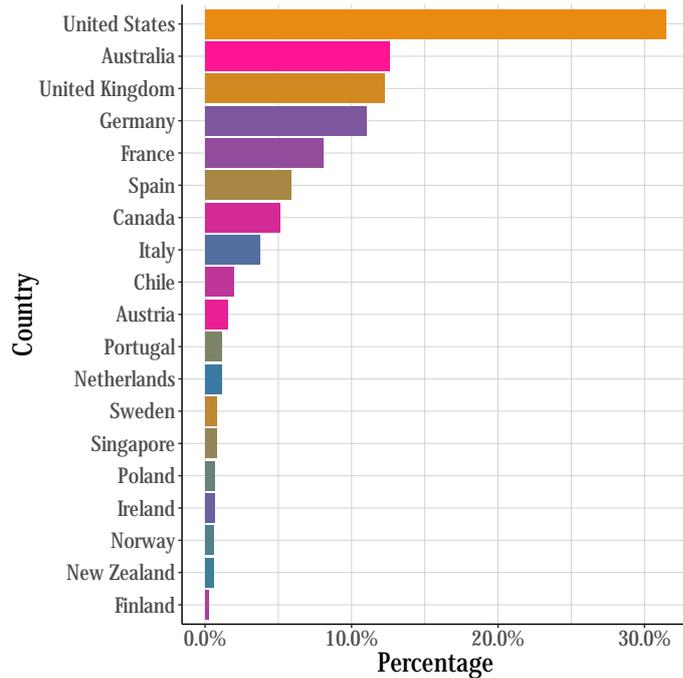


Figure 30: Infrastructure markets with the most potential in the next 5 years (advanced economies)



7. Market Trends

Table 1: Intention to invest in infrastructure in the next 3-5 years

Investment intention	2019	2017
Much more than you currently do	29%	29%
Somewhat more than you currently do	50%	61%
Keep allocation unchanged	17%	10%
Less than you currently do	1%	0%
Much less than you currently do	1%	0%
You will not have infrastructure investments	2%	0%

investment despite the apparent lack of progress with public-policy announcements.

We also note that the United Kingdom remains high on the list of infrastructure investors' favoured markets despite the expected macroeconomic and political shocks of 2019 with the UK's exit from the European Union. This highlights the key role of the UK as one of the most developed and sizeable markets for infrastructure investment, as well as the strength of investors' belief in the long-term value of infrastructure companies.

With regard to promising emerging markets (EM), respondents listed some of the most prominent, albeit not the most investable, infrastructure markets.

7.2.1 Emerging Markets

We note a slight decrease of enthusiasm on the part of investors when it comes to investing in EM infrastructure.

Figure 32 shows that almost 45% of respondents already invest in emerging markets and, if those who also intend to invest in such markets are included, more than half of respondents are interested in EM infrastructure.

However, table 2 shows that this dynamic has waned somewhat since 2017. A lower percentage of respondents reported wanting to increase their EM exposures than in 2017, and a quarter reported wanting to keep this allocation unchanged for the time being.

This evolution can be partly attributed to the larger survey sample in 2019, but even so, the flow of private capital into EM infrastructure does not appear to be increasing.

This may be due to the evolution of investors' risk appetites, perceived macro risk factors (see below), and the significant limits to the growth of market size in EM.

Indeed, infrastructure investment in EM requires significant resources to access individual transactions, take part in public procurement, forge local partnerships, etc. The complexity of leading such transactions is a natural break on the ability of investors to deploy capital in such markets.

We note that in the 2017 edition of this survey, a majority of investors had declared finding project-preparation facilities led by multilateral institutions to add considerable value to EM transactions.

7. Market Trends

Figure 31: Infrastructure markets with the most potential in the next 5 years (emerging markets)

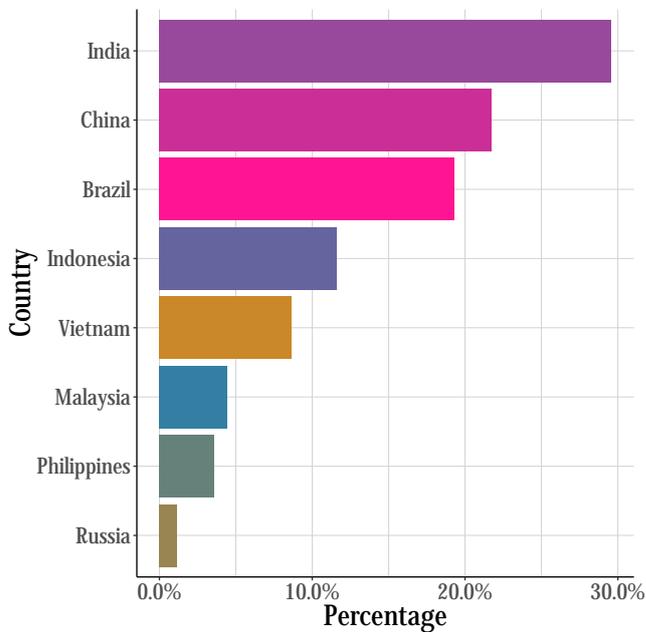


Figure 32: Does your firm invest in emerging-market infrastructure?

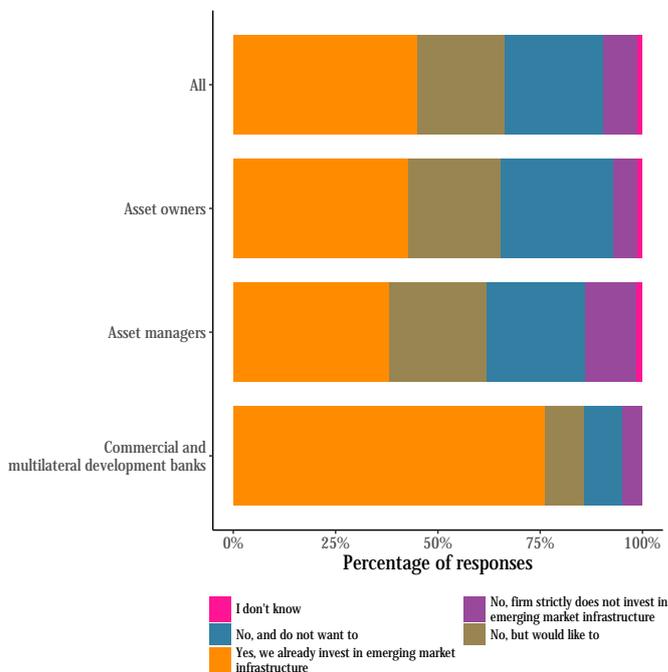
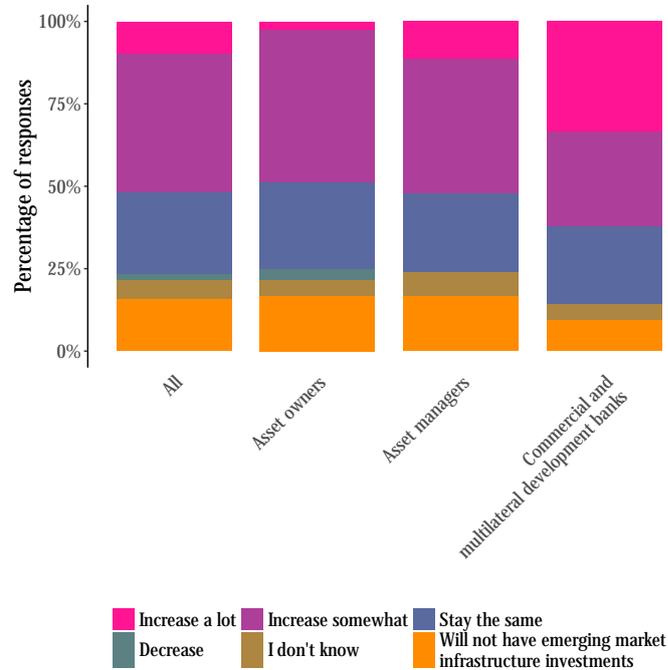


Table 2: Expected change in emerging-market infrastructure exposure

Investment intention	2019	2017
Increase a lot	10%	9%
Increase somewhat	42%	73%
Stay the same	25%	0%
Decrease	2%	0%
I don't know	6%	18%
Will not have emerging market infrastructure investments	16%	N.A.

7. Market Trends

Figure 33: How is your exposure to emerging markets going to change in the next 3-5 years?



7.3 Macro Risks

Among the risks that may be limiting infrastructure investor's ambitions and investment intentions in EM are two major forms of macro risk that impact investments across the portfolio: interest-rate risk and foreign-exchange risk.

Figure 34 shows the proportion of respondents expecting interest-rate risk to negatively impact their infrastructure portfolio. The proportion of investors who expect adverse effects in advanced economies is high, at 47%, but it is much higher for emerging-market investments (54%).

Interest-rate risk is inherent to long-term assets like infrastructure companies, whose sole value is determined by a future stream of cash flows often extending decades into

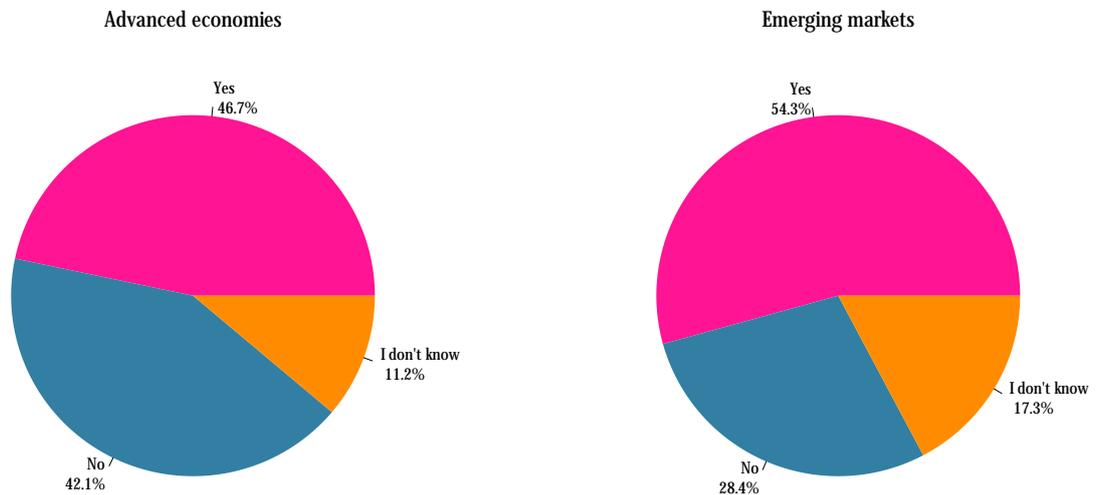
the future because of the large sunk costs and long repayment periods that characterise their businesses.

Hence, even equity investments have a well-defined "duration," and any movements in interest rates can be expected to impact valuations. In emerging markets, rising interest rates may also be associated with capital flight and even lead to higher foreign-exchange risk.

Indeed, figure 35 shows that respondents' level of concern about the impact of foreign-exchange risk in infrastructure investment is significant. Almost half of respondents declared that such risks are a major barrier to their investing in infrastructure.

7. Market Trends

Figure 34: Will rising interest rates in the US and the expected trend to monetary-policy normalisation in other markets negatively impact infrastructure markets?

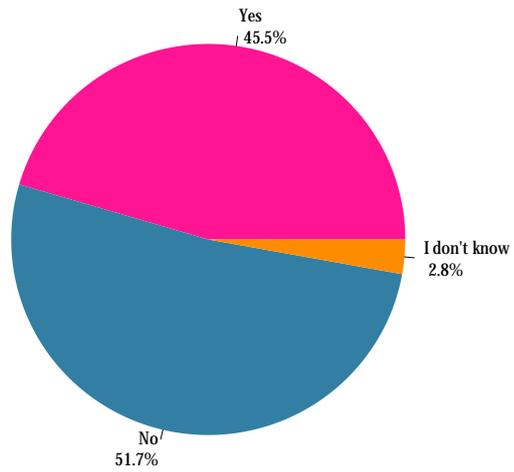


Among the large investors who took this survey, exposures to major currencies are typically managed at the portfolio level instead of at the individual-asset-class level. Still, managing long-term foreign-exchange risk, especially outside of major markets, is more difficult and costly.

Conversely, when projects in emerging markets are financed in hard currency, a mismatch with the currency of their revenue stream is typically created, which can be equally – if not more – risky for investors. Indeed, individual investments are less likely to survive a large shift in foreign-exchange rates and the ensuing losses than large investors at the portfolio level.

7. Market Trends

Figure 35: Is foreign-exchange risk a major barrier to increasing your allocation to infrastructure?



8. Defining Mandates



8. Defining Mandates

A central issue for investors wanting to access the infrastructure asset class is the definition and classification of individual investments and, by extension, that of entire strategies.

As discussed in chapter 5, actual investment decisions in highly illiquid asset classes like infrastructure are likely to involve multiple tilts relative to broad policy benchmarks.

Each of these strategies typically is the object of one or several individual investment mandates, which themselves need to be defined in reasonably clear terms relative to the policy benchmark and objectives.

We asked survey respondents how they chose to define such mandates.

Figure 36 shows the importance of the "core," "core+," etc. taxonomy relative to other aspects of the risk profile of infrastructure investments such as "business risk" (whether infrastructure firms are "contracted," "regulated," or "merchant"), "industrial activity," "geography," or "company type" (i.e., project vehicles vs. so-called corporates).

Respondents prioritise "business risk" and geography over "core/core+."

We note that the distinction between industries and types of corporate structures remains less important than the distinction between "core" and "core+."

This may be because the impact of such dimensions are implicit in the pre-existing taxonomy or because the distinction is not necessarily well understood, let alone documented, among investors.

Looking solely at the rating of the importance of the "core" taxonomy, table 3 suggests that asset owners are the keenest to use a terminology inherited from real estate to define investment mandates: more than 60% reported finding the distinction between "core," "core+," and "opportunistic" to be very important in the definition of an investment mandate, while asset managers and consultants, perhaps surprisingly, seem less attached to this terminology, and even less so commercial and development banks.

This result may be a reflection of asset owners' strong demand for information and understanding of what infrastructure investment mandates entail *ex ante*. They may find these classifications important because they need to know *at least* that much about asset managers' or their own infrastructure team's mandates.

Again, the lumpiness, low liquidity, and link with public procurement that characterise individual transactions may make this level of granularity in the definition of individual investment mandates unrealistic if not self-defeating.

Finally, we also asked whether asset owners found responses to requests for proposals (RFPs) by asset managers easy to compare between investment managers.

8. Defining Mandates

Figure 36: How do you define an infrastructure-investment mandate or strategy?

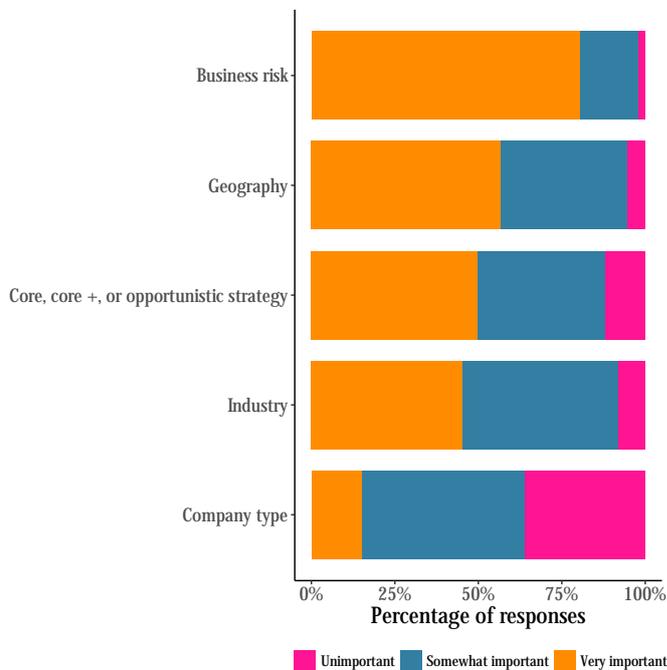


Table 3: How important is it to define infrastructure-investment mandates in terms of "core," "core+," etc.

Organisation type	Very important	Somewhat important	Unimportant
Asset owners	61%	35%	4%
Asset managers	46%	36%	18%
Commercial and multilateral development banks	26%	58%	16%
Consultants	47%	38%	16%

Figure 37 shows that in 50% of cases, investors find RFPs difficult to compare with one another. This suggests that despite the information required and provided in the context of individual mandates, a certain level of improvement remains possible in the standardisation of the definition and classification of infrastructure investments and strategies.

Since late 2018, EDHEC*infra* publishes and maintains the EDHEC Infrastructure Companies Classification Standard (ICCS), an industry standard for the classification of infrastructure investments that is the object of annual consultations and validation by

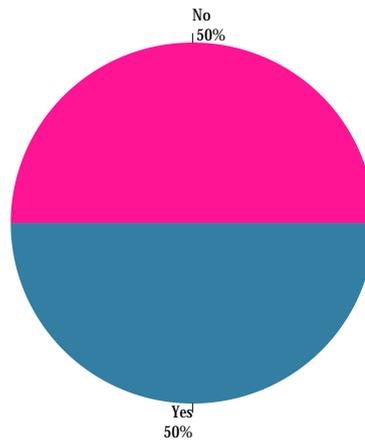
a review committee including both asset owners and managers.

Thanks to the development of such consensus-based classification schemes, the definition of investment mandates and the comparability of RFPs may be improved significantly. With benchmarks built according to such classifications, mandate-specific benchmarks can also be defined and used to assess the track records of individual managers.

8. Defining Mandates

Figure 37: Comparing infrastructure-asset managers

When receiving responses to requests for proposal (RFP),
is it easy to compare asset managers?



9. ESG Considerations



9. ESG Considerations

The environmental, social, and governance (ESG) aspects of infrastructure investments have been an increasingly important set of considerations for investors in infrastructure. Figure 38 shows that the vast majority of investors are at least somewhat aware (48%) if not very aware (42%) of the ESG characteristics of their infrastructure investments.

ESG is very relevant to the infrastructure sector. Infrastructure is critical to the health and wealth of economies, and infrastructure spending increases economic output and overall factor productivity. Furthermore, some types of infrastructure, such as renewable-energy projects, are expected to contribute to a more sustainable future and can be considered *sustainable infrastructure*.

Wiener (2014) defines sustainable infrastructure as that which integrates ESG directly into a project's planning, building, and operating phases with the aim of mitigating risk, reducing emissions, and promoting social cohesion and economic development while ensuring resilience in the face of climate change or other shocks.

The relationship between the **impact** of certain companies' activities on their social and natural environments on the one hand and their ability to deliver a certain level of financial performance on the other is now a central question in the debate around responsible investment, especially when investors represent large constituencies of

members of pension plans, whether they belong to collective or individual schemes.

In effect, favouring investments with desirable ESG characteristics is becoming a matter of principle or investment philosophy for an increasing proportion of investors.

Figure 39 shows that in the 2016 edition of this survey, 17% of asset owners identified achieving ESG objectives to be a "first order question," possibly at the expense of financial performance (Blanc-Brude et al., 2016). In 2019, this figure has reached close to 36%.

This implies that rather than using ESG as driver of (higher or lower) returns in the portfolio, investors increasingly see ESG as a set of *filters* that should lead them to exclude certain assets from their investment set.

Meanwhile, the argument is often made by asset managers that better ESG investing goes hand in hand with higher returns or even that an "ESG factor" exists and that it drives the performance of companies over and above traditional risk factors (see Amundi, 2019, for a recent example).

Why more-sustainable infrastructure should exhibit systematically higher returns might seem puzzling from the point of view of asset-pricing theory. The question of ESG's impact on infrastructure returns relates to the risk exposures created by the corresponding firm characteristics. If

9. ESG Considerations

Figure 38: How aware are investors of the ESG performance of their infrastructure investments?

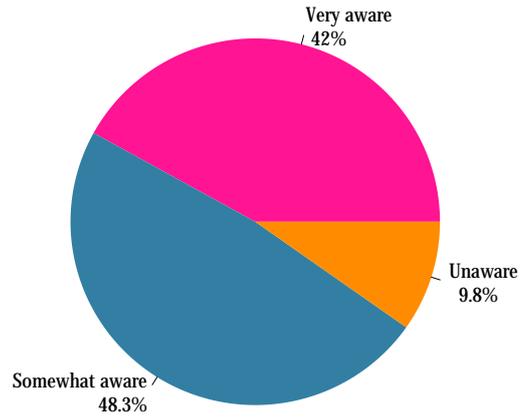
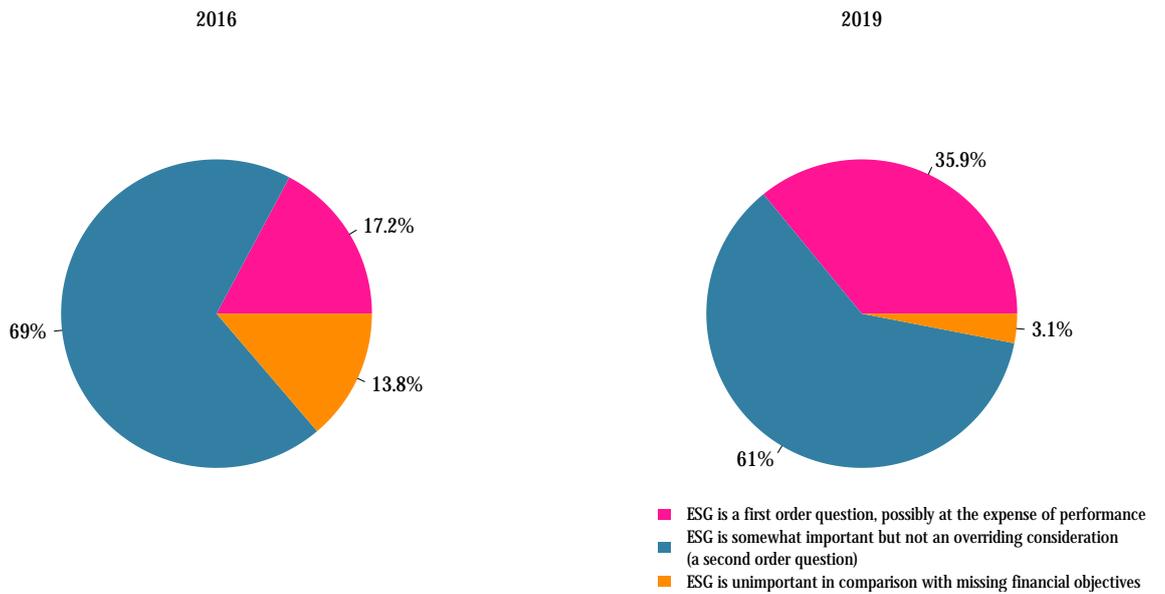


Figure 39: How principled is institutional investors' stance about the social and environmental impact of infrastructure investments?



9. ESG Considerations

different levels of ESG impact affect the riskiness of investment in infrastructure companies, their values should reflect this.

Thus, if more-sustainable energy infrastructure is less likely to face costly future carbon-emission regulation, it can be considered less risky than otherwise equivalent assets: hence it should have lower expected returns.

Conversely, if renewable-energy investments are understood to create a large exposure to energy-sector regulatory risk, then such investments should indeed be expected to exhibit higher returns. For instance, a government could abruptly withdraw subsidies to the solar sector, pushing an entire generation of renewable energy projects to the brink of bankruptcy.

One question is whether the ESG characteristics of infrastructure companies, and the risk exposures they create, can be expected to have a clear-cut, systematic impact on returns. In fact, the effect of the *E* in ESG is not necessarily the same as that of the *S* or the *G*. These effects, which are mostly a matter of current and future regulation, may have different sizes and signs. They may also change size and sign over time. What the net effect of better ESG incorporation on infrastructure returns should be is not self-evident.

A second question is whether the actual impacts of certain infrastructure businesses on the economy, environment, and society at large may ever enter the realm of the

regulation of these sectors and impact their bottom line. For instance, say that most ports in Europe are part of well-documented drug-trafficking routes, ensuring the distribution of cocaine across Europe (see for example Europol, 2013, p.46) and contributing to an equally well-documented negative social impact. It seems unlikely that the same port companies should, as a result, be expected to face new and costly regulation to address what is essentially a law-enforcement issue. Not all social or environmental impacts of infrastructure companies, of which there are many, are the object of regulation or re-regulation that may have a systematic effect on the financial performance of infrastructure firms. Externalities are, by definition, not priced.

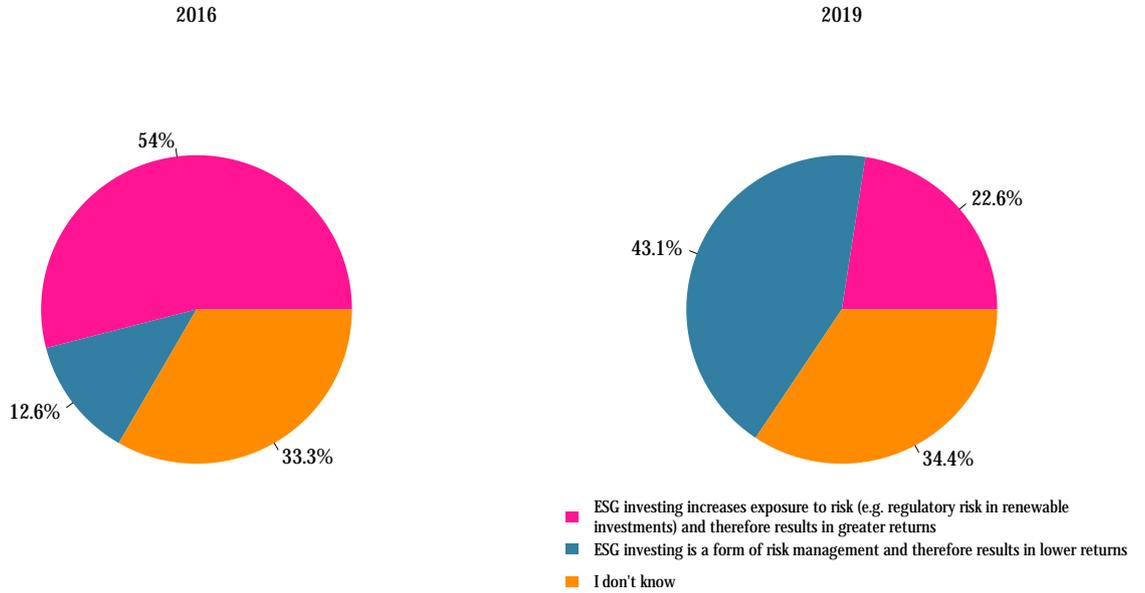
Figure 40 shows the 2016 and 2019 responses to the question "Does better ESG lead to higher or lower returns?" In three years, the dominant view has shifted from the notion that ESG should lead to higher returns (implying higher risk) to the opposite view: better ESG means managing/lowering risks and thus should lead to lower returns (higher prices).

Both views are of course valid in theory, as discussed above. The question of which effects play the largest roles in practice remains a matter of empirical research.

In a first paper on this topic, Garcia and Whittaker (2019) compare ESG-reporting scores and their relationship with return on

9. ESG Considerations

Figure 40: Does better ESG lead to higher or lower returns?



assets and find that they are not correlated in any meaningful way.

Future research will aim to establish any empirical link between actual impact and financial performance. In the meantime, this topic remains an important aspect of infrastructure investors' "investment beliefs" and one that is evolving over time, as the survey results demonstrate.

10. Conclusions



10. Conclusions

In this section, we briefly summarise the findings of the 2019 EDHEC*infra*/GIH survey of infrastructure investors.

10.1 Investment Intentions

Investors' willingness to deploy capital in the infrastructure space has not diminished. The largest investors in the world focus primarily on unlisted infrastructure equity and, increasingly, debt.

They reported a constant and growing allocation to infrastructure, including in emerging markets, which are a relevant geography for 50% of respondents.

Still, based on investors' declared intentions, we note that investment in emerging-market infrastructure is unlikely to experience the exponential growth that is required to fill the infrastructure-funding gap in many countries.

Overall, the infrastructure sector is showing signs of becoming more mainstream and represents larger allocations among very large investors.

10.2 ESG Considerations

As the infrastructure asset class develops, attitudes to ESG in infrastructure are evolving. One-third of investors report that ESG is a first-order problem for them, up from less than one-fifth in the previous edition of this survey.

Most investors continue to grapple with the role of ESG in their portfolio and in particular its relationship with performance, if any.

However, the trend to consider ESG as a matter of investment philosophy or principle (i.e., as a filter of the investable set rather than a component of the investment strategy) is likely to have the greatest impact on infrastructure investing.

10.3 Benchmarking Practices

A benchmark is defined as a portfolio of reference and, consequently, it is supposed to be representative of the risks of the managed portfolio. It is widely accepted that the choice of benchmark plays an important role in portfolio performance.

Benchmark construction allows objectives to be fixed in terms of the portfolio's systematic risk exposure, which is reflected in the choice of strategic asset allocation. Benchmarks also serves to evaluate portfolio performance.

however, this survey shows that most investors rely on absolute benchmarks to determine their allocations to infrastructure equity or debt.

This implies that most such allocation decisions are completely ad hoc and, in all likelihood, highly suboptimal, because portfolio optimisation tools cannot be applied without risk measures.

10. Conclusions

Indeed, infrastructure investors acknowledged this situation in their responses to this survey, highlighting the many flaws of their current practices.

At the asset-allocation level, investors need benchmarks of unlisted infrastructure investments that are representative of their strategic choice, provides a measure of risk-adjusted returns, and allows the measurement of correlations with other asset classes in order to make the best strategic allocation to infrastructure.

With regards to performance monitoring, our results also highlight the underdevelopment of benchmarks.

Because infrastructure-investment strategies are likely to represent significant sector, geography, and business-risk tilts due to the lumpiness and illiquid nature of investments, performance-monitoring benchmarks should be tailored to represent actual investment strategies, which can sometimes only be known ex post.

However, half of investors in infrastructure reported using the policy or asset-allocation benchmark for performance monitoring. Moreover, the use of absolute benchmarks preclude investors from separating the delivery of the core performance of the strategy from any out-performance relative to this objective.

Hence, reported performance-monitoring benchmarks exhibit all the flaws of asset-allocation benchmarks: they do not offer

any insight into risk-adjusted return and they are not representative.

At the heart of the question of performance monitoring is also that of the fair valuation of unlisted infrastructure investments, be they equity or debt instruments. As long as private assets like infrastructure debt and equity are valued using ill-suited proxies (e.g., listed infrastructure), monitoring performance is essentially impossible for investors.

Finally, survey respondents reported sometimes perplexing choices for their risk-management benchmarks, acknowledging that little risk management can take place in the current state of benchmarking for the asset class.

Respondents also highlight the lack of measurement of risk factors, let alone across asset classes.

Finally, they all lament the lack of understanding of infrastructure investments' potential contribution to asset-liability management, including the difficulty of using long-term infrastructure assets as liability-hedging instruments.

It seems, therefore, that today's infrastructure investors create risk exposures that they cannot easily optimise nor control and may be creating unknown dependencies in their portfolios, for example, by adding more interest-rate risk than they are aware of or able to measure.

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About Global Infrastructure Hub



About Global Infrastructure Hub

In November 2014, G20 leaders agreed to a “Global Infrastructure Initiative” to lift quality public and private infrastructure investment, including the establishment of the Global Infrastructure Hub (the GI Hub).

The Global Infrastructure Hub has a G20 mandate to grow the global pipeline of quality, bankable infrastructure projects.

By facilitating knowledge sharing, highlighting reform opportunities, and connecting the public and private sectors, its goal is to increase the flow and quality of private and public infrastructure investment opportunities in G20 and non-G20 countries.

With an expected global infrastructure deficit widely estimated at up to USD20 trillion to 2030, it is clear that this gap needs to be addressed.

The GI Hub works to address data gaps, lower barriers to investment, increase the availability of investment-ready projects, and improve project and policy environments for infrastructure.

The GI Hub provides independent data and analysis of the addressable opportunities for investment, the specific blockages to infrastructure development, and tools and insights to help overcome them. Our resources are informed by the private, public, and multilateral sectors and validated by independent bodies and GI Hub experts. We zero in on the knowledge, improvements, and innovations that will really make a difference.

The GI Hub's resources include data mapping, a tool to assess country-level infrastructure environments, a knowledge platform, and project-pipeline and leading practices. These resources make it easier for government procurement professionals to understand how reforms can help them attract finance and deliver infrastructure, connect to international peers for advice and support, access best-practice tools, as well as showcase their projects to private investors.

We believe that targeted reforms to adopt best practices in project development and procurement will transform infrastructure outcomes: more bankable projects, more productive economies, and more liveable communities for investors, governments, and communities.

<http://globalinfrastructurehub.org>



About EDHEC Infrastructure Institute-Singapore



About EDHEC Infrastructure Institute–Singapore

EDHEC*infra* addresses the profound knowledge gap faced by infrastructure investors by collecting and standardising private investment and cash-flow data and running state-of-the-art asset pricing and risk models to create the performance benchmarks that are needed for asset allocation, prudential regulation, and the design of new infrastructure investment solutions.

Origins

In 2012, EDHEC-Risk Institute created a thematic research program on infrastructure investment and established two Research Chairs dedicated to long-term investment in infrastructure equity and debt, respectively, with the active support of the private sector.

Since then, infrastructure investment research at EDHEC has led to more than 20 academic publications and as many trade press articles, a book on infrastructure asset valuation, more than 30 industry and academic presentations, more than 200 mentions in the press, and the creation of an executive course on infrastructure investment and benchmarking.

A testament to the quality of its contributions to this debate, EDHEC*infra*'s research team has been regularly invited to contribute to high-level fora on the subject, including G20 meetings.

Likewise, active contributions were made to the regulatory debate, in particular directly supporting the adaptation of the Solvency-II framework to long-term investments in infrastructure.

This work has contributed to growing the limited stock of investment knowledge in the infrastructure space.

A Profound Knowledge Gap

Institutional investors have set their sights on private investment in infrastructure equity and debt as a potential avenue toward better diversification, improved liability-hedging, and reduced drawdown risk.

Capturing these benefits, however, requires answering some difficult questions:

1. **Risk-adjusted performance measures** are needed to inform strategic asset allocation decisions and monitor performance;
2. **Duration- and inflation-hedging properties** are required to understand the liability-friendliness of infrastructure assets;
3. **Extreme risk measures** are in demand from prudential regulators, among others.

Today none of these metrics is documented in a robust manner, if at all, for investors in privately held infrastructure equity or debt. This has left investors frustrated by an apparent lack of adequate investment solutions in infrastructure. At the same time, policy-makers have begun calling for a widespread effort to channel long-term savings into capital projects that could support long-term growth.

To fill this knowledge gap, EDHEC has launched a new research platform, EDHEC*infra*, to collect, standardise, and produce investment performance data for infrastructure equity and debt investors.

Mission Statement

Our objective is the creation of a global repository of financial knowledge and investment benchmarks about infrastructure equity and debt investment, with a focus on delivering useful applied research in finance for investors in infrastructure.

We aim to deliver the best available estimates of financial performance and risks of reference portfolios of privately held infrastructure investments and to provide

About EDHEC Infrastructure Institute-Singapore

investors with valuable insights about their strategic asset allocation choices in infrastructure, as well as to support the adequate calibration of the relevant prudential frameworks.

We are developing unparalleled access to the financial data of infrastructure projects and firms, especially private data that is either unavailable to market participants or cumbersome and difficult to collect and aggregate.

We also bring advanced asset pricing and risk-measurement technology designed to answer investors' information needs about long-term investment in privately held infrastructure, from asset allocation to prudential regulation and performance attribution and monitoring.

What We Do

The EDHEC*infra* team is focused on three key tasks:

1. **Data collection and analysis:** we collect, clean, and analyse the private infrastructure investment data of the project's data contributors as well as from other sources, and input it into EDHEC*infra*'s unique database of infrastructure equity and debt investments and cash flows. We also develop data collection and reporting standards that can be used to make data collection more efficient and more transparently reported. This database already covers 15 years of data and hundreds of investments and, as such, is already the largest dedicated database of infrastructure investment information available.
2. **Cash-flow and discount-rate models:** Using this extensive and growing

database, we implement and continue to develop the technology developed at EDHEC-Risk Institute to model the cash flow and discount-rate dynamics of private infrastructure equity and debt investments and derive a series of risk and performance measures that can actually help answer the questions that matter for investors.

3. **Building reference portfolios of infrastructure investments:** Using the performance results from our asset pricing and risk models, we can report the portfolio-level performance of groups of infrastructure equity or debt investments using categorisations (e.g., greenfield vs. brownfield) that are most relevant for investment decisions.

Partners of EDHEC*infra*

Monetary Authority of Singapore

In October 2015, Deputy Prime Minister of Singapore Tharman Shanmugaratnam announced officially at the World Bank Infrastructure Summit that EDHEC would work in Singapore to create "usable benchmarks for infrastructure investors."

The Monetary Authority of Singapore is supporting the work of the EDHEC Singapore Infrastructure Investment Institute (EDHEC*infra*) with a five-year research development grant.

Sponsored Research Chairs

Since 2012, private-sector sponsors have been supporting research on infrastructure investment at EDHEC with several Research Chairs that are now under the EDHEC Infrastructure Investment Institute:

About EDHEC Infrastructure Institute-Singapore

1. The EDHEC/NATIXIS Research Chair on the Investment and Governance Characteristics of Infrastructure Debt Instruments, 2012-2015
2. The EDHEC/Meridiam/Campbell-Lutyens Research Chair on Infrastructure Equity Investment Management and Benchmarking, 2013-2016
3. The EDHEC/NATIXIS Research Chair on Infrastructure Debt Benchmarking, 2015-2018
4. The EDHEC / Long-Term Infrastructure Investor Association Research Chair on Infrastructure Equity Benchmarking, 2016-2019
5. The EDHEC/Global Infrastructure Hub Survey of Infrastructure Investors' Perceptions and Expectations, 2016

Partner Organisations

As well as our Research Chair Sponsors, numerous organisations have already recognised the value of this project and have joined or are committed to joining the data collection effort. They include:

- The Global Infrastructure Hub;
- The European Investment Bank;
- The World Bank Group;
- The European Bank for Reconstruction and Development;
- The members of the Long-Term Infrastructure Investor Association;
- Over 20 other North American, European, and Australasian investors and infrastructure managers.

EDHEC*infra* is also :

- A member of the Advisory Council of the World Bank's Global Infrastructure Facility
- An honorary member of the Long-term Infrastructure Investor Association

EDHEC Infrastructure Institute Publications



EDHEC Infrastructure Institute Publications

EDHEC Publications

- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Equity Indices: Benchmarking European Private Infrastructure Equity 2000-2016" (June 2017).
- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Debt Indices: Benchmarking European Private Infrastructure Debt 2000-2016" (June 2017).
- Blanc-Brude, F., G. Chen, and T. Whittaker. "Towards Better Infrastructure Investment Products: A Survey of Investors' Perceptions and Expectations from Investing in Infrastructure" (July 2016).
- Blanc-Brude, F., T. Whittaker, and S. Wilde. "Searching for a Listed Infrastructure Asset Class: Mean-Variance Spanning Tests of 22 Listed Infrastructure Proxies" (June 2016).
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- Blanc-Brude, F., T. Whittaker, and M. Hasan. "Revenues and Dividend Payouts in Privately-Held Infrastructure Investments" (March 2016).
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- Blanc-Brude, F., and D. Makovsek. "How Much Construction Risk Do Sponsors Take in Project Finance?" (August 2014).
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EDHEC Infrastructure Institute

Publications

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- Hasan, M., and F. Blanc-Brude. "You Can Work It Out! Valuation and Recovery of Private Debt with a Renegotiable Default Threshold." *Journal of Fixed Income*, 26(4), 2017, pp. 113-127.
- Blanc-Brude, F., S. Wilde, and T. Witthaker. "Looking for an Infrastructure Asset Class: Definition and Mean-Variance Spanning of Listed Infrastructure Equity Proxies." *Financial Market & Portfolio Management*, 31, 2017, pp. 137-179.
- Blanc-Brude, F., and M. Hasan. "A Structural Model of Credit Risk for Illiquid Debt." *Journal of Fixed Income*, 26(1), 2016, pp. 6-19
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- Bianchi, R., M. Drew, E. Roca, and T. Whittaker. "Risk Factors in Australian Bond Returns," *Accounting & Finance*, 2015.
- Blanc-Brude, F. "Long-Term Investment in Infrastructure and the Demand for Benchmarks." *JASSA: The Finsia Journal of Applied Finance*, 3, pp. 57-65, 2014.
- Blanc-Brude, F. " Risk Transfer, Self-Selection and Ex Post Efficiency in Public Procurement: An Example from UK Primary and Secondary School Construction Contracts." *Revue d'Economie Industrielle*, 141(1st Quarter), pp. 149-180, 2013.
- Blanc-Brude, F., H. Goldsmith, and T. Valila. "A Comparison of Construction Contract Prices for Traditionally Procured Roads and Public-Private Partnerships." *Review of Industrial Organization*, 35(1-2), pp. 19-40, 2009
- Blanc-Brude, F., H. Goldsmith, and T. Valila. "Public-Private Partnerships in Europe: An Update." *EIB Economic & Financial Reports*, 2007.
- Blanc-Brude, F., and R. Strange. "How Banks Price Loans to Public-Private Partnerships: Evidence from the European Markets." *Journal of Applied Corporate Finance*, 19(4), pp. 94-106, 2007.
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Books

EDHEC Infrastructure Institute Publications

- Blanc-Brude, F., and M. Hasan. *Valuation and Financial Performance of Privately-Held Infrastructure Investments*. London: PEI Media, 2015.

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