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Towards Better Infrastructure Investment Products?

A survey of investor's perceptions
and expectations from investing in infrastructure

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Foreword

The purpose of the present publication, "Towards better infrastructure products: a survey of investor's perceptions and expectations of infrastructure investment", which is sponsored by the Global Infrastructure Hub, is to conduct the first in-depth study of the perceived role by infrastructure assets for investors, including asset owners representing approximately USD8 trillion of institutional assets under management (AUM).

Asset owners have gradually developed an interest for infrastructure investment over the past two decades with several motives: improving diversification benefits through higher and more diverse alternative allocations, and as a result of the shift towards liability-driven investment and the corollary search for duration. Still, their decision to invest in infrastructure typically rests on a range of investment beliefs and aims to achieve different objectives. In this survey, the authors provide a breakdown of these investment beliefs by type of institutions, differentiating between respondent types.

Beyond the difference of perspective and preferences documented here for the first time, this paper illustrates how far the market for infrastructure investment management still has to go. Today, they are stuck between a rock and a hard place: accessing infrastructure through ill-suited fund structures or investing directly and making unnecessary concentrated bets. A key area where progress awaits is for investors to better understand the potential contribution of infrastructure assets to their investment strategy.

One such development is the integration of infrastructure investment to the factor investing paradigm. The majority of respondents declare wanting to buy-and-hold highly illiquid infrastructure for very long periods. Hence, portfolio optimisation and rebalancing must be done on a multi-asset basis and understanding the factor exposures created by infrastructure assets becomes a necessity.

With better data and better models, the part taken by infrastructure investment to a global investment solution designed to reach investors' long-term investment goals will become clearer and more powerful.

This survey also provides a powerful validation of the work done by EDHEC*infra* to populate a global database of infrastructure cash flows and build risk-adjusted performance measures of portfolios of private infrastructure. The immense majority of survey respondents confirms that such works is important to them and remains to be done.

We are grateful to Global Infrastructure Hub for their support of this study and wish you an interesting and thought-provoking read.

Noël Amenc

Associate Dean, EDHEC Business School

About the Authors

Frédéric Blanc-Brude is Director of the EDHEC Infrastructure Institute-Singapore and represents EDHEC Business School on the Advisory Board of the Global Infrastructure Facility of the World Bank. He holds a Ph.D. in Finance (King's College London), and degrees from London School of Economics, the Sorbonne and Sciences Po Paris.

Grace Chen is Senior Relationship Manager at EDHEC Infrastructure Institute-Singapore. She has close to ten years of work experience managing investor relations and raising funds across the real estate investment trust, private real estate and private equity markets. She has a bachelor's degree in journalism from the University of Queensland and started her career as a journalist at CNBC Asia.

Tim Whittaker is an Associate Research Director at EDHEC Infrastructure Institute-Singapore and Head of Data Collection. He holds a Master of Business (Financial Management) and a Ph.D. in Finance from Griffith University.

Executive Summary

Executive Summary

This paper presents the result of the first in-depth survey of institutional investors' perceptions and expectations of infrastructure investment.

It documents the reasons for investing in infrastructure and whether currently available investment products or strategies are helping investors meet these objectives. The findings provide a first step towards integrating infrastructure in long-term investment solutions.

We report the views of 184 individuals involved in infrastructure investment. Half of them represent institutional investors or "asset owners" (insurers, pension plans and sovereign wealth fund), one-third are infrastructure asset managers and the remainder are infrastructure investment specialists from multilateral development banks, rating agencies and consultancies.

Excluding managers and other respondents, asset owners that participated in this study represent approximately USD 8 trillion in assets under management (AUM) or ten percent of global AUMs. [1]

Respondents are mostly senior executives active in the top management (CEO, board members – 14.5 percent), strategic (CIO, Head of ALM or Asset Mix – 25.5 percent), investment (Head of Infrastructure, investment director – 46.2 percent) or other (14.5 percent) functions of the organisations they represent.

1 - USD2.6 trillion of pension funds; USD4.8 trillion of insurance companies; USD0.5 trillion of sovereign wealth funds (SWFs)

Survey highlights

- Close to eighty percent believe that private infrastructure is an asset class but only half thinks that listed infrastructure has distinctive characteristics;
- The majority of asset owners and managers agree that infrastructure investments derive their characteristics from their contractual, not industrial features;
- Investors disagree about expected returns: a third believes that infrastructure should be "expensive" (low yielding) while the remainder requires higher returns. Managers systematically report higher expected returns than asset owners.
- Ninety four percent of respondents declare that no usable benchmark currently exists for investors in infrastructure;
- Eighty two percent of asset owners say that the classic close-ended PE infrastructure fund is outdated and not adding value ;
- Close to half of institutional investors do not trust, or do not know whether or not they can trust the valuations reported by infrastructure managers.
- Three quarters of asset owners are concerned or very concerned about the amount of dry powder accumulated in private infrastructure equity and debt mandates and how it might undermine the quality of future investments.
- A minority of asset owners declares ESG to be a first order priority, while the

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majority thinks that while important it is a second order problem.

A growing consensus on the definition of the infrastructure asset class

1. There is wide disagreement amongst respondents about whether listed infrastructure equity or debt qualify as an asset class. However, **unlisted infrastructure** is widely considered to be a "unique" asset class, both on the private debt and privately-held equity sides;
2. Most respondents also believe that focusing on infrastructure investment **only makes sense if it can be defined as an asset class**, whereas a minority reports preferring to approach infrastructure as an investable bundle of factor exposures;
3. Most respondents perceive infrastructure investment's **unique feature to be either its potential for portfolio diversification or for harvesting risk premia**, whereas it is less frequently believed that infrastructure has *unique* interest rate or inflation hedging properties;
4. Investors and managers **define infrastructure in terms of long-term contractual arrangements and monopoly regulation** and acknowledge that industrial sectors are a much less informative way to categorise such investments. In the same spirit, the stability of long-term contracts and the role counter-party risk are perceived to be the most important and unique characteristics of infrastructure firms (compared to other firms). Finally, "brownfield" (existing) and "contracted" infrastructure is reported to be the most attractive to investors, closely followed by brownfield regulated utilities;

A range of views on the risk/return trade off of infrastructure investing

1. **Expected returns follow a clear pattern** determined by the "business model" (contracted, merchant or regulated) and the lifecycle (greenfield or brownfield) of infrastructure firms, with greenfield merchant investments requiring higher returns than brownfield regulated and contracted infrastructure;
2. Despite viewing infrastructure as characterised by long-term stable contracts and being most attractive once it has been built, **most investors and their managers expect relatively high returns**. A majority considers that infrastructure assets should **not** be "expensive" and requires equity returns ranging from the high single digits to the low teens. Asset managers systematically report higher expected returns than asset owners.

Strong interest for emerging markets infrastructure

1. More than **half of participating asset owners declare investing or wanting**

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to invest in emerging markets, and indicate willingness to increase their current allocation. SWFs and pensions plans are the most involved and willing types of investors investing or aiming to invest emerging market infrastructure;

2. The main reported reasons to expand into emerging market infrastructure are **higher returns and country risk diversification**, while the main concerns of investors are public policy reversals and the enforceability of contractual claims.
3. Required returns in emerging markets are higher but otherwise follow the same patterns as in OECD markets. However, the **emerging market premium on returns varies for different types of infrastructure projects**: investments in the contracted and regulated categories command much higher spreads (above the OECD required returns), particularly at the brownfield stage, whereas emerging market merchant risk is perceived to be almost equivalent to OECD merchant risk.

A degree of divergence between asset owners and managers

1. The immense majority of asset owners are rather **dissatisfied with existing infrastructure investment products**;
2. Fee levels are the first reason for this state of affairs but, in second place, the absence of **well-defined investment objectives of the various infrastructure funds and platforms** is another important source of dissatisfaction;
3. Even **co-investment** alongside managers or banks is considered by almost half of asset owners to be **only a second best** i.e. they would rather have access to the investment products they need and want.
4. The immense majority of asset owners consider the classic closed-ended **private equity infrastructure fund model** to be "outdated" and "not adding value";
5. The majority of investors also declare themselves to be concerned or very concerned by the accumulation of "dry powder" in numerous infrastructure fund mandates, because it could lead to a **deterioration of investment/underwriting standards**.

Diversification and outperformance are the main objectives of asset owners today, but not the only ones.

1. Most respondents concur in saying that infrastructure investment only really makes sense as **a long-term strategy** (beyond ten years), and a majority declares themselves willing to **buy and hold infrastructure investments until maturity**. Logically, but perhaps surprisingly, most investors report not being particularly concerned by the absence of liquidity of such investments.
2. Most investors declare **preferring investing in privately-held infrastructure** debt or equity – as opposed

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to public stocks or bonds – but they are evenly divided between those who **prefer direct investment and those who would rather delegate to a manager**.

3. Overall, the objectives pursued through infrastructure by the majority of investors are linked to **improving diversification and achieving higher performance**. Other objectives that are intuitively associated with infrastructure investing such as **hedging inflation or interest rate risk are less present** in the series of objectives currently being pursued. However they are amongst the highest ranked objectives that investors **would like to be able to achieve** through infrastructure investing (along with stable cash flows and illiquidity premia).

Current infrastructure benchmarks are either lacking or inadequate

1. Investors' current use benchmarks for their infrastructure investments are as likely to be relative or absolute, nominal or real, or relative to a market or a macroeconomic index. There is **no clear market practice**;
2. In fact, the immense majority of investors and managers agree that currently available benchmarks are inadequate and that **proper infrastructure investment benchmarks just do not exist**;
3. Survey respondents confirm that **risk metrics in particular are not documented** and that **valuations** are sufficiently problematic to cast doubt on any measure of returns as well. More than half of asset owners either **do not trust** or do not know if they can trust the **valuations reported by the infrastructure asset managers.**

ESG considerations matter more but remain a second-order problem for most investors

1. Investors acknowledge the relevance of ESG considerations but **a majority considers ESG to be a second order problem** i.e. one that does not trump first order questions like strategic asset allocation;
2. Nevertheless, 17 percent of owners consider ESG to be a first order question;
3. Most respondents also expect ESG to be positively related to investment returns.

1. Introduction

1. Introduction

This paper presents the result of the first in-depth survey of institutional investors' perceptions and expectations of infrastructure investment.

Infrastructure investment is a relatively new area for pension funds, insurers, sovereign wealth funds and other "asset owners", one that involves significant upfront investments and long repayment periods, about which limited empirical evidence is currently available. Investment beliefs thus play an important role in the decision to invest. Hence, this survey first aims to delineate asset owners' investment beliefs on infrastructure equity and debt.

We examine their preferred definitions of the infrastructure "asset class", as well as their understanding of the mechanisms that drive value and risk in such businesses, including what investors and their asset managers expect to be the distinguishing, if not unique, characteristics of infrastructure investments compared to other types of firms, including return expectations, from the point of view of different types of investors and that of their asset managers.

The survey also enquires about investor risk preferences, including investing in new – so called 'Greenfield' – infrastructure, or investing beyond the OECD in emerging market infrastructure and with what risk premia expectations. These answers also have some relevance to public policy and the financing of infrastructure for economic development.

In principle, investing in infrastructure can take many forms, including equity or debt instruments, public or private assets, direct investment, delegation to a specialist asset manager or co-investment. This survey investigates asset owners' views and preferences in these respects. In fact, infrastructure investing is not an end in itself for investors. Instead, investing in a portfolio of highly illiquid and relatively large assets that is difficult and costly to rebalance must be part of a broader investment solution designed to achieve certain key objectives.

We ask what these objectives are and how currently available infrastructure investment products or strategies are expected to contribute to meeting them. We also query investors' degree of satisfaction with existing products and what improvements – if any – they would like to see in the way asset managers propose to gain exposure to infrastructure firms.

The rest of the survey is structured thus: Chapter 2 describes our approach and the reasons why we decided to focus on four strands of questions: investment beliefs, investment objectives and products, benchmarking and ESG. Chapter 3 describes the sample of respondents used in this survey. Chapter 4 is a detailed review of the survey results and Chapter 5 provides a summary and discussion of the key findings.

2. Approach

2. Approach

In this chapter, we outline the approach taken to conduct this survey: investors' perceptions and expectations of infrastructure investment are divided into four areas, which we discuss in turn: investment beliefs (section 2.1), investment products (section 2.2), the role of performance benchmarks (section 2.3) and finally the relationship between infrastructure investing and environmental, social and governance considerations (section 2.4).

2.1 Investment Beliefs

2.1.1 Is infrastructure an asset class?

As institutional investors become gradually aware of the opportunity to invest in infrastructure debt or equity, the notion of an "infrastructure asset class" has become a frequent item on discussion panels, in the pitches of asset managers, and even in the speeches of politicians.

However, since the 2008 financial crisis, larger, more sophisticated investors have also been assessing their approach to investing in notional asset classes and have instead begun to adopt the principles of factor investing (Martellini and Milhau, 2015). Hence, in this survey, we ask whether asset owners perceive infrastructure from an asset class angle or, instead from a factor angle.

Strictly speaking, an asset class is defined as "homogenous investments with comparable characteristics, driven by similar factors, including a conventional legal or regulatory structure, thus correlating highly with each other" (Fabozzi and Markowitz, 2011, p.16). As a result, the combination of two or more asset classes should provide diversification benefits since two distinct asset classes should exhibit low return *covariance*.

Investors' interest in factors springs, amongst other reasons, from the fact that asset classes can become highly correlated in bad states of the world – that is, when diversification matters the most. The objective to seek exposures to investment factors springs from the recognition that taxonomies that do not capture an underlying value process can lead risk management astray if assets are given similar labels when their performance is driven by fundamentally different forces or vice-versa and that grouping assets notionally (stocks, bonds, private equity, etc.) affords very little predictive power.

Factor investing aims to identify common dimensions (factors) in the cross-section of asset returns, some of which exist across asset classes, and to allocate funds efficiently to *rewarded* risk factors, so as to achieve the highest reward per unit of risk (Amenc et al., 2014).

As we report in the rest of this paper, achieving better diversification is one of the main motivations of asset owners investing in infrastructure. Such investments are also highly illiquid and rebalancing is likely to be challenging and costly. Hence, understanding infrastructure investments' contribution in a multi-asset setting by focusing on factors that are found across asset

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classes (e.g. interest rate risk) is likely to be very useful.

With a better understanding of the factor exposures created through infrastructure investment, asset owners can begin to integrate infrastructure investment into a larger asset management or asset-liability management context, and aim to achieve more efficient total portfolio outcomes, while holding private and non-traded assets such as infrastructure over long horizons.

They may also better understand the potential for partial or complete replication using public assets, which could be useful for benchmarking but also hedging purposes.

Hence, the survey explores investors' perceptions of infrastructure as an asset class, and beyond.

2.1.2 Defining infrastructure investments

Next, we ask some questions about what investors' and their managers think are the defining characteristics of infrastructure investments, and how they differ from other firms, public or private, especially regarding their business model.

Defining infrastructure investment has become a more pressing concern with the rise of dedicated asset allocations, and a series of regulatory consultations and decisions concerning which assets should qualify under a given prudential treatment (e.g. the recent Solvency-II consultations led by EIOPA in Europe).

Infrastructure corresponds to large structures of steel and concrete created to perform a series of industrial functions (water and power supply, transportation, etc.) and is typically labelled following such industrial sector classifications, assuming that the delivery of essential services falls squarely into a series of GIC codes.

Still, a clear distinction must be made between infrastructure as a matter of public policy, in which case the focus is rightly on industrial functions, and the point of view of financial investors, who may be exposed to entirely different risks through investments in firms providing the same industrial functions (e.g. a "real" toll road and an "availability payment" road [2]).

In Blanc-Brude (2013), we argued that industrial sectors offer limited information about the investment characteristics and the risk profile of such investments: infrastructure assets are large, stand-alone, single-use structures, involving significant sunk costs and very long repayment periods; in other words, they are very *relationship-specific*.

It is long-term contracts that make infrastructure investment possible. Crucially, these contracts transfer *risks* between the different parties involved and are therefore quite likely to explain a non-trivial proportion of the cross-section of asset *returns*.

2 - "Real" toll roads charge user fees as a function of effective traffic, whereas "availability payment" projects receive a fixed compensation from the public sector in exchange for the construction, operations and maintenance of a road according to a pre-agreed output specification.

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Hence, focusing on the characteristics associated with **the structuring of capital projects involving highly relationship-specific assets, that can only be repaid over multiple decades of effective use**, provides a much more robust framework to understand, benchmark and predict long-term investments in infrastructure, while the sector classification or "reality" of infrastructure investments constitute a poor model of underlying cash flow processes, whether they accrue to equity or debt investors.

The survey addressed asset owners and infrastructure managers' views on how infrastructure investment should be defined.

2.1.3 Expected returns

Another key dimension of investment beliefs is the level – and the dispersion – of required returns by different types of investors. In this survey, we ask whether infrastructure investments should be "expensive" or not i.e. have relatively low returns.

The "infrastructure investment narrative" suggest that infrastructure investments are expected to yield predictable streams of payoffs extending far into the future.

If infrastructure investments are indeed low risk and have predictable payoffs un-correlated with future states of the economy, then for investors with long-term liabilities **this kind of financial asset should be very valuable**, and these investors should be willing to pay high prices for them: the reason is that payoffs that can be expected to happen with reasonable certainty far into the future, including in very appalling states of the world, have a high marginal value today.

Still, if private infrastructure investments are highly illiquid, they can be expected to yield an illiquidity or "inconvenience" premium, despite otherwise being a stable source of cash flows.

Moreover, private infrastructure investment also takes place in an "incomplete market": different investors are willing to pay different prices for the same asset and, in the absence of a liquid market or instruments that can continuously hedge the expected payoff of this asset, the bid-ask spread does not have to narrow. Instead, individual investors preferences partly determine the price paid in individual transactions (and the subsequent returns).

Hence, this survey explores the range of views expressed by asset owners and manager's about the returns they require from different types of infrastructure investments (using the categories discussed above to define such investments).

2.1.4 Emerging markets

Emerging market infrastructure is an important growth area for infrastructure investors given the large infrastructure investment needs that exist in non-OECD markets.

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Since infrastructure investment is primarily a matter of contractual arrangements, jurisdictions with a weaker record in term of contractual claims enforcement can be riskier. Hence, the motivations to invest in emerging market infrastructure can include increasing risk-taking (with the expectation of higher returns).

Emerging market infrastructure investment should also further diversify the risks found in OECD infrastructure. Indeed, regulatory and policy cycles – the attitude of public bodies towards privatised infrastructure investments – can be expected to be rather uncorrelated with that of OECD governments.

Any exposure of infrastructure investments to emerging market economic cycles – as long as it is not linked to a global market like oil & gas – can also be expected to co-vary less with OECD infrastructure investments, than these do amongst themselves.

In this survey, we query investors' current exposure to infrastructure in emerging markets and their intentions to invest in the future, as well as what they perceive to be the primary road blocks.

We also ask about the level of expected returns in different types of infrastructure assets and provide a comparison with earlier responses about required returns, hence deriving a rough measure of an emerging market premium.

2.2 Investment Products

Asset owners can access infrastructure investments through different channels, in public and private markets, by mandating managers or internalising the capability to source and execute individual transactions.

In this survey, we ask investors to rank the range of available options to access infrastructure and to state their preferences regarding access, the horizon and, ultimately, investment objectives.

By far, the most common investment product available to asset owners is a closed-ended private equity fund focusing on certain industrial sectors or geographies. But PE infrastructure funds tend to behave like other PE funds and aim to exit their investments after a few years. [3]

This focus on exit, while perfectly legitimate as an investment strategy, is not necessarily representative of the long-term performance of underlying infrastructure investments (the "narrative"), nor does it necessarily match the objectives investors are trying to achieve through infrastructure investment.

In fact, it is because they are not representative of such performance that a number of large asset owners have gradually opted to exit infrastructure PE funds, to internalise infrastructure asset management, and to invest directly in underlying assets in order to gain the exposure to the long-term, predictable cash flows they expect to find in such firms.

3 - Infrastructure PE funds are somewhat different from other PE funds, they are found to be larger and to keep assets for a few more years than other PE funds; they are also very concentrated in a few investments (see Blanc-Brude, 2013, for a review)

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In this survey, we ask investors if they are satisfied with the standard infrastructure PE fund model and what improvements or alternatives they would like to see, if any.

A major aspect of the definition of new infrastructure investment products is the ability to measure a number of performance metrics, both to design products and monitor investments.

Next, we turn to the question of benchmarking infrastructure investments.

2.3 Benchmarking

In recent years, frequent calls have been made in policy fora for data collection efforts to be stepped up on infrastructure investment to improve the measurement of the risk-adjusted performance of infrastructure investments.

The current demand for infrastructure investment benchmarks springs from three sources:

- Long-term investors who need to formulate investment beliefs before they can make asset allocation decisions, require benchmarks to evaluate their infrastructure investment managers or strategies, and also want to assess the social and environmental impact of their investments;
- Prudential regulators who are required to adequately calibrate long-term infrastructure equity and debt investment within their respective risk-based frameworks such as Solvency-II;
- Policy makers who have been calling for a greater use of long-term savings to invest in capital projects that can have a positive impact on economic growth.

These actors have a common goal to accurately frame infrastructure investment so that long-term capital can be *adequately* deployed in the infrastructure sector.

Unfortunately, as we discuss below, it remains very difficult to answer such questions today due to the lack of relevant information.

2.3.1 Creating the infrastructure bucket

Documenting the risk-adjusted performance of infrastructure investments compared to other public or private assets is necessary to make it a relevant question at the strategic asset allocation level. It allows assessing the contribution of an allocation to infrastructure to investment objectives, as well as monitoring internal or external infrastructure managers relative to expectations.

Hence, for asset allocation and monitoring purposes, investors need answers to the following questions:

1. What is the *expected return* profile of a relevant portfolio of infrastructure investments, and what investment factors or *betas* can it be decomposed into?

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2. What is the current *value* of the portfolio? (to compute realised returns)
3. What is the reward-to-risk ratio (e.g. the Sharpe Ratio) of this portfolio?
4. What are the correlations of realised portfolio returns with those of other relevant groups of assets?

Answering these questions can settle the debate outlined above about whether the infrastructure is an "asset class" in its own right or corresponds to a persistent and unique combination of investment factors.

In the positive, privately-held infrastructure equity or debt can have allocation buckets in their own right. On the contrary, the risk adjusted performance of infrastructure investments can effectively be reproduced by combining other assets. While this would not exclude infrastructure assets from allocation decisions, it would not justify any particular focus on them.

4 - The regulatory treatments of privately-held infrastructure, such as Solvency-II in Europe or RBC-2 in Singapore, are debatable and certainly contradict the investment beliefs that draw investors to infrastructure in the first place.

5 - cVaR is a so-called coherent risk measure and benefits from properties such as additivity which make it an adequate measure of portfolio risk

2.3.2 Documenting extreme risks

Prudential regulation is the second context within which benchmarking infrastructure investments can make a significant contribution.

Regulators are primarily interested in systemic risk (the risk of collapse of the financial system). As such, they require a clear understanding of the likelihood of severe losses for investors in privately-held infrastructure equity or debt in states of the world where other investments also exhibit vast losses.

It is by such assessments that prudential regulation sets "capital buffers" that aim to prevent individual and cascading bankruptcies.

Today, privately-held infrastructure equity and debt tend to be considered high-risk by regulators because they are illiquid, long-term assets with no documented track record.

Hence, without adequate calibration of existing prudential regulatory frameworks, institutional investors are less likely to invest in infrastructure, due to its high regulatory cost. [4]

To improve current calibrations, the following questions require answering:

1. What are the *value-at-risk* (VaR) and *conditional value-at-risk* (cVaR or expected shortfall [5]) of relevant portfolios of infrastructure equity or debt?
2. What is the maximum draw-down of such reference portfolios?
3. What are the different measures of *dependence* including non-linear correlations (e.g. correlations in dreadful states of the world) of the returns of relevant portfolios of infrastructure investments with other financial assets?

2.3.3 Understanding the "liability-friendliness" of infrastructure

Third, numerous investors approach infrastructure investment because of its expected ability to help meet liability-hedging objec-

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tives. Privately-held infrastructure equity and debt can have long tenors, and are expected to provide predictable cash flows that are at least in part linked to a domestic price index. For these reasons, infrastructure investments may have the potential to contribute to liability-driven investment objectives, *even if they do not correspond to a well-identified asset class from a pure asset allocation perspective*.

Moreover, because most infrastructure investments correspond to a fixed-term concession contract, even the equity stake in infrastructure projects has an end date and therefore a *duration*. In other words, private infrastructure project equity is potentially "liability-friendly".

The questions that require answering to document the potential role of infrastructure in a liability-driven investment context include:

1. What is the *effective* (option-implied) *duration* of senior infrastructure debt, taking into account the role of covenants and refinancing in project finance?
2. What are the *modified duration* of infrastructure equity and quasi-equity?
3. What is the *correlation with the relevant rate of inflation* of privately-held infrastructure equity returns?

Such metrics can play a key role in the integration of infrastructure investments in the asset-liability management of institutional investors, *and are fully part of the objective to benchmark such investments*. Indeed, the potential liability-hedging properties of infrastructure investment stand out as some of its unique and attractive characteristics.

2.3.4 Why these questions are very difficult to answer today

The questions listed above are important to the future of infrastructure investment by long-term investors, in particular investors with a liability profile and subjected to prudential rules, such as insurance firms. However, the current state of investment knowledge does not allow answering them.

Market proxies are ineffective

The first place to look for estimates of expected performance and risk in privately-held infrastructure investments is the market for publicly traded securities, including stocks and bonds.

Some thematic infrastructure indices have been created in recent years that include stock or bonds corresponding to issuers associated with specific industrial sectors (e.g. transport, energy, etc.) and deriving a certain proportion of their income from the same list of "infrastructure" sectors.

As reported before, this approach has so far failed to arrive at meaningful results (Blanc-Brude, 2013): listed infrastructure equity and debt indices tend to exhibit higher risk than broad market indices (higher maximum drawdown, higher VaR) because they are highly concentrated in a few large constituents and, crucially, do not create

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any *persistent* improvement of investors' existing portfolios.

In a coming paper, Blanc-Brude et al. (2015) show that the mean-variance frontier of efficient portfolios available to investors allocating to asset classes (stocks, bonds, commodities, etc.) or to factors (value, growth, etc.) is not improved by the addition of a listed infrastructure index, whether provided by an indexer or by directly selecting all stocks corresponding to "infrastructure" sectors and deriving most of their income from infrastructure.

Focusing on industrial sectors is ineffective because what explains the performance of underlying infrastructure investments is to be found elsewhere. Indeed, infrastructure investments should not be conceived as "real" assets since the value of investors' claims is almost entirely determined by the contractual and legal aspects of each infrastructure project (see Blanc-Brude, 2013, for a detailed discussion).

The main difficulty with finding listed proxies of privately-held infrastructure investments is the small number of stocks and bonds that solely correspond to a *pure* exposure to the performance of underlying infrastructure equity or debt.

Other approaches involving the use of public market data to benchmark private investments include the public market equivalent (PME) of Ljungqvist and Richardson (2003), Kaplan and Schoar (2005) or Phalippou and Gottschalg (2009) which consists of using the cash flows into and out of private investment as if they represented buying and selling a public index.

A second version of the PME consists of matching private investments with listed industry betas, deriving the un-levered industry betas using industry averages and re-leveraging them using investment specific information (see Kaplan and Ruback, 1995; Ljungqvist and Richardson, 2003; Phalippou and Zollo, 2005, for various applications).

However, these approaches imply that the market *beta* of infrastructure equity and debt is *already known*, which is at odds with the starting point i.e. the objective to discover what its true value.

Existing studies of private investment data are too limited

Next, several databases exist that have been used in studies of the performance of private equity investments in infrastructure (see for instance Peng and Newell, 2007; Newell et al., 2011). However, such sources of data suffer from major limitations.

Firstly, like listed stocks, they are not categorised according to what explains volatility and performance in infrastructure (contracts, risk-sharing mechanisms, revenue support agreements, etc.) but according to private equity (venture capital and leveraged buyouts) and industrial categories.

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Secondly, they report the cash flows and asset values of private equity infrastructure funds: typically ten-year ventures with high fees and additional fund-level leverage. Thus, there is little to learn about the risk-adjusted performance of portfolios of infrastructure equity from the historical performance of PE infrastructure funds, let alone about the calibration of their prudential treatment or their role in an LDI context. Such products may also not be representative of the future of infrastructure investing by large institutional investors.

On the debt side, the main body of evidence has been collected by rating agencies. These entities have provided numerous ratings for individual issues, both listed and private bonds as well as private loans. However, rating methodologies do not constitute a fully-fledged valuation framework, and rank issues relative to each other but never consider the portfolio-level, which is the relevant one to answer the questions identified above. Moreover, ratings *imply* an expected performance but never actually measure it (the letters never become numbers). Individual credit ratings thus cannot be aggregated to create an infrastructure debt benchmark.

More quantitative studies by rating agencies exist that document incidences of default and recovery as reported by creditors (see for instance Moody's, 2015). These reports are by far the most informative studies conducted today but also remain insufficient to answer the questions highlighted above.

But this information is still categorised by industrial sector, which makes it difficult to quantify the impact of the main drivers of credit risk, such as differences in revenue risk in infrastructure projects.

Thus, information available from rating agencies about infrastructure debt, while richer than what exists on the private equity side, is insufficient to answer important questions about the risk adjusted performance, extreme risk and effective duration of reference portfolios of private infrastructure debt.

2.3.5 Reported financial metrics are inadequate

Finally, because most existing information about private investment in infrastructure equity is inherited from the PE universe, reported performance metrics tend to be limited to net asset values (NAVs) and internal rate of return (IRR). [6]

However, the academic literature on private equity documents again and again the tendency of private equity managers to report NAVs opportunistically (see Jenkinson et al., 2013, for a recent study). Appraisal-based NAVs also suffer from the usual stale pricing issues which lead to smoothing of returns and underestimating the volatility of returns.

More generally, using IRR as a performance metric is inadequate: the finance

6 - The constant discount rate that makes an investor's Net Present Value (NPV) since the date of investment equal zero

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literature has long argued that using such constant and deterministic discount rates can be problematic. Standard corporate finance textbook examples (Brealey and Myers, 2014, see) show that the utilisation of a single risk-adjusted discount rate for long-lived assets is defective if projects have multiple phases and project risk changes over time as real options are exercised by asset owners.

Indeed, a constant risk premium does not measure risk properly on a period by period basis, but rather implies that cash flows occurring further in the future are riskier than cash flows occurring earlier (Haley, 1984), which may not be the case, especially given the kind of sequential resolution of uncertainty which characterises infrastructure projects. The use of constant discount rates then leads to biased NPV calculation (Ben-Horim and Sivakumar, 1988).

Examples of the inadequacy of using IRRs abound in the literature: Phalippou (2008) highlights that the use of IRRs to measure fund performance, allows fund managers to time their cash flows and boost reported performance measures without increasing investors' effective rate of return.[7] (Ang and Liu, 2004) present multiple examples of erroneous valuations resulting from the use of a constant discount rate compared to the use of a term structure of time-varying discount rates.

When it comes to building investment benchmarks, the use of a constant discount rate is also inadequate for other reasons:

- The IRRs of individual investments cannot be easily used to estimate performance at the portfolio level, as the IRR of a portfolio is not the same as the weighted average IRRs of individual investments;
- IRR-based valuation methodologies cannot be used to identify different sources of return, which requires identifying period returns and decomposing them into systematic and idiosyncratic components. In fact, it is possible to build two streams of cash flows with the same IRR but diametrically opposed market betas;
- In the case of a finite-life investment, using the IRR does not lead to correct duration measure if the risk profile changes over time.

Hence, the metrics currently reported in privately-held infrastructure investments are not fit-for-purpose to answer the key questions highlighted above, from asset allocation, to prudential calibrations, to asset-liability management.

In this survey, we ask investors which **objectives** they pursue by choosing to invest in infrastructure, from performance-seeking to liability-hedging. We also query investors' perceptions of the **metrics** currently available to measure the performance of private infrastructure investments and what improvements, if any, they would like to see.

7 - Phalippou (2013) also shows that the Yale endowment's return since inception of its private equity fund stays close to 30% due to a few large capital distributions in early years, and is almost entirely insensitive to later performance, making the metric economically meaningless.

2. Approach

2.4 Environmental, Social and Governance Aspects

ESG matters are not limited to infrastructure investing but they loom large in a sector where individual investments can have a significant positive or negative impact, from economic growth and job creation to environmental considerations and social dislocation (e.g. relocation of rural communities).

Climate change and investing in energy projects that contribute to the transition to a de-carbonated economy are also very immediate issues in the infrastructure sector.

In this survey, we ask investors' whether they perceive ESG matters to be a first-order question (i.e. on par with asset allocation) or a set of considerations that must be subordinated to meeting their financial objectives. We also query them about the perceived but undocumented trade-off between ESG characteristics and performance.

In the next chapter, we describe the sample of 184 respondents to this survey.

3. Survey Respondents

3. Survey Respondents

In this chapter, we describe the sample of respondents used in this survey, with a focus on the type of organisation each respondent represents, what position they occupy within their organisation, geographic focus and whether they are mostly interested in investing in debt or equity.

3.1 Organisations

3.1.1 All Respondents

Data for this survey was collected through an online form, phone interviews and paper forms distributed during EDHEC Infrastructure Institute Executive Masterclasses. A total of 184 individuals provided responses deemed to qualify for this survey: for the most part, respondents are either asset owners (also referred to as "institutional investors") and asset managers (infrastructure fund managers).

We also include responses from the third category of organisations, which includes investment and development banks engaged in project financing, as well as rating agencies, individual advisors or academics. All have frequent interactions with asset owners and managers in the infrastructure finance and investment sectors and can be expected to have informed views about investors preferences and expectations in this area.

Figure 1 shows the number and proportion of respondents by type of organisation. Just under half (87, or 47 percent) of respondents represent institutional investors, while approximately 33 percent (60) are asset managers, and the remaining 37 correspond to the 'Others' category described above.

Hence, responses are evenly split between two perspectives:

1. Institutional investors are interested in infrastructure in the context of achieving broader investment objectives: for pension plans, sovereign wealth funds and insurers, infrastructure investment is a means to an end.
2. Infrastructure fund managers, lenders and advisors are providers of investment services and opportunities in the infrastructure space. From their perspective, infrastructure investment is an end in itself. It is their business.

3.1.2 Institutional Investors

In the rest of this survey, we systematically report the perspective of each group of respondents. Asset owners are of particular interest, and represent different types of institutions as shown in figure 2: 34.5 percent are insurers, 15 percent defined contribution pension schemes and 33.3 percent defined contribution plans. Sovereign Wealth and Endowment funds make up another 17 percent of respondents.

Figure 3 shows the distribution of asset owners represented in this survey by size (assets under management – AUM). Our sample of respondents includes large, if not very large institutions, especially in the insurance and sovereign wealth fund (SWF) categories. The majority of respondents are

3. Survey Respondents

Figure 1: Survey respondents by organisation type

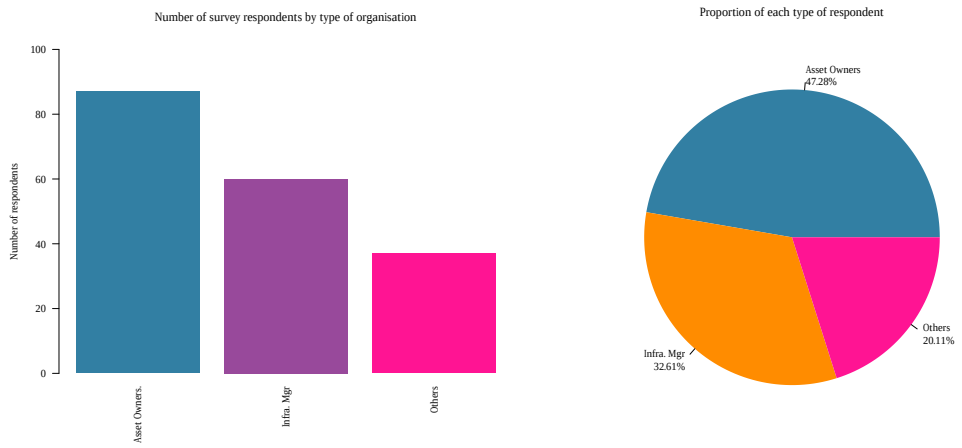
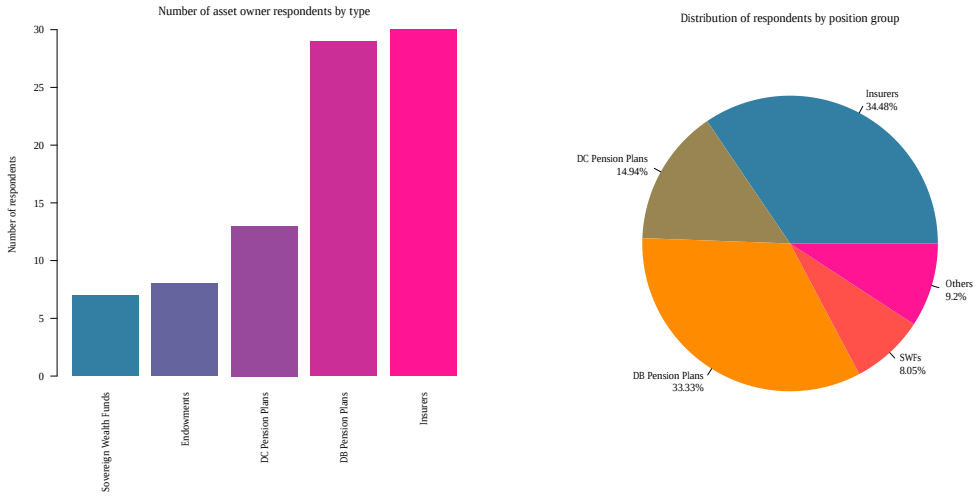


Figure 2: Breakdown of asset owners respondents by category



neither small nor extremely large, mostly falling within the USD5-100bn bracket.

Next, figure 4 reports the proportion participating institutional investors that already invest in infrastructure. Close to 80 percent of respondents have some experience of infrastructure investment, while 20 percent do not.

Even though most respondents have some expertise in the sector, their track record is relatively limited as figure 4 also illustrates (right panel). Most of the investors represented in this survey have been involved in infrastructure investment for 10 years or less, while roughly 20 percent of respondents have invested for more than 10 years (up to 25 years for a couple of them).

3. Survey Respondents

Figure 3: Frequency and proportion of participating institutional investor by assets under management

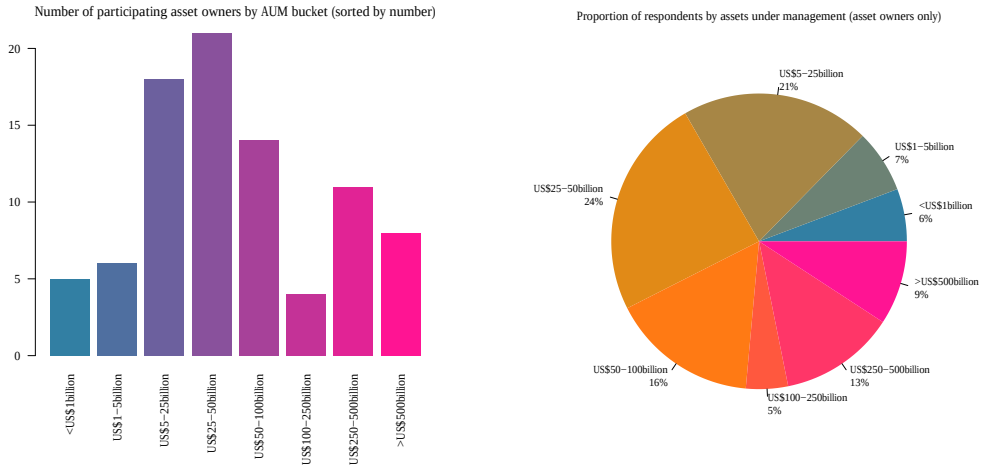
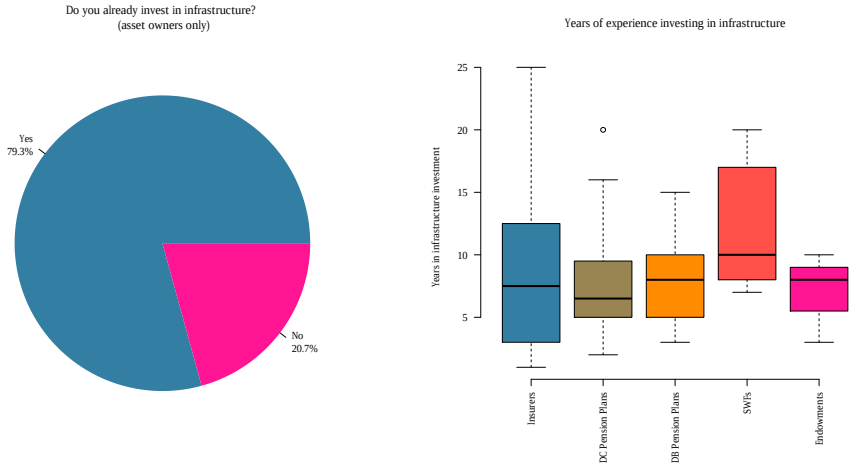


Figure 4: Asset owners already investing in infrastructure and for how long



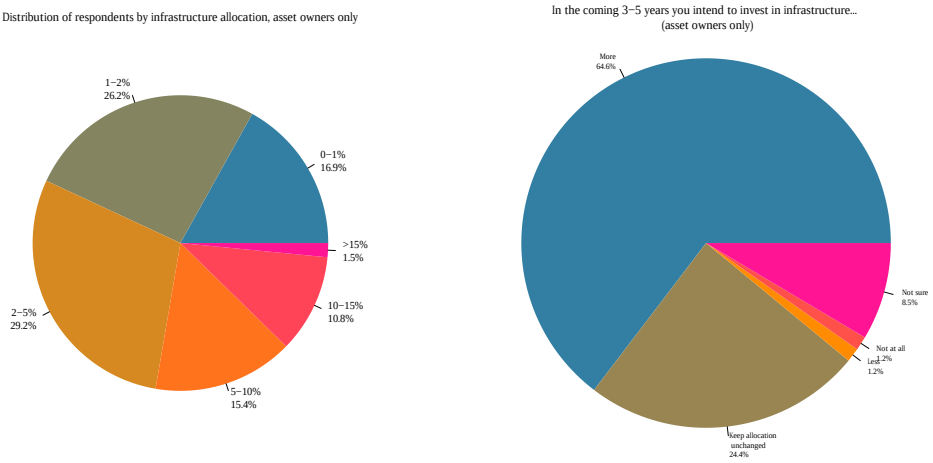
Perhaps partly as a result of the limited history of infrastructure investment by institutional investors, total allocations remain limited too, in line with existing surveys of investors allocations to infrastructure when they have one (see for example OECD, 2014).

The majority of investors who own designated infrastructure assets report allocations between less than 1 percent and 5 percent of AUMs. More than a quarter of respondents however reports infrastructure holdings higher than 5 percent of AUM, up to 10-15 percent (8 percent of respondents) or more (1 percent), as shown in Figure 5.

Close to 65 percent of investors also report that they intend to increase their allocation to infrastructure over the next 3 to 5 years, while 24 percent intend to keep it at its current level or even to decrease

3. Survey Respondents

Figure 5: Current allocation to infrastructure and intention to invest in the next 3 to 5 years, asset owners only



their exposure (the remaining 9 percent are undecided, see figure 5, right panel).

Amongst investors who declare not wanting to increase their infrastructure allocation (23 respondents), the primary reasons given are: a current exposure deemed sufficient (45 percent), a preference for other assets (35 percent) or the perception that investment opportunities are insufficient (20 percent).

These less enthusiastic respondents are split between insurers (45 percent), DB pension plans (33 percent) and DC pension plans (22 percent). Sovereign wealth funds all report their intention to increase their infrastructure allocation.

Hence, our sample of respondents **is very heavily biased towards investors that are large or sophisticated** enough to have made forays in a relatively new alternative investment space like infrastructure. While this undoubtedly makes their reported views more accurate, it should be contrasted with the fact that most institutional investors today do not invest in infrastructure at all (OECD, 2014).

3.2 Respondent Positions

Respondents also represent different perspectives within their organisations. Roughly one quarter of respondents represent a strategic function (CIO and heads of portfolio mix or LDI), just under one half represent an investment function (Head of Infrastructure, Head of Alternatives, Investment Director), while another 13.5 percent represents the top executive level and the last 15 percent represent other functions (e.g. advisory).

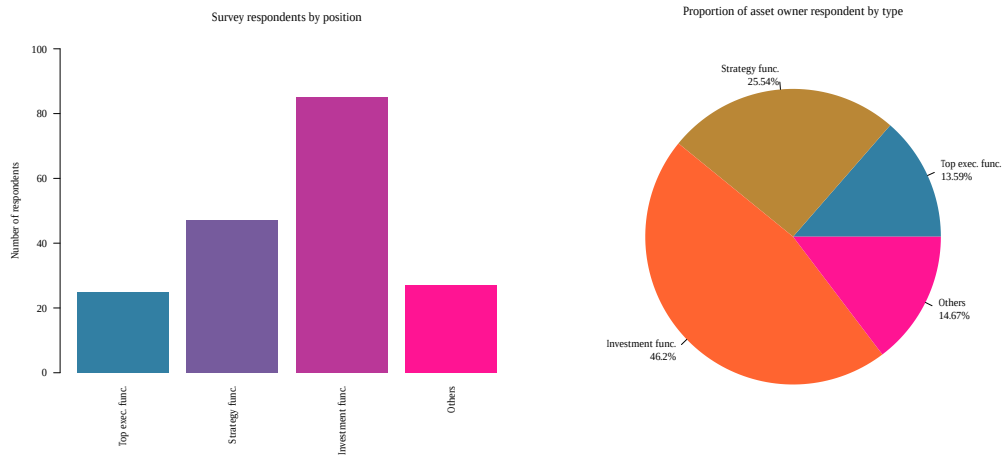
Table 1 and figure 6 show the distribution of respondents by organisation type for each group of positions. Most CIOs and other strategic asset allocation functions are found within the institutional investor category, while respondents in charge of the

3. Survey Respondents

Table 1: Number of respondent of institution and position

Position	Institutional Inv.	Asset Managers	Others	Total
Top exec. func.	9.00	9.00	7.00	25.00
Strategy func.	36.00	11.00	0.00	47.00
Investment func.	37.00	38.00	10.00	85.00
Others	5.00	2.00	20.00	27.00
Total	87.00	60.00	37.00	184.00

Figure 6: Number and proportion of respondents by position group



investment process (head of infrastructure and investment directors) are evenly split between asset owners and infrastructure asset managers.

Institutional investors are represented by approximately 40 percent of respondents at the strategic level (CEO, CIO, head of asset allocation), and roughly 40 percent at the investment level, while less than 20 percent have other functions. Within asset managers the majority of respondents represent the investment function and 20 percent the strategic and top executive level. Within the 'Other' category, one in five respondents represents the top management, and one in four the investment/origination function and the remaining half corresponds to other functions.

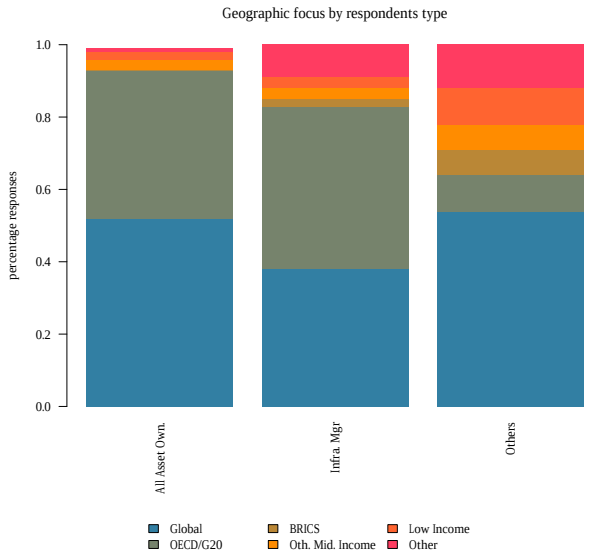
Hence, we can be confident that responses provided by asset owners and their managers are representative of both the strategic and investment levels. The other category is likely to represent a more diverse (perhaps noisier) set of perspectives, which does not include the strategic investment perspective.

3.3 Geographic Focus

The respondents to this survey also have varying geographic remits. Figure 7 shows reported geographical focus per type of organisation.

3. Survey Respondents

Figure 7: Geographic focus of respondents



Unsurprisingly, large institutional investors have, for the most part (54 percent), a global mandate. The remaining asset owners are focused on investing in the OECD, with a small proportion investing solely in emerging markets.

Asset managers can be more geographically specialised and a few managers (around 15 percent) report investing primarily in emerging markets including middle and low-income countries.

Only the 'other' category, which includes some multilateral banks, declares a more sizeable geographic focus on non-OECD markets.

Hence, our sample is also mostly biased towards actors investing primarily in the OECD, which is congruent with a bias towards large sophisticated institutional players. The geographic focus of asset managers then tends to mirror the preferences of their clients, except those that specialise in providing exposure to emerging market risk. We return to investors preferences and investment beliefs with regards to infrastructure in emerging market infrastructure in the next chapter.

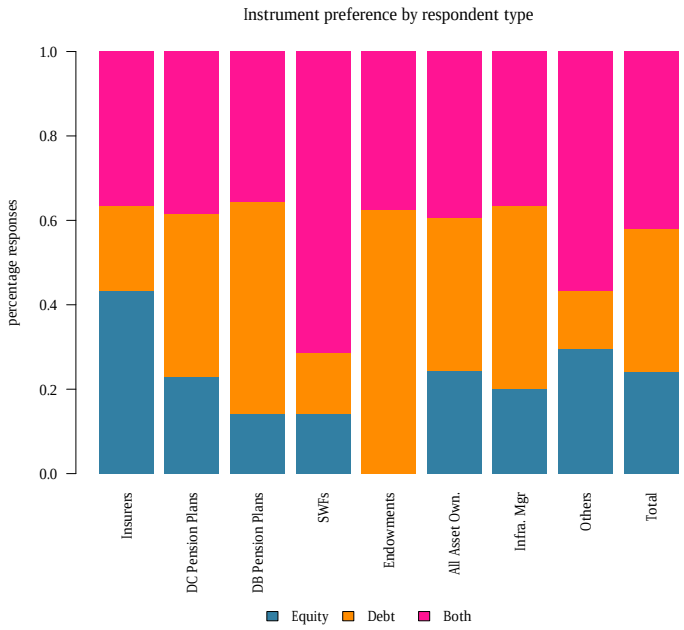
3.4 Debt and Equity Focus

While originally associated with private equity investment, the infrastructure investment theme increasingly incorporates fixed income instruments.

Indeed, as reported in Figure 8, more than 40 percent of respondents in all categories of organisations have interests in both equity and debt, while roughly one third is interested solely in infrastructure debt.

3. Survey Respondents

Figure 8: Is your organisation interested/specialised in infrastructure debt,equity, or both?



Asset owners are still less likely to be interested solely in infrastructure debt than to asset managers.

3.5 Conclusion

In conclusion, the dataset that was collected captures the perspective of relatively large asset owners active primarily in OECD markets, and their asset managers in the infrastructure equity and debt sector, as well as that of a smaller sample of commercial banks, multilateral organisations and advisors.

Next, we report their responses to the rest of the survey questions about investment beliefs, investment solutions, benchmarking and the role of ESG on infrastructure investment.

4. Survey Results

4. Survey Results

In this section, we review the answers to four groups of questions about respondents' perceptions and expectations concerning infrastructure investment: investment beliefs (section 5.1), investment products (section 4.2), benchmarking (section 5.3) and the relationship between ESG and infrastructure investing (section 4.4).

4.1 Investment Beliefs

4.1.1 The Asset Class

Whether infrastructure investment is or can be considered an asset class is a frequent discussion point in both investment and policy circles. The question of the existence of a "well-defined and unique" infrastructure asset class is met with a range of views summarised in Figure 9, which can be summarised thus:

- There is widespread disagreement about the existence of a "listed infrastructure" asset class including amongst asset owners. Overall, respondents are split almost evenly on this matter, even though a sizeable proportion of respondents (close to ten percent) also declared not having a view at all.
- Conversely, both asset owners and asset managers widely believe (75-80 percent) that unlisted infrastructure equity and debt are distinctive asset classes, even though it can be noted that insurers tend to be more circumspect on this matter and only report this belief 60 percent of the time.

When asked whether the existence of such an asset class matters with regards to the decision to invest in infrastructure, most respondents (close to 70 percent) report that they do indeed want to see infrastructure investment through an asset class lens (Figure 10).

Only 27 percent of investors and 16 percent of managers respond that it does not matter if investing in infrastructure corresponds to a unique asset class, but that it can instead be seen as a useful contributor to an existing bucket or as a combination of risk factor exposures.

This result springs from the fact that most investors continue to allocate funds into buckets defined in terms of notional asset classes rather than remunerated risk factors (Martellini and Milhau, 2015), but also results from what these investors are trying to achieve by investing in infrastructure.

Figure 11 reports what respondents believe to be the most unique aspect of infrastructure investments (only one answer was possible): asset owners explicitly focus on the role of infrastructure as a diversifier of their portfolio (approx. 40 percent) followed by the search for higher risk premia (close to 20 percent) and some degree of inflation hedging (12 percent) or drawdown protection (11 percent).

Asset managers also report diversification as the most distinctive feature of infrastructure investment.

4. Survey Results

Figure 9: Do you believe that there exists a well-defined and unique infrastructure asset class? Percentage positive responses by organisation type

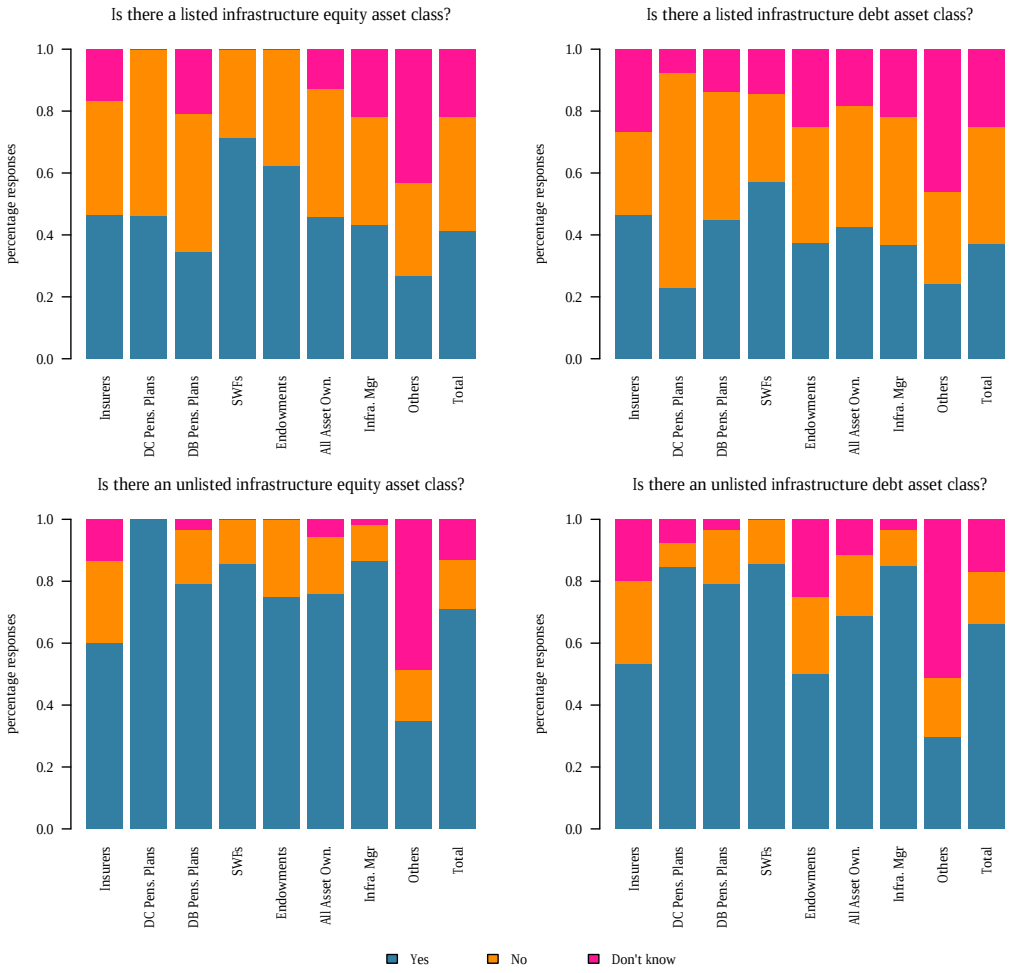
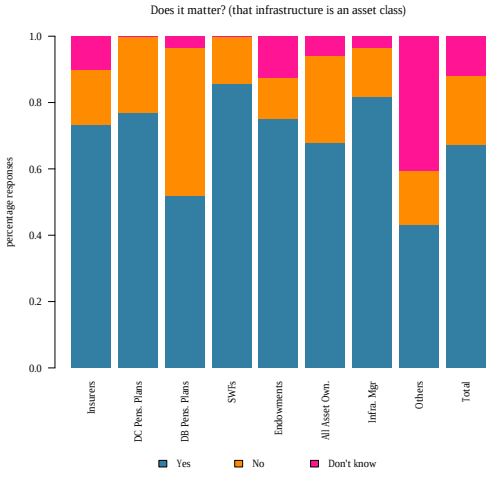
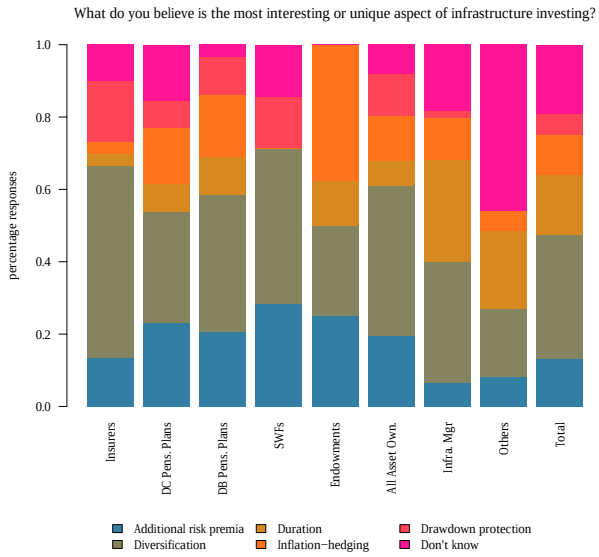


Figure 10: Does it matter whether infrastructure is an asset class or not? Percentage across organisation type



4. Survey Results

Figure 11: Uniqueness of infrastructure investments



Managers and other respondents also give a high ranking to the 'duration' of infrastructure, while asset owners are less than 8 percent to report duration as the most distinctive feature of infrastructure assets. This apparent discrepancy may be driven by different interpretations of the term 'duration': indeed, the duration (interest rate risk) of 20-30 year infrastructure investments is not necessarily very different from that of a long duration bond benchmark (say, about 12 years) making it non-unique for a large fixed income investors. For non-institutional respondents, the opportunity to invest over a period of 35 years ("duration" interpreted as "maturity") stands out as a unique feature of this kind of investments.

Between asset owners, perceptions of the uniqueness of infrastructure investment also vary somewhat. Endowments for instance see inflation-hedging as the best unique identifier of infrastructure as an asset class, which is also, but to a lesser extent, the primary characteristics of infrastructure amongst roughly 20 percent of DB and DC pensions plans. Insurers on the other hand barely register inflation hedging as a reason to consider infrastructure unique amongst other investment opportunities.

Similarly, the ability to deliver risk premia is a the defining characteristics of infrastructure for SWFs twice as often as it is for insurance companies, highlighting differences in perspectives and objectives when it comes to defining asset classes.

Beyond their most unique feature, the survey also queried respondents about how they define infrastructure investments, which we discuss next.

4. Survey Results

4.1.2 Defining Infrastructure Investments

As we argued in Chapter 2, defining infrastructure investment has become a more pressing concern since the prudential treatment of these investments has been called into question, and also as more investors want to create specific infrastructure buckets.

Hence, the survey asks a series of questions about the defining characteristics of infrastructure firms (compared another type of companies), as well as the most important and the most attractive aspects of infrastructure companies for investors.

Figure 12 reports the range of scores given to four aspects of infrastructure businesses which can be expected to set them apart from other types of firms.

The relationship-specific nature of infrastructure investment that we discussed in the previous chapter appears to be rather well understood amongst survey respondents: the contractual arrangements allowing infrastructure investment to take place are at the top of what respondents recognise to be what most distinguishes infrastructure businesses from other firms, followed by monopoly characteristics and regulation, with industrial sectors ranked last as a defining feature.

Both the mean tendency (median and weighted average score) and the range (size of the box) of the views expressed suggest a certain consistency of beliefs between asset owners and managers, with managers tending to believe a little more often that infrastructure investment is all about contracts.

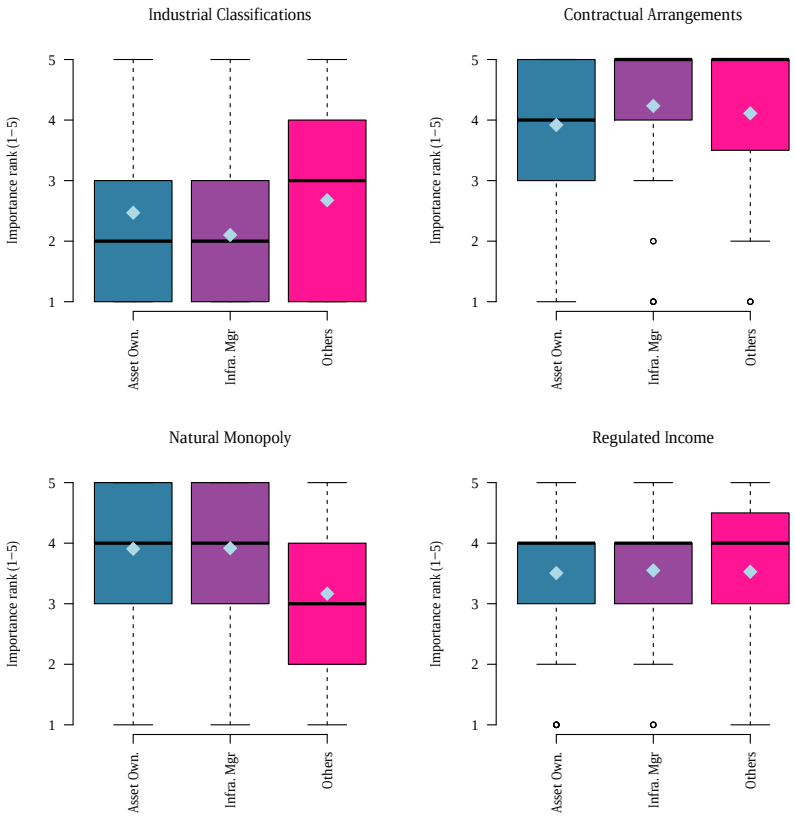
Next, Figure 13 shows the weighted average ranks of the "important" aspects of infrastructure companies (respondents could rank each aspect). Again, in line with the "infrastructure investment narrative" (Blanc-Brude, 2013), respondents rank highly the stability of regulation and contractual environment, as well as the stability of earnings, closely followed by the existence of off-take contracts, signalling further stability created through contractual arrangements.

The fact that investors tend to equate infrastructure investment with stable contractual arrangements is also reflected by responses to the question "What type of infrastructure investments are institutional investors most attracted to?" as shows on Figure 14: brownfield (existing) projects with contracted income and regulated utilities come first, largely preferred to greenfield merchant projects, which carry construction and demand risks.

However, views held by asset owners and asset managers are less consistent. For instance, asset managers are more likely to believe that investors prefer Brownfield projects with contracted income and, conversely, have little interest in Greenfield projects with merchant income, when asset owners report a greater range of views on these two questions and, on average, rank

4. Survey Results

Figure 12: What are the defining aspects of infrastructure investment? Ranked from 1 (lowest) to 5 (highest); the black line is the median, diamonds indicate the weighted averaged score



the former less highly than managers do and the latter more highly.

Overall, respondents report a clear understanding of the financial economics of infrastructure firms, what drives risks and the notion that infrastructure businesses should rely on stable, enforceable long-term arrangements and can be expected to become all the more stable once they are well-established and operating.

4.1.3 Expected Returns

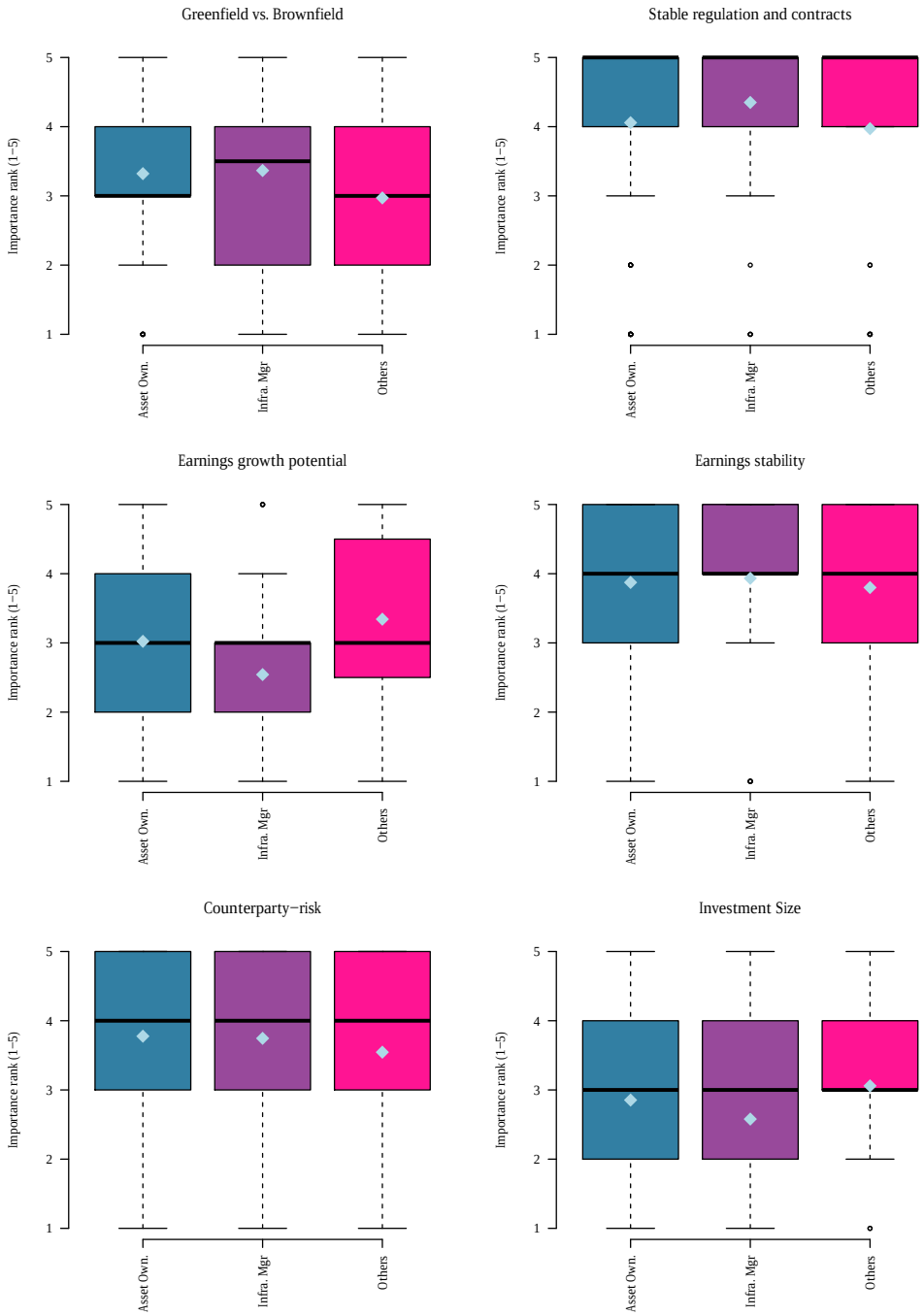
Despite the relative coherence of views expressed by respondents about the nature and key characteristics of infrastructure firms, asset owners and their infrastructure managers disagree about expected returns in infrastructure investment.

To the question "Should infrastructure asset be expensive i.e. low yielding?", close to 28 percent respond positively, in line with the argument outlined in chapter 2: long-term, stable cash yielding investments should be very valuable to investors with well-defined long-term liabilities. However, close to half of respondents respond the opposite and just under a quarter have no view, as illustrated in Figure 15.

The level of disagreement is consistent across asset owner categories, but asset managers are more likely to say that infras-

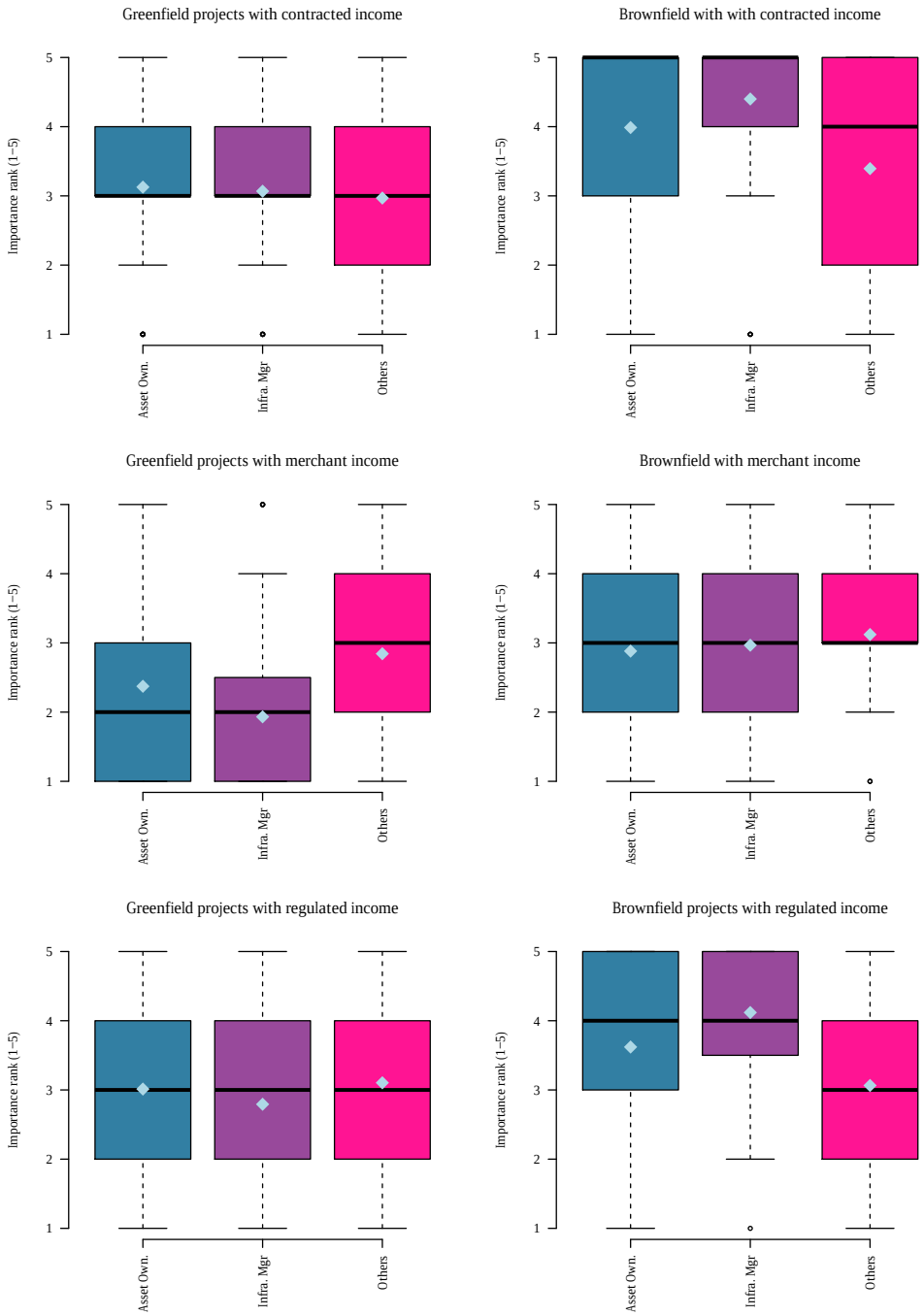
4. Survey Results

Figure 13: Most important aspects of underlying infrastructure investments. Ranked from 1 (lowest) to 5 (highest); diamond indicates the weighted averaged score



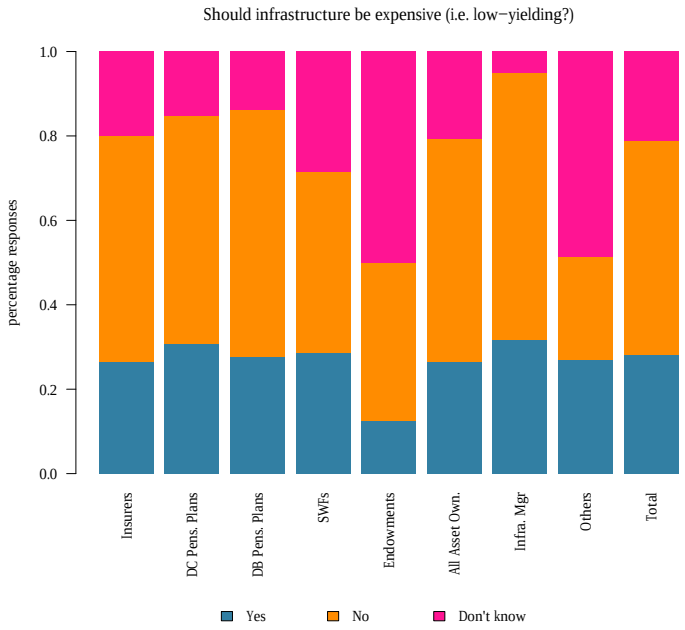
4. Survey Results

*Figure 14: What type of infrastructure assets are most attractive to **institutional investors**? Ranked from 1 (lowest) to 5 (highest); diamond indicates the weighted averaged score*



4. Survey Results

Figure 15: Return expectations



tructure assets should not be (relatively) expensive.

Next, Figure 16 shows the range of expected equity returns for different types of infrastructure investments across the revenue risk (contracted, regulated, merchant) and lifecycle (greenfield vs. brownfield) spectrums, for equity and debt investments, respectively (all respondents).

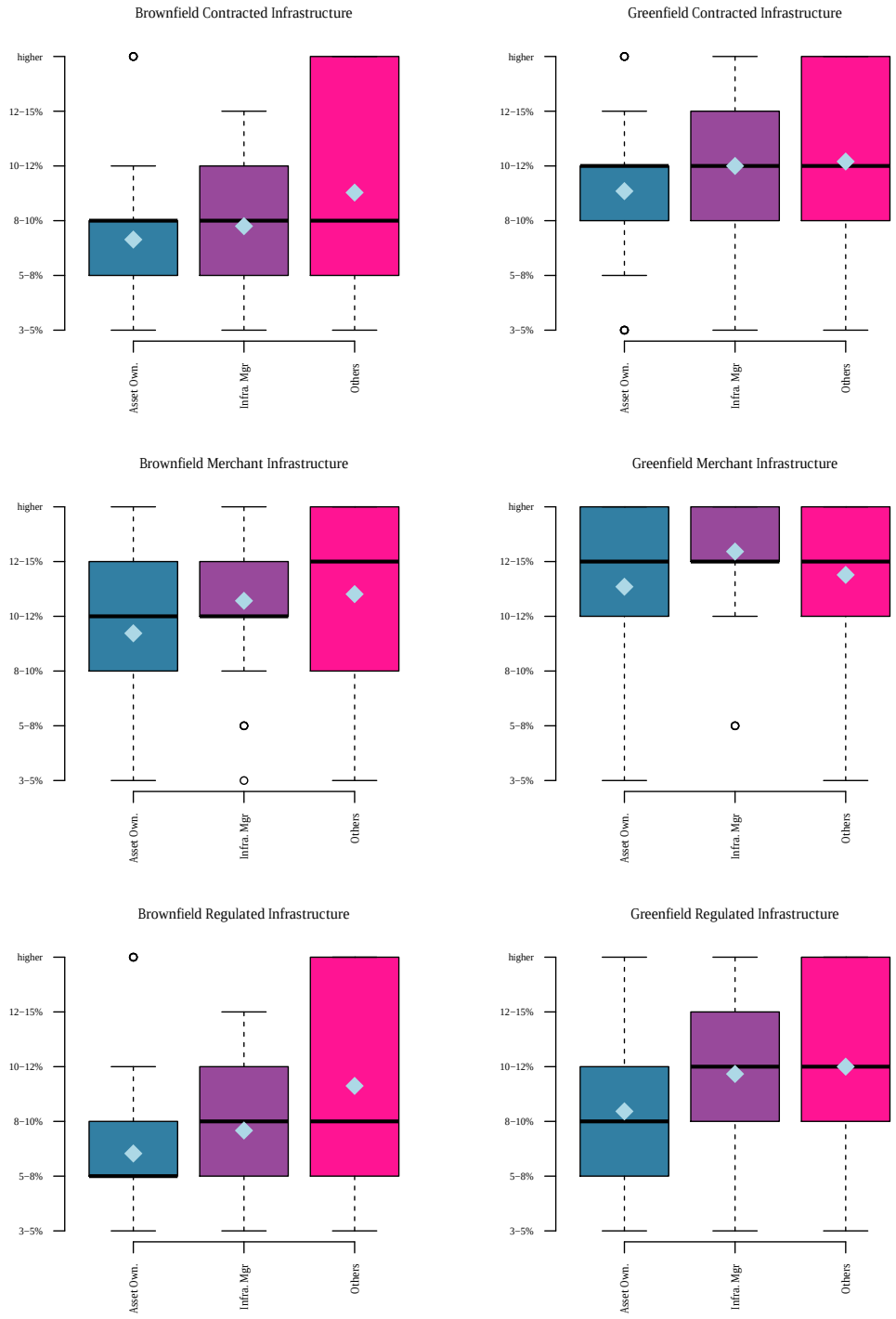
Overall the hierarchy of risks expressed by respondents in their answers about the nature of infrastructure investment and the role of contracts is respected in the views expressed about expected returns: projects are expected to yield higher returns in the earlier parts of their lifecycle and when they are exposed to merchant risk.

However, both mean (median and weighted average) and range of required equity returns reported by asset owners and managers tend to be different: managers almost systematically report higher expected returns from all types of infrastructure investments, as Figure 16 also illustrates. In some cases, the required returns reported by 'other' respondents is even higher.

Beyond the tendency of asset owners and managers to disagree of expected returns, the responses also show a very significant range of expectations for investments in firms that are reasonably well defined and homogenous (e.g. brownfield contracted infrastructure).

4. Survey Results

Figure 16: What is your expected range of equity returns for the following types of infrastructure investments?



4. Survey Results

We return to the interpretation of these results in the next chapter .

4.1.4 Emerging Market Infrastructure Investments

Turning to investors' beliefs about infrastructure investment in emerging markets, 20 percent of respondents reports already investing in these markets and one-third declares wanting to. Close to 44 percent of respondents declare not wanting to invest in infrastructure in emerging markets. As illustrated on Figure 17, another 3.5 percent of respondents are unsure.

But as Figure 17 also shows (bottom panel), amongst those who invest or want to in emerging market infrastructure, close to 60 percent report that their exposure was likely to increase in the near future, with 6.4 percent reporting a significant planned increase.

Breaking down intentions to invest in emerging market infrastructure by type of investor reveals further heterogeneity of preferences and perceptions amongst asset owners. Figure 18 reveals that only pension plans and SWFs are already invested in emerging market infrastructure and also that DC pension plans are a lot less likely to do so than DB plans or SWFs. Furthermore, the intention to begin investing in such markets in the future is also much higher amongst SWFs.

The bottom panel of Figure 18, further indicates that institutional investors may be on the cusp of a major investment push into emerging market infrastructure: while they do no report any current involvement in non-OECD infrastructure markets, insurers and endowments that declared wanting to invest in such markets are also reporting in their immense majority a planned increase in their exposure.

Asset owners are drawn to emerging market infrastructure for reasons that are summarised in Figure 19. First amongst them is the search for higher returns, followed by the lack of investment opportunities in OECD infrastructure. Creating diversification benefits across countries or sectors is a lesser concern.[8] Nevertheless, both the mean tendency and the range of answers reported in Figure 19 suggest very heterogeneous attitudes and motivations amongst respondents.

With higher returns should come higher risks, which investors are nonetheless keen to control.

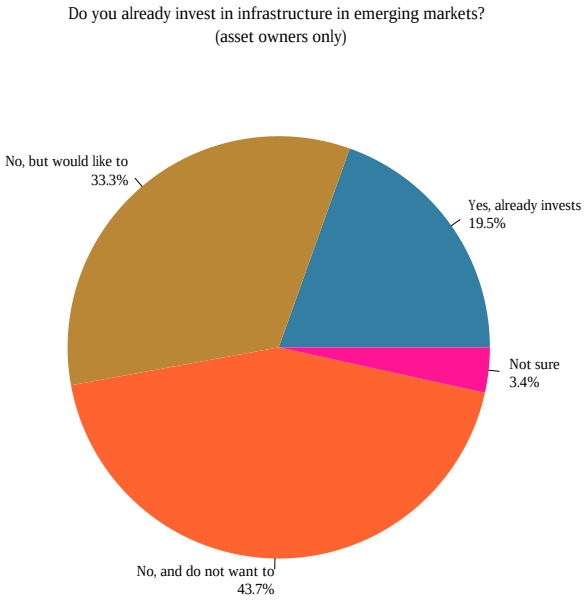
The chief concern for investors investing or considering investing in emerging market infrastructure is the role of government agencies and the perceived instability of public policies with regards to infrastructure. As Figure 20 reports, this concern is followed by more standard concerns common to most foreign direct investments about macro-economic risk, taxation or the ability to work with local partners, be they public or private.

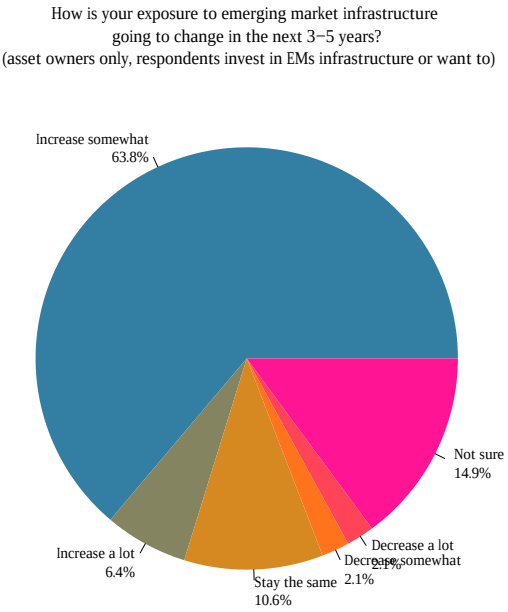
Finally, Figure 21 reports the level of equity returns required by the different

8 - Responses made by different types of asset owners only are quasi-identical.

4. Survey Results

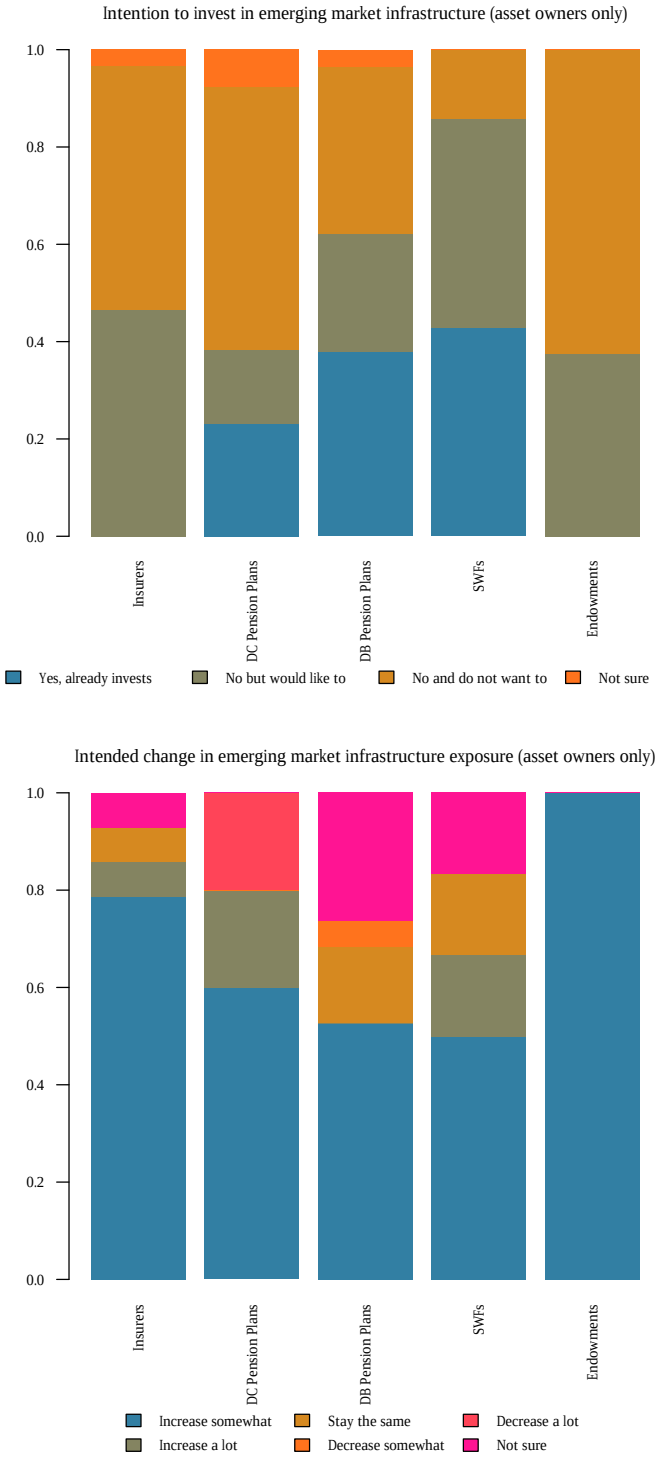
Figure 17: Existing and intended investment in emerging market infrastructure (asset owners only)





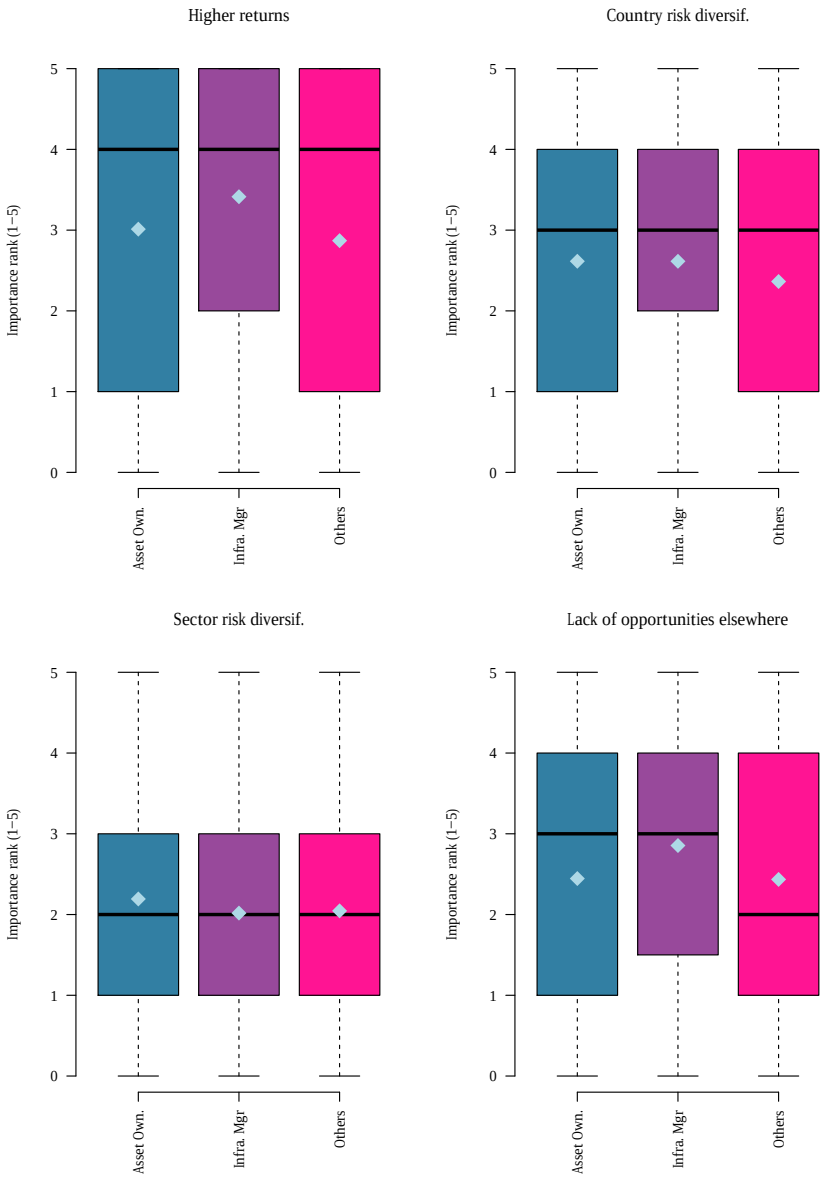
4. Survey Results

Figure 18: Existing and intended investment in emerging market infrastructure by type of asset owner



4. Survey Results

Figure 19: Reported reasons to invest in emerging market infrastructure. Ranked from 1 (lowest) to 5 (highest); diamond indicates the weighted averaged score.



4. Survey Results

Figure 20: Reported factors that make investing into emerging market infrastructure more difficult than in the OECD. Ranked from 1 (lowest) to 5 (highest); diamond indicates the weighted averaged score.

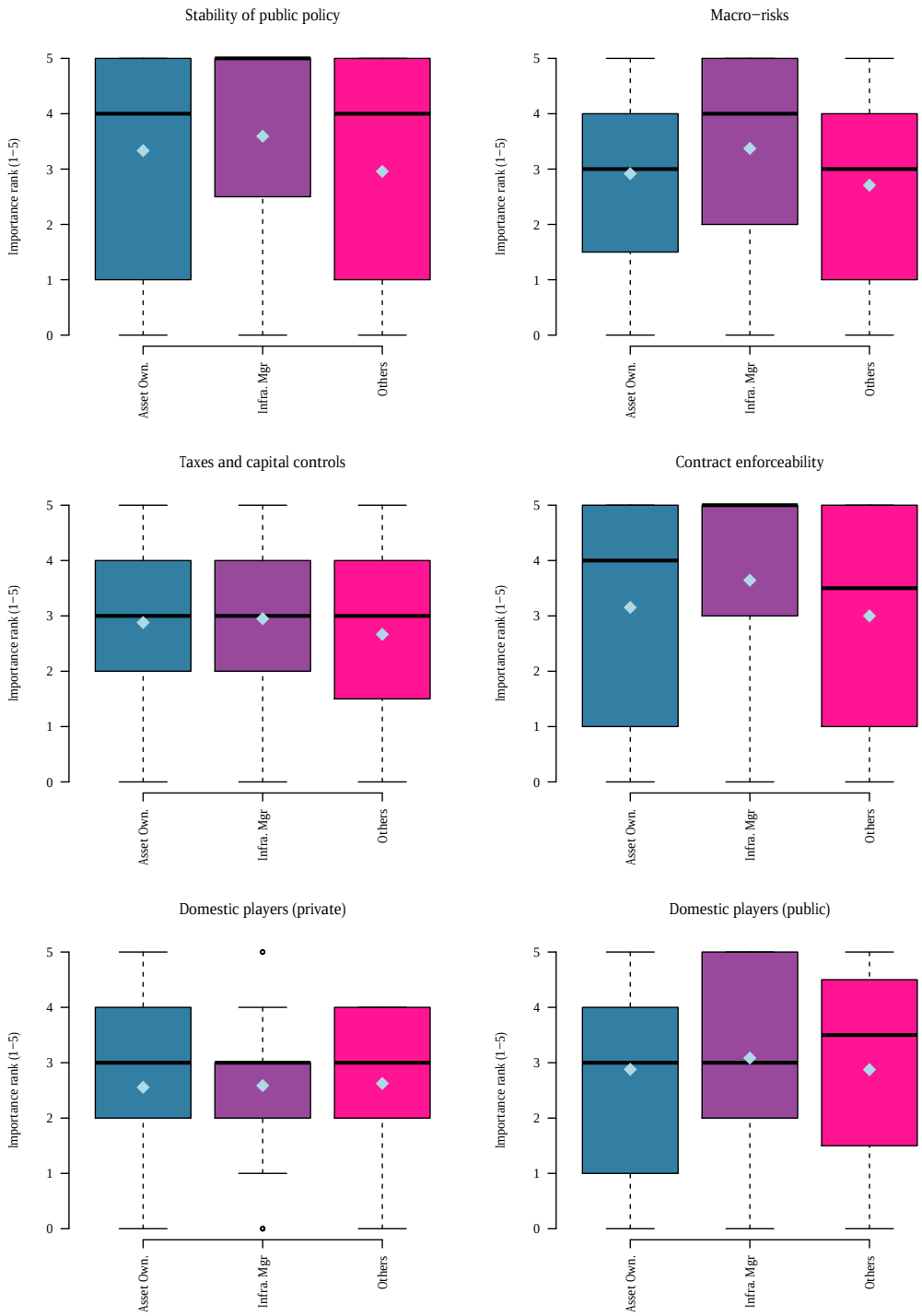


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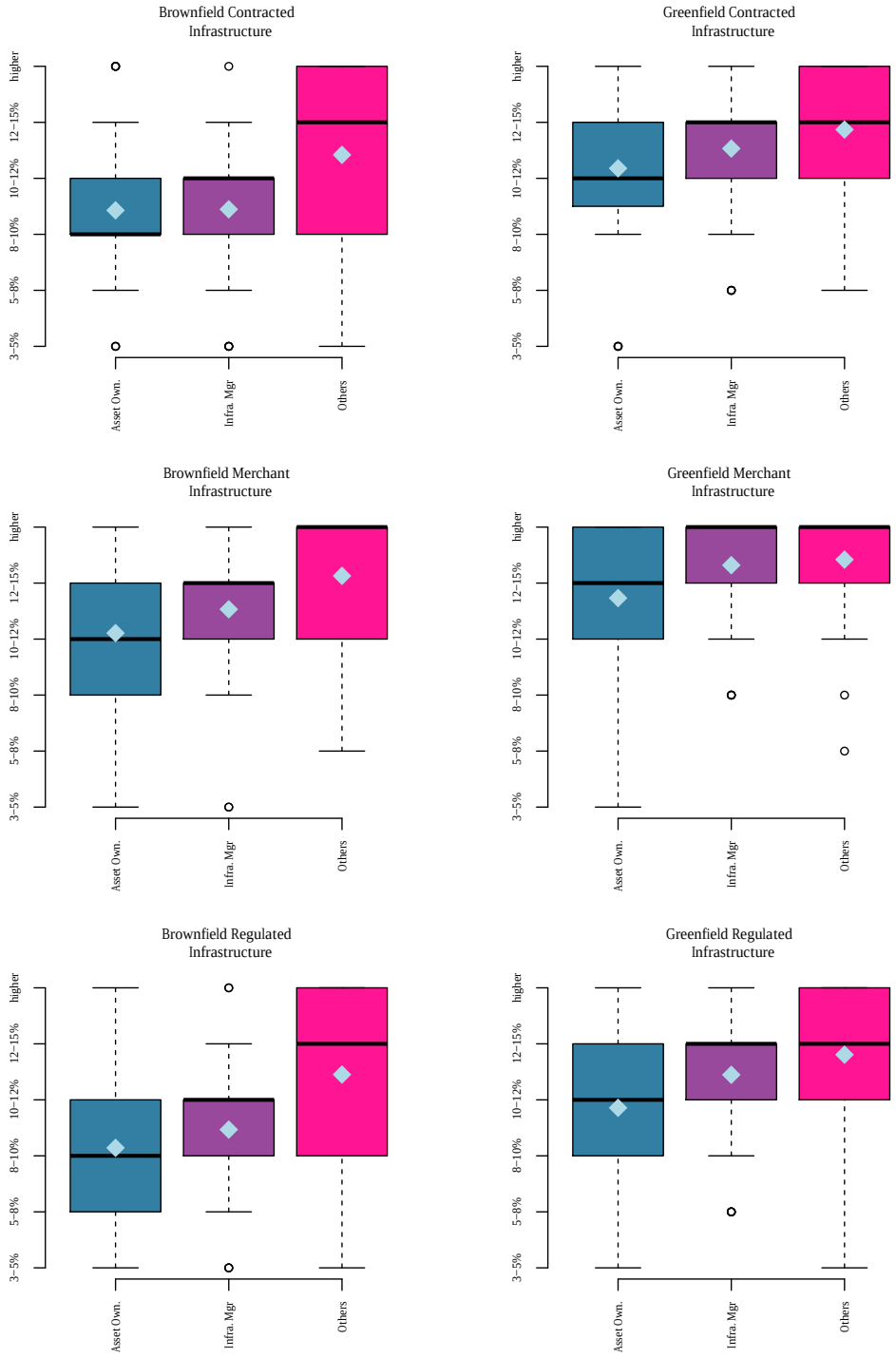
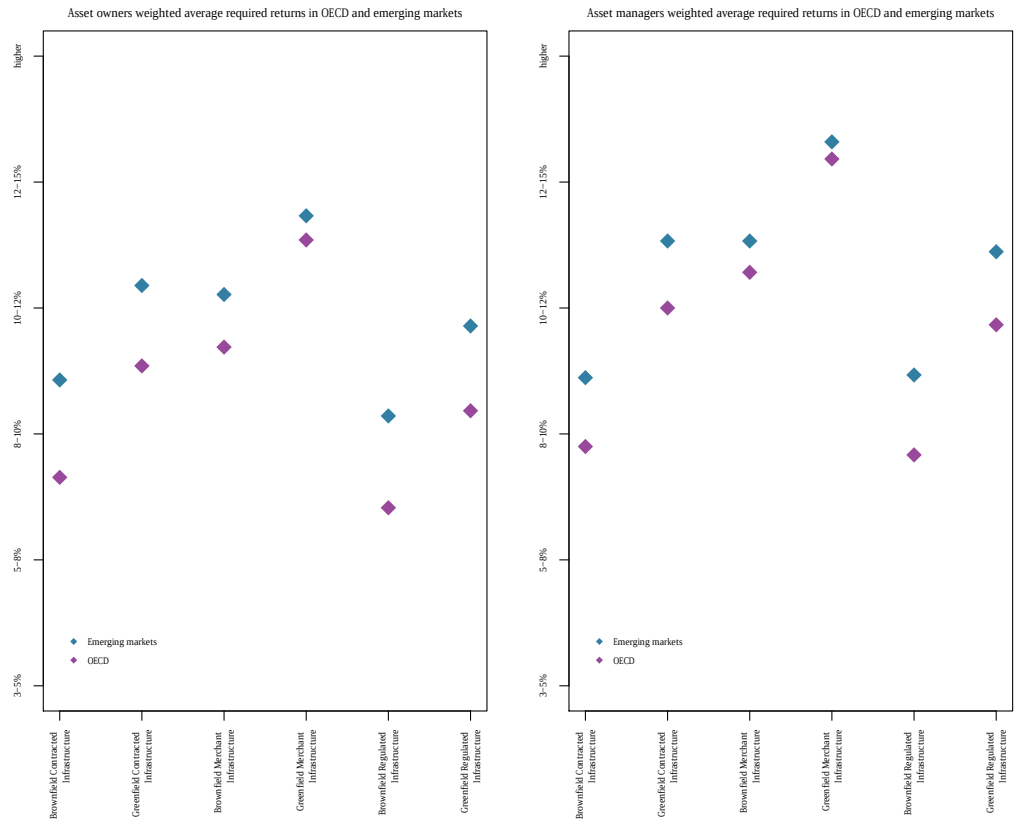
Figure 21: Expected equity returns from infrastructure investment in emerging markets.



4. Survey Results

Figure 22: Emerging market risk premium in different types of emerging market infrastructure



categories of respondents for different categories of infrastructure investments. As before, the level of returns is explained along the Greenfield/Brownfield and contracted/merchant/regulated axes. The pattern by which asset owners systematically report lower expected returns than asset managers is also found here.

We can also report the average difference between required equity returns in emerging market infrastructure and the required returns reported earlier in section 4.1.3 for OECD markets. Figure 22 shows the weighted average score for different required return bands in both cases, for each of the previously identified types of infrastructure investments (from Greenfield to Brownfield, contracted to merchant or regulated), for asset owners (left panel) and asset managers (right panel).

Unsurprisingly, emerging market infrastructure commands a risk premium relative to other markets. However, this risk premium differs significantly between different types of investments: it much more significant for contracted and regulated infrastructure than for merchant infrastructure, for which the emerging market risk premium is close to zero.

This is congruent with the view reported by respondents in Figures 12 and 20 that contracts and regulation are at the heart of

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infrastructure investment and also amongst the most challenging aspects of the long-term investment in emerging market infrastructure. In comparison, merchant risk, while it commands a higher absolute premium, there is not much of an emerging market premium when it comes to merchant infrastructure.

The emerging market infrastructure premium is also higher (relative to the OECD base) at the Brownfield stage in the contracted and regulated cases. Hence, while Greenfield projects command a higher absolute premium, the difference between OECD and emerging market required returns is higher at the Brownfield stage. This is further confirmation that the viability of long-term contracts in emerging markets, which is revealed at the Brownfield stage, is a greater concern amongst investors.

4.1.5 Conclusion

In conclusion, reported investment beliefs about infrastructure equity and debt investments seem both sophisticated and heterogeneous: asset owners, their asset managers and other participants in the infrastructure investment sector tend to have a sound understanding of the mechanisms at play and the inherently contractual nature of each underlying investment.

Clearly the range of views about required returns in the private infrastructure space is considerable. It can be driven by some considerations that go beyond the Greenfield/Brownfield and Contracted *v.s.* Merchant *v.s.* Regulated distinctions used here, including country-level or project-level risks, and, above all, a wide spread of investor preferences in a market which is too *incomplete* for unique price measures to exist i.e. bid ask spreads are likely to remain very significant when potential buyers and sellers are organisations as diverse in their outlook as European life insurers, North American Defined-Benefit pension plans or Asian Sovereign Wealth Funds.

In line with the notion that – for the majority of respondents – "infrastructure should not be expensive" i.e. returns are expected to be relatively high, numerous respondents still require equity returns in the double digits.

At the same time, an equally high proportion of respondents reports that the beliefs that infrastructure investments rest on stable long-term contracts, and the preference for the "Brownfield/contracted" type of infrastructure investment, that is, the most conservative.

Beyond the volatility of future payoffs, a certain proportion of required returns may be determined by the illiquid nature of such investments. Still, as we report next the majority of respondents declare wanting to buy-and-hold infrastructure firms and not being particularly troubled by their illiquidity. We further discuss the sources of expected risk premia in very illiquid investments such as infrastructure in the next chapter.

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4.2 Investment Products and Objectives

We now turn to the part of the survey dedicated to the use made by investors of infrastructure debt or equity in their overall portfolio strategy. We first review responses of asset owners about existing products offered by asset managers (section 4.2.1), their preferences in terms of investment horizons and ways to access infrastructure investments (section 4.2.2), and finally about the objectives they pursue through infrastructure investment (section 4.2.3).

4.2.1 Current Products

While asset owners who responded to this survey express a keen interest in infrastructure investment, majority of them are rather unsatisfied with the products offered by infrastructure asset managers.

Figure 23 reports asset owners' views of whether existing investment products offered by asset managers meet their needs. Only 4.6 percent of institutional investors surveyed say those existing products "fully fulfil their needs", while 84 percent declare that their needs are only partly fulfilled by what infrastructure investment managers have to offer today. A further 11.5 percent reports that existing infrastructure fund managers' product offering is "mostly inadequate."

Next, we asked what improvements of asset managers product offering would be welcomed from the perspective of asset owners. Figure 24 reports the answers given by each type of asset owner about five potential areas of improvement.

First amongst them, unsurprisingly, is lower delegation costs. Fee levels have of course been a recurring theme in recent years and not limited to infrastructure investment. Still, limited partners (LPs) perceive management costs to be high in the infrastructure fund sector.

High costs have been a primary reason for numerous asset owners to become 'direct' infrastructure investors in recent years. However, internalising infrastructure investment is costly as well. We return to this question below when we review responses regarding investors' preference on delegation and in Chapter 5 when we discuss the cost of delegating investment decisions to a specialist in comparison to the potential opportunity cost of lower diversification when asset owners can only invest directly in a limited number of private assets.

The second most desired improvement of infrastructure investment products is "better-defined investment objectives." In other words, asset owners want asset managers to better define the proposed outcome of investing in infrastructure through an infrastructure fund, in terms that are more congruent with their own investment objectives e.g. regarding certain financial metrics, or relative to a given benchmark. We return to benchmarking in section 5.3.

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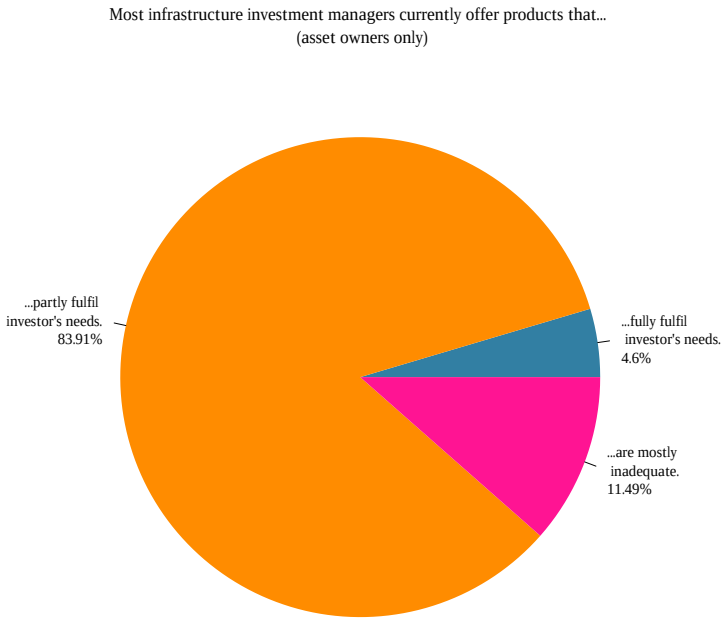
Figure 23: Usefulness of existing infrastructure investment products for asset owners



In the third, fourth and fifth places are "achieving longer duration" (which is in line with ten-year private equity infrastructure funds outdated – see below), better geographic and sectoral diversification.

It should be noted that these last concerns are gradually being addressed by managers with the creation of longer and larger funds, which can achieve longer durations, and be in a position to invest across more countries and sectors.

Next, when asked if co-investment alongside asset managers or lenders was a desirable route or only a second best, close to 54 percent of asset owners agreed with the former, even though this may have been mainly driven by concerns over investment costs. Still, for 46 percent of investors, having to co-invest instead of fully delegating investment decisions is a sign that the market for investment delegation does not function well enough (we return to this point in Chapter 5).

Indeed, when we asked respondents to describe the "traditional closed-ended private infrastructure equity funds with fund-level leverage", 82 percent say that this model is "outdated and not adding value" (Figure 25), which is striking considering that this remains the most common type of infrastructure fund, many of which have been raised very recently.

In fact, the sheer amount of money that has recently been raised by managers to invest further in infrastructure but has not yet found a home (the so-called "dry

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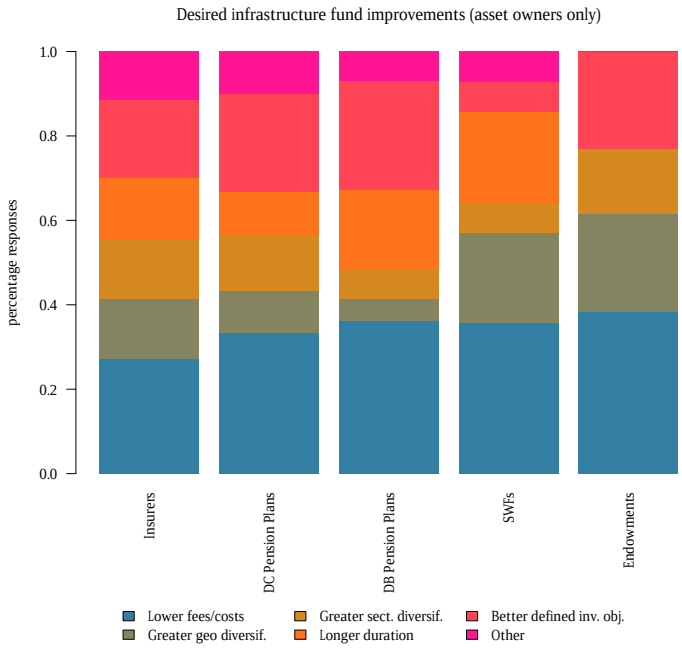
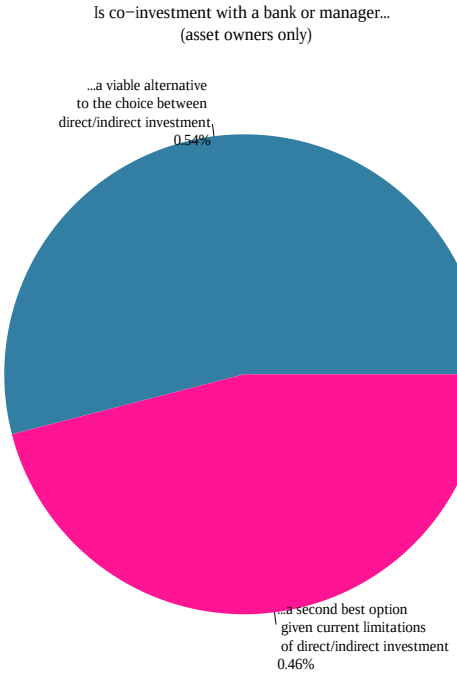
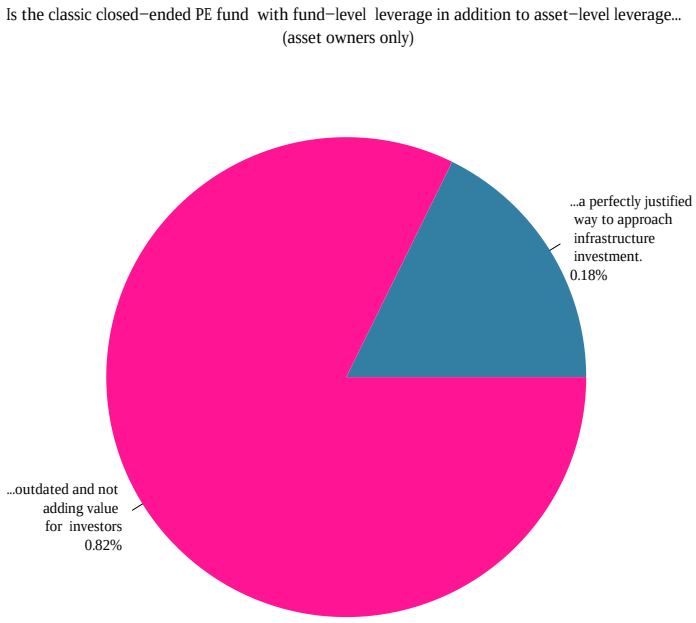
Figure 24: Improving products and co-investing alongside asset managers

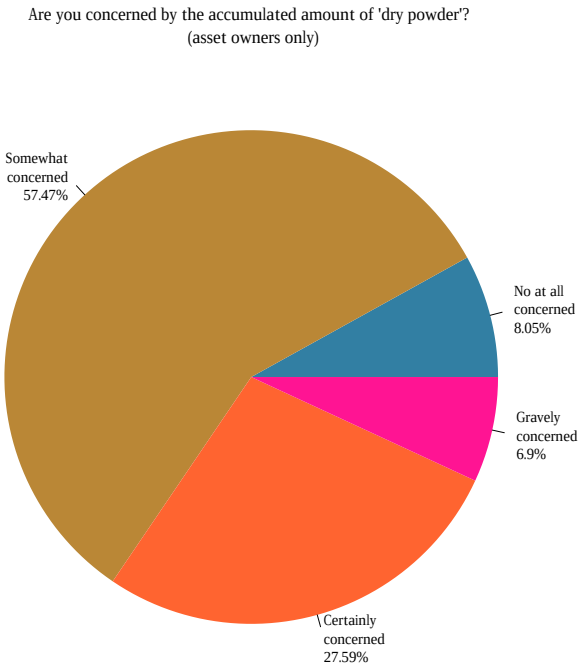




4. Survey Results

Figure 25: Perceived added value of infrastructure private-equity-style funds





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powder") is a source of concern amongst investors. "Too much cash chasing too few deals" tends to increase prices but may also lead to a gradual degradation of underwriting standards (Figure 25, bottom panel): eight percent of respondents think that this is not an issue, while one-third are either "certainly" (28 percent) or "gravely" concerned (7 percent). In their responses, this last group expressed the idea, amongst other possibilities, that follow-on funds might create the equivalent of pyramid schemes.

Based on these results, it can be argued that asset owners would like to see some improvements in the product offering of infrastructure asset managers. Some of the shortcomings of infrastructure funds have already led a number of large asset owners to favour a more direct investing route. Nevertheless, as we discuss in the next chapter, in a world of heterogeneous skill endowments, delegation to a specialist should be welfare improving for all parties, assuming a well-functioning market for delegation. In the next section, we review investor's responses about their preference in terms of horizon and investment delegation.

4.2.2 Horizon and Access

Investment horizons

Buying infrastructure equity or debt is overwhelmingly understood to be a long-term, buy-and-hold investment decision. Figure 26 (left panel) reports what respondents believe is the most justified investment horizon for asset owners with respect to infrastructure investment.

A small minority of managers and other actors consider infrastructure investment to be a short term play, but not a single asset owner shares this view. Instead, asset owners overwhelmingly look at infrastructure as a long-term investment (81 percent), while managers are less inclined to see it this way (67 percent). Nevertheless, the majority of respondents agree that infrastructure investment makes more sense when taking a long-term view (more than 10 years). SWFs and endowments are much more likely to consider infrastructure a medium-term strategy (5-10 years) than other asset owners, the immense majority of which (85-90 percent) reports that long-term holding periods are the most justified.

Indeed, close to 70 percent of asset owners and managers concur that investors want to hold infrastructure assets to maturity, while only one in five reports wanting to buy to exit (Figure 26, bottom panel). Different types of asset owners also report different views: DC pension plans are less likely to say that infrastructure is a buy-and-hold decision than the rest of asset owners, even though more than half of them do.

Finally, a significant proportion declares that liquidity is of minimal importance. More than half of respondents report that liquidity is either "unimportant" or "of limited importance." While these sound intuitive, they may well have important

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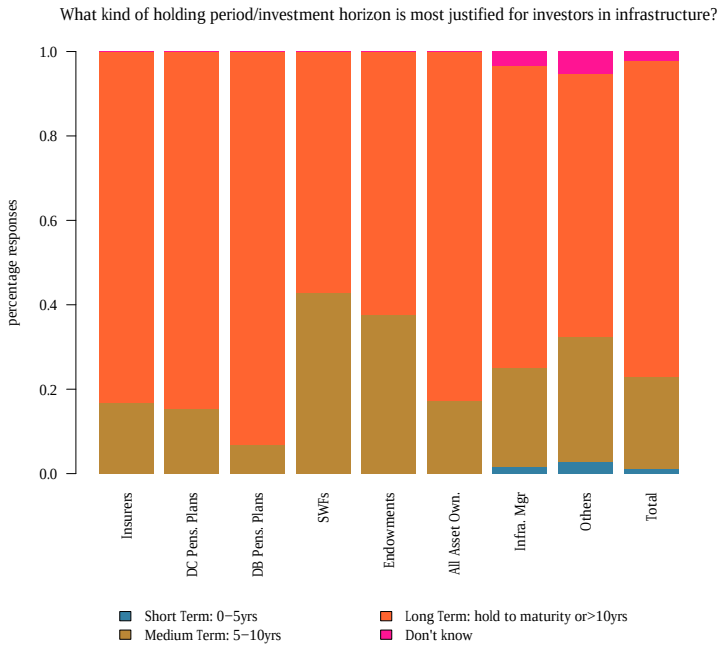
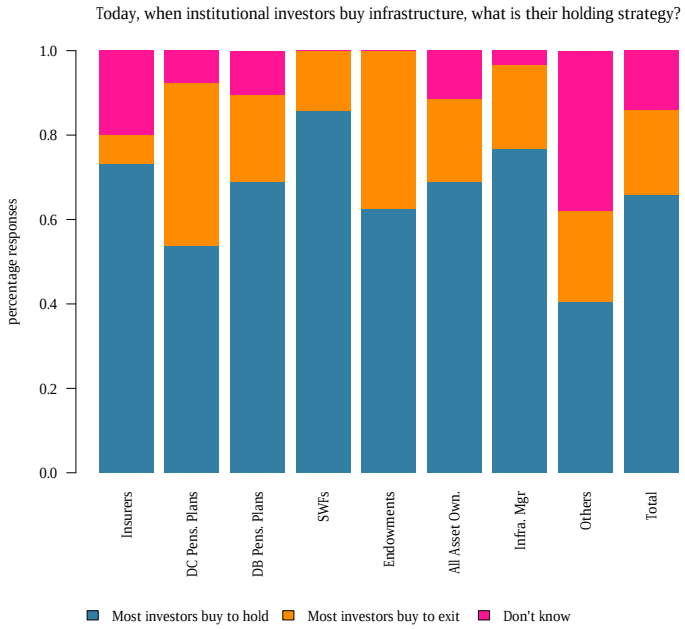
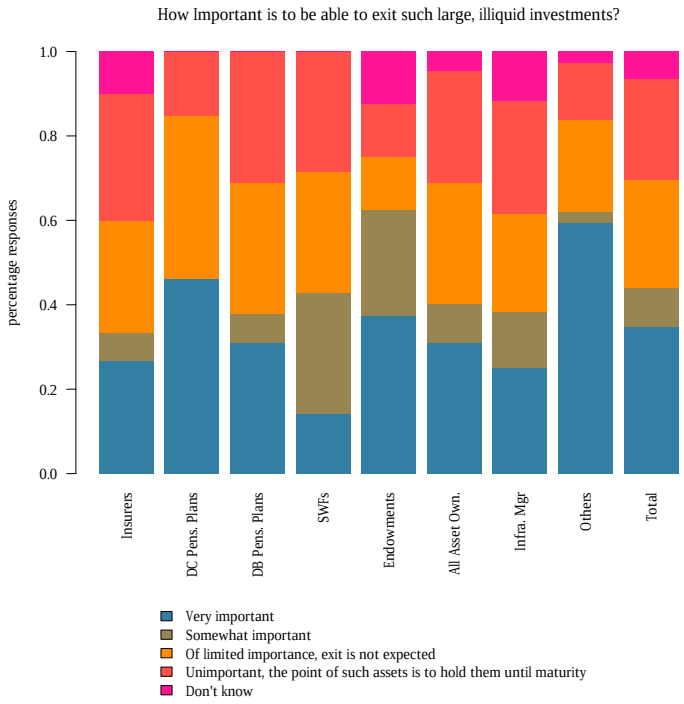
Figure 26: Preferred horizon and holding strategy of asset owners with respect to infrastructure





4. Survey Results

Figure 27: Asset owners' declared preference for liquidity with respect to infrastructure investments



implications for the pricing of any "illiquidity premium".

Next, we look at investors' preferences in terms of accessing infrastructure investments.

Listed or unlisted investment

More than three quarters of respondents (80 percent) agree that institutional investors prefer unlisted to listed infrastructure investments, while the balance reports that they prefer investing via public markets.

Figures 28 reports the reasons why different respondents expressed a preference for either listed or unlisted investments. Unsurprisingly, listed infrastructure is favoured primarily because it is perceived as more liquid and more transparent, as well as cheaper to access.

Unlisted assets are preferred primarily because of the extent of management control on the firm i.e. as a form of active investment. They are also perceived as a diversifier of capital markets and a better outperformer.

Direct or indirect investment

Turning to the choice between direct and indirect investment in infrastructure, respondents are split between two schools of thought. As Figure 29 shows, 45 percent of respondents think that asset owners prefer direct investing, while 55 percent believe that they prefer delegating.

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Figure 28: Asset owners' preference for listed vs unlisted investment in infrastructure and stated reasons, ranked from 1 (lowest) to 5 (highest); the black line is the median, diamonds indicate the weighted averaged score

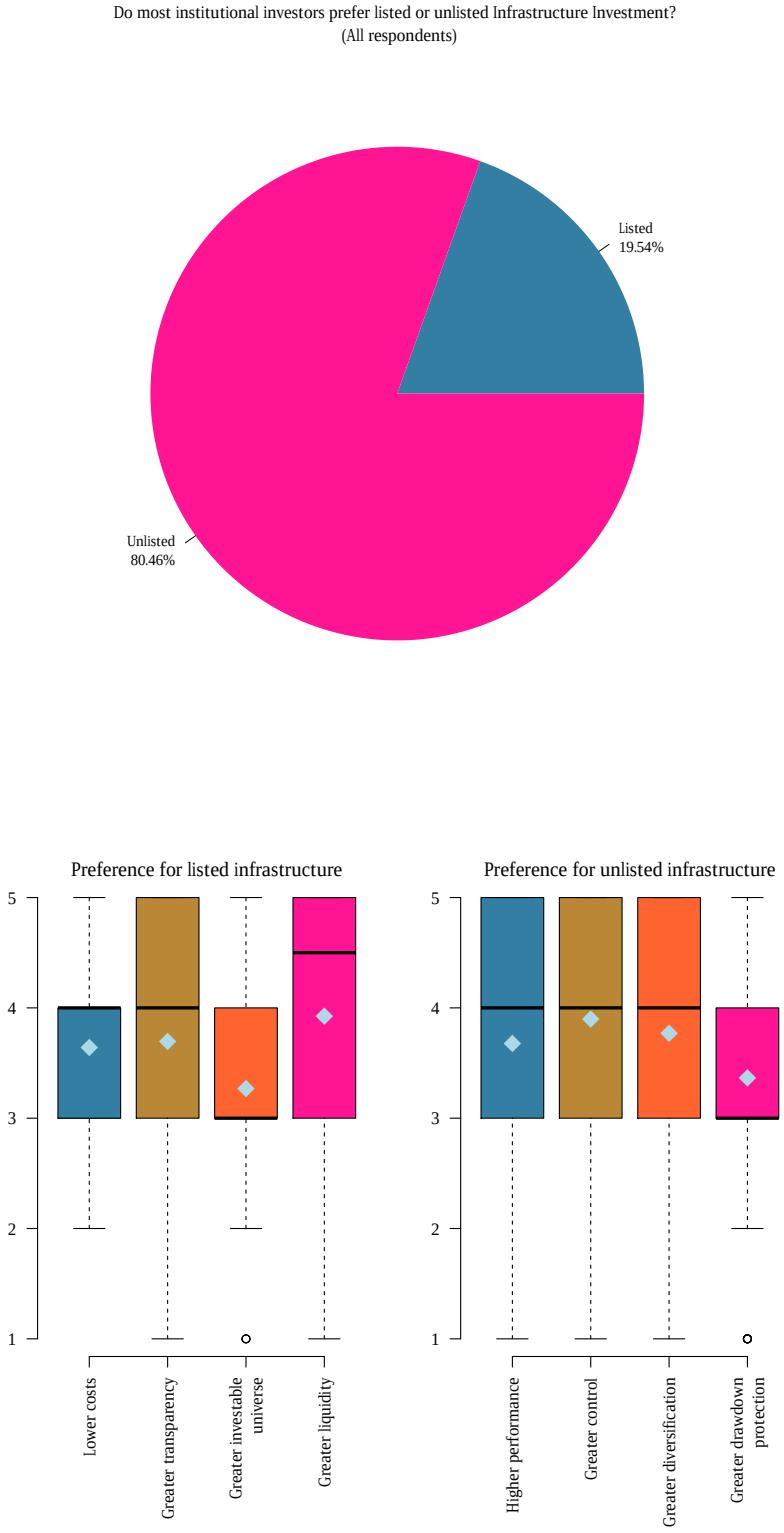

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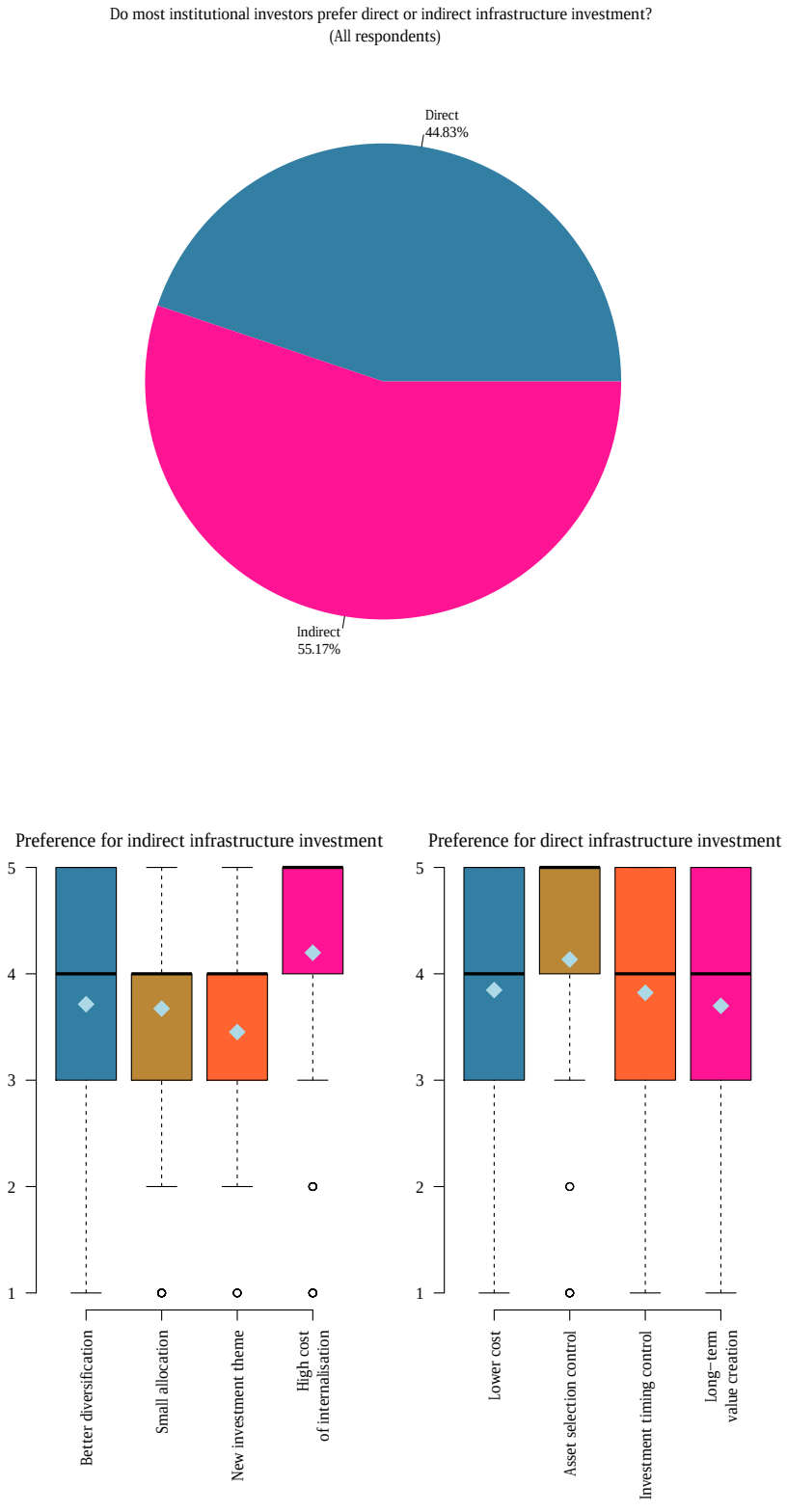
Figure 29: Asset owners' preference for direct vs indirect investment in infrastructure and stated reasons, ranked from 1 (lowest) to 5 (highest); the black line is the median, diamonds indicate the weighted averaged score



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Thus, a small majority of respondents consider that institutional investors prefer indirect investment through a specialist fund manager. This result is congruent with the high cost of creating a direct investment capability as well as the current fund raising evidence, by which infrastructure fund raising is at historic highs. It is also striking if one considers the answers reported above about the lack of satisfaction of investors with the current product offering in this sector.

The reasons why investors report preferring direct investment in infrastructure are reported in the bottom part of Figure 29 (only those who expressed a preference for direct investment responded): respondents rank control highly. They wish to control asset selection in particular, as well as investment or divestment timing and to create value through the direct management of the firm over the extended period. In other words, they are confident that they can do at least as well as a specialist asset manager.

Turning to the reasons given by respondents who believe asset owners prefer indirect investment (also Figure 29), the cost of internalising the investment process received, unsurprisingly, the highest rank, followed by the opportunity to achieve better diversification by investing through multiple vehicles. For some asset owners, infrastructure is simply too new or too small to justify a direct investment.

Thus, a majority of investors appears to prefer investing in unlisted infrastructure using infrastructure asset managers to do so, but there is a significant segment of the asset owner population that prefers direct investment, as well as a less important subgroup privileging listed infrastructure over its private counterpart.

Such a range of preferences is likely to correspond to an equivalent range of investment objectives pursued by asset owners, relative to which infrastructure investment is only a mean to an end. We discuss these next.

4.2.3 Investment Objectives

In this section, we turn to the context in which the decision to invest in infrastructure makes sense for asset owners: their investment objectives.

Figure 30 reports the rank of a series of potential goals which investors might be trying achieve better by opting to include infrastructure in their strategic allocation.

Overall, achieving better risk-adjusted performance is the highest ranked objective, followed closely by that of improving diversification both of capital market instruments and of other alternative assets.

These considerations are followed by risk control (drawdown protection) and liability-hedging (duration and inflation) objectives.

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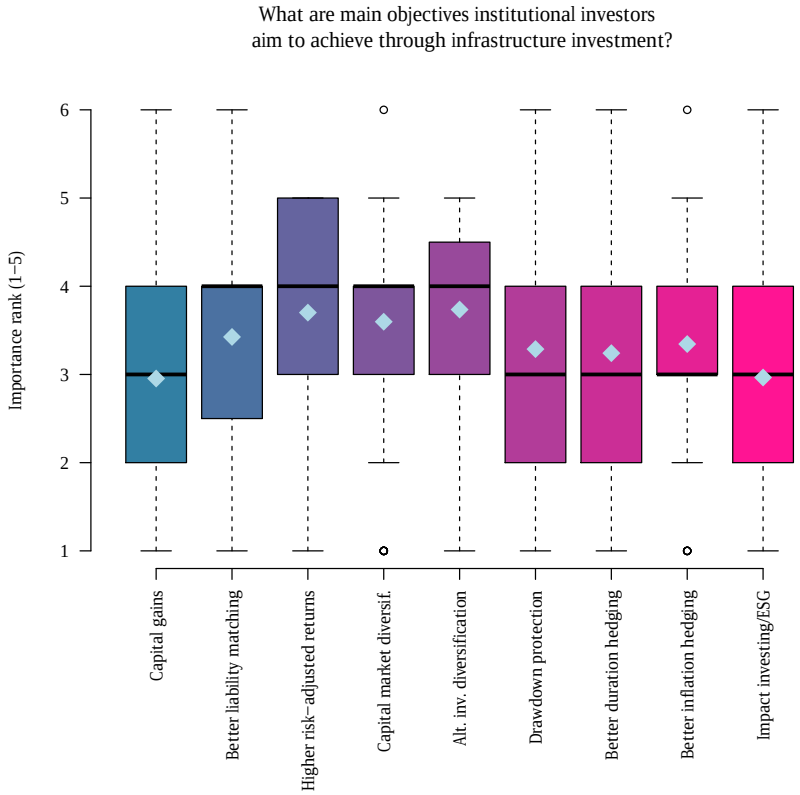
Figure 30: Investment objectives pursued by asset owners through infrastructure investment



Capital gains and ESG impact rank the lowest amongst these objectives (we return to ESG in section 4.4).

Given the roles that investors tend to attribute to infrastructure investment in their portfolio, we also asked what specific investment objectives investors would like to see infrastructure investment product formulate or try to achieve more explicitly.

As Figure 31 reports, asset owners overwhelmingly report that infrastructure investment products should be specifically designed to target stable cash flows, capital preservation and an illiquidity premium.

4.2.4 Conclusion

As Figure 31 also illustrates, different investors want different things from infrastructure investment, in particular, the perceived role of infrastructure investment and its contribution to the overall investment policy of each asset owner may explain differences of perspectives on the required risk/reward trade-off available for such assets.

For instance, investors who " value" the expected stability of payout of infrastructure assets may not require returns that are as high as those investors who are solely focused on performance. As we argued earlier, such stability – if it can be relied

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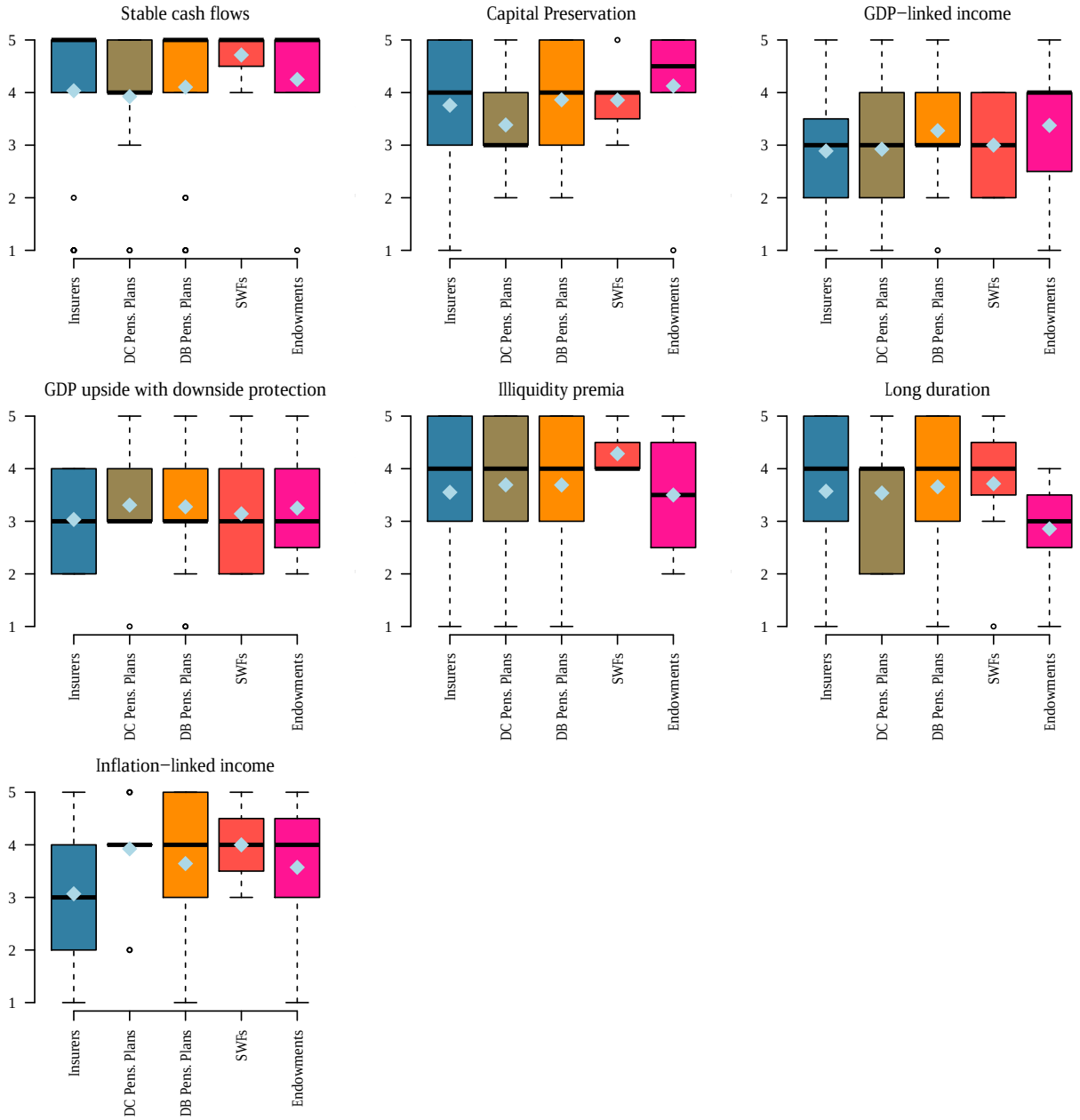
Figure 31: Which investment objectives would asset owners like manager to try and deliver more explicitly



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upon – should be very valuable, and would justify lower returns *ceteris paribus*.

Still, the ability of infrastructure investments to help meet the objectives of asset owners cannot be known without computing the right metrics and comparing this performance with that of other investments. Thus, we turn next to the matter of benchmarking infrastructure investments.

4.3 Benchmarking

4.3.1 Current benchmarking practices

Current benchmarking practices vary significantly across types of organisations. As shown in Figure 32, when trying to compare the reported performance of their infrastructure investments to an index of reference, 57 percent of respondents reported using an absolute measure of performance, while one-third declares using a relative measure and the rest of respondents report not knowing the answer to the question.

Amongst those who expressed a preference for absolute benchmarks, exactly half prefer nominal indices while the other half reports using real indices.

Amongst the respondents who expressed a preference for relative benchmarks, most chose listed equity (29 percent), followed by bond indices (25 percent), then inflation (21 percent).

Investors use different benchmarks because they invest in infrastructure for various purposes and have different investment objectives and liability structures. Still, these results make the likelihood of observing asset owners using one type of benchmark or another almost random since the chances of this benchmark being absolute or relative, nominal or real, or relative to equity, bond or CPI indices are almost equal.

4.3.2 Limitations of current performance measures

Despite reporting the use of relative or absolute benchmarks to determine asset allocations and monitor performance, the immense majority of respondents are very critical of available benchmarking options. Asset owners and managers as well as other respondents all agree that currently used benchmarks for infrastructure investment are either lacking (62 percent) or completely inadequate (34 percent).

Risk measures in particular are reported as being ill-documented. Amongst the dimensions of the financial performance of infrastructure investments the least well documented metrics are volatility, tail risk and correlations.(see Figure 34).

Valuations also stand out as an item of concern when it comes to measuring the performance of private infrastructure investments.

It comes third in the list of ill-documented metrics and, as Figure 35 reports, less than half of investors actually trust the valuations reported by infrastructure asset managers, with a quarter of asset owners

4. Survey Results

Figure 32: Current use of benchmarks in infrastructure investment

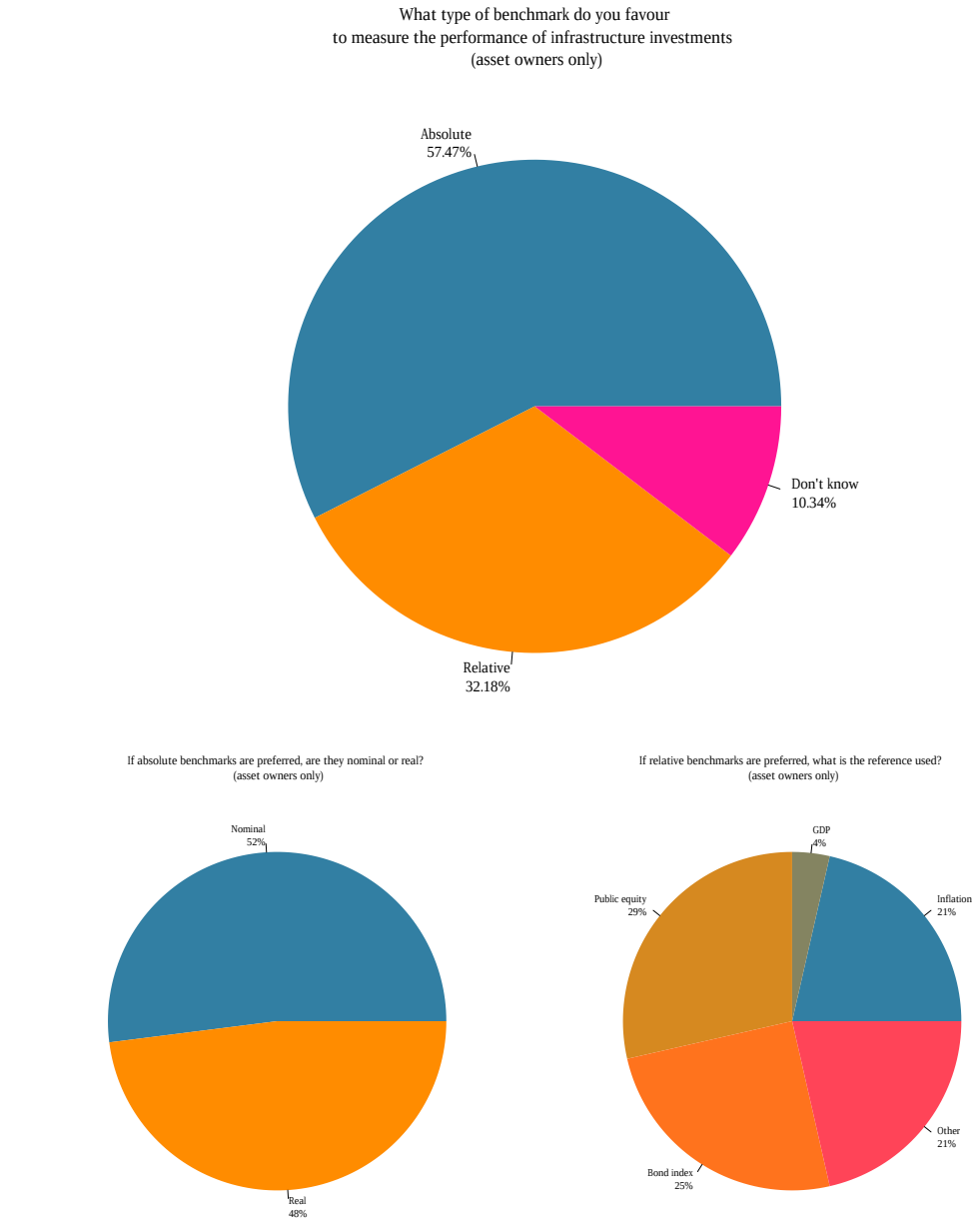

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Figure 33: Limitations of available benchmarking options

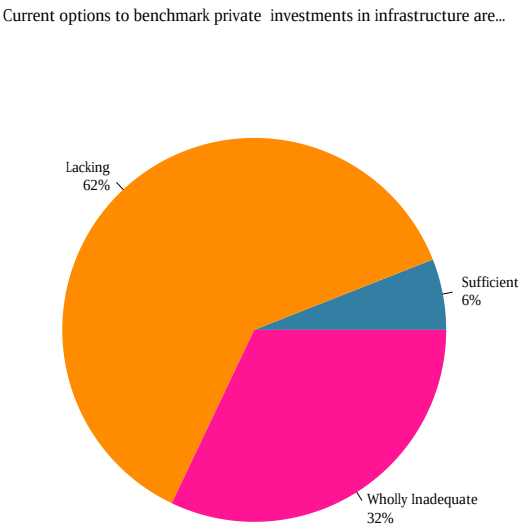

Figure 34: Missing metrics

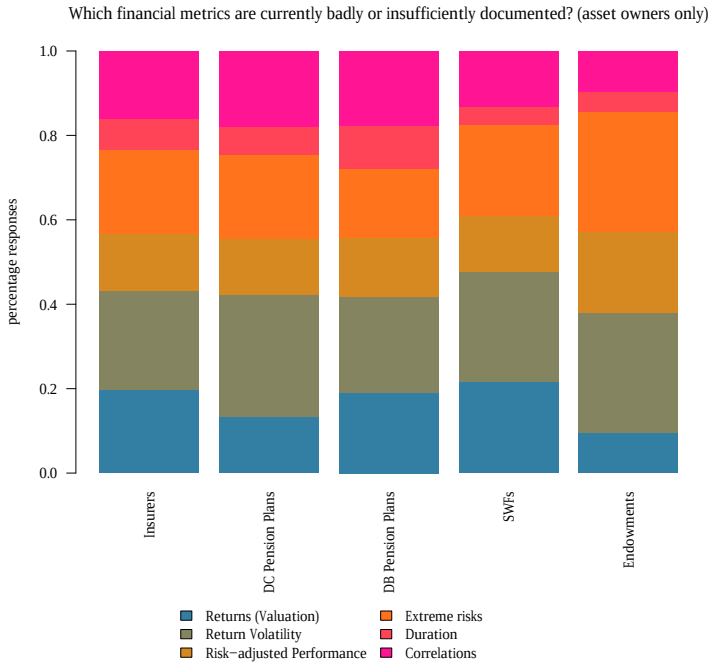

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Figure 35: Limitations of current asset valuation approaches

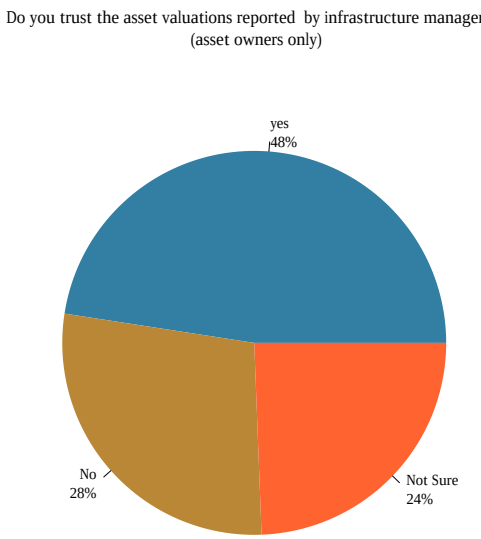
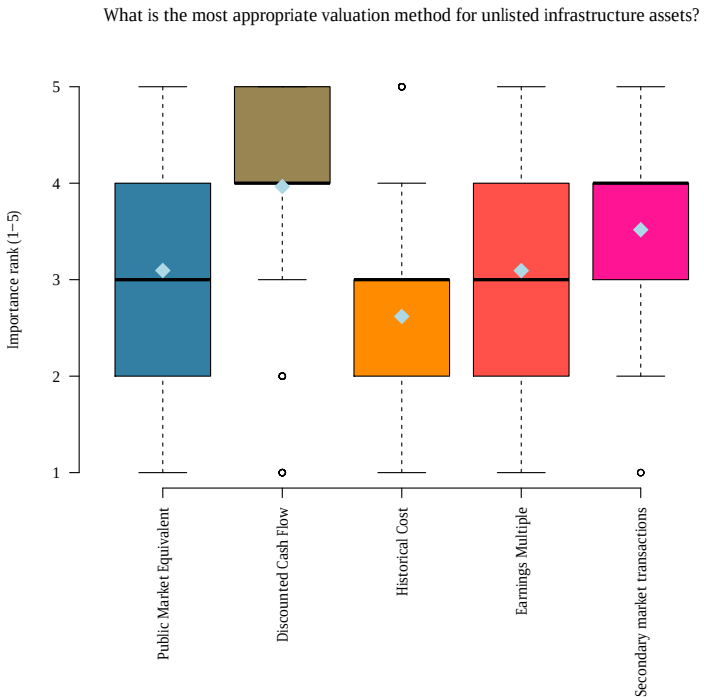


Figure 36: Preferred valuation methodology for infrastructure investments



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reporting that they do not know whether these valuations can be trusted and another 28 percent declaring outright that they do not trust reported NAVs.

In other words, less than half of LPs in infrastructure funds consider that they can take the performance metrics that are currently being reported (IRRs and NAVs) seriously.

4.4 Environmental, Governance and Social Aspects

Finally, we examine investors' views of the ESG debate and what it means for their infrastructure investment preferences or decisions.

We first ask how important ESG aspects are relative to financial performance. The results are reported in Figure 37.

Responses are very consistent across organisation types, with the majority of respondents (69 percent) answering that, while important, ESG considerations are not overriding relative to achieving financial objectives, and another 13.8 percent considering that ESG is 'unimportant' relative financial considerations. Asset owners and managers' answers are very much in line in this case.

Still, 17.2 percent of respondents find that ESG matters are a first-order problem i.e. on par with strategic asset allocation.

This view is also reflected in the answers to the question: "Given two otherwise comparable infrastructure investments, do investors prefer the one offering better financial performance at the expense of ESG or, better ESG at the expense of returns?" The vast majority of respondents (71.2 percent) suggests that investors should pick assets that deliver better financial performance even if this comes at the expense of ESG characteristics. As shown in Figure 38, "impact investing" remains a second order problem compared to meeting the investment objectives of the plan.

Still, 29 percent of investors suggest that investments in infrastructure should take into account ESG characteristics including if this is at the expense of financial returns.

The last question on the topic queries respondents' belief about the existence of a trade-off between returns and ESG: as shown in Figure 39 more than half of respondents consider that there is a positive relationship between ESG characteristics and financial performance.

In other words, they believe that projects that are less harmful to the environment or less likely to create social problems are also likely to exhibit higher risk-adjusted returns. It should be noted however that a third of respondents answered that they did not know.

We discuss these results in the next chapter.

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Figure 37: Principled investing and infrastructure

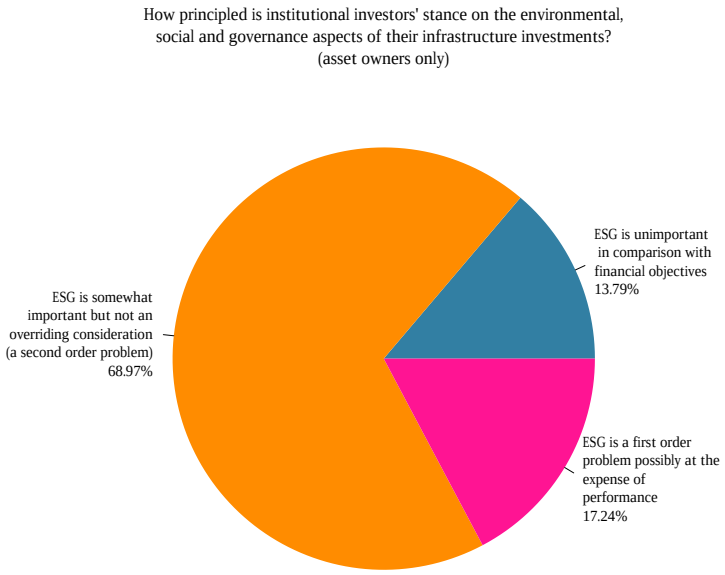

Figure 38: First and second order problems

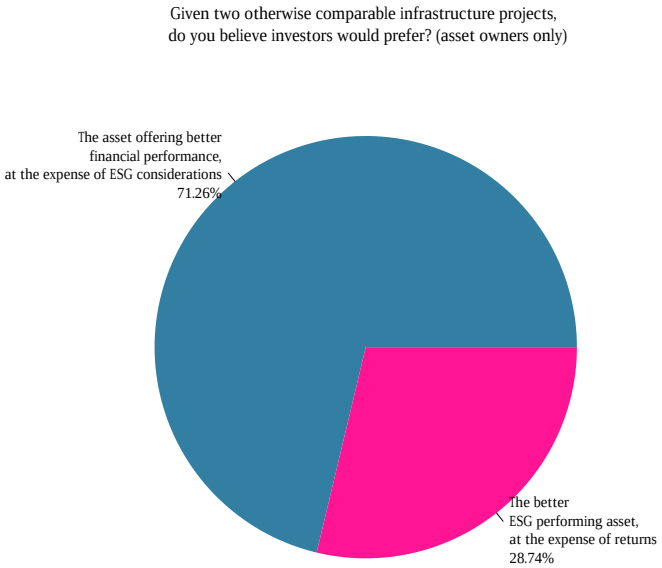

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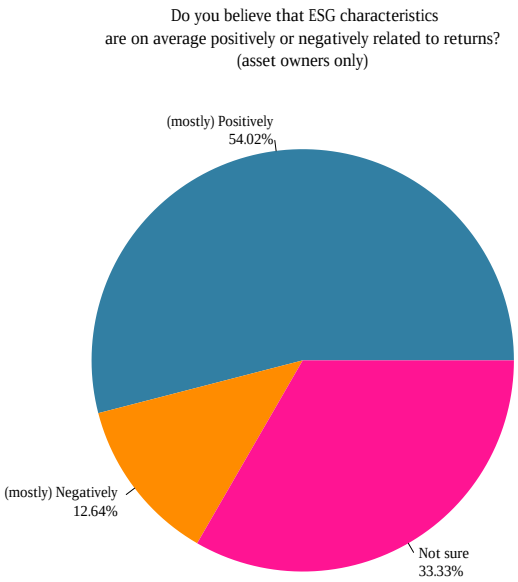
Figure 39: The ESG trade-off



5. Conclusions and Discussion

5. Conclusions and Discussion

In this survey we report the views of 184 individuals involved in infrastructure investment; half of them represent institutional investors or "asset owners" (insurers, pension plans and sovereign wealth fund), one-third are infrastructure asset managers and the remainder are infrastructure investment specialists from multilateral development banks, rating agencies and consultancies. Respondents are mostly senior executives actives in the top management (CEO, board members – 14.5 percent), strategic (CIO, Head of ALM or Asset Mix – 25.5 percent), investment (Head of Infrastructure, investment director – 46.2 percent) or other (14.5 percent) functions of the organisations they represent.

In what follows, we summarise the findings of the survey and provide some elements for discussion and future research.

5.1 Investment Beliefs

5.1.1 Key findings

The main findings on asset owners' and managers' investment beliefs are:

1. There is wide disagreement amongst respondents about whether listed infrastructure equity or debt qualify as an asset class. However, **unlisted infrastructure** is widely considered to be a "unique" asset class, both on the private debt and privately-held equity sides;
2. Most respondents also believe that focusing on infrastructure investment **only makes sense if it can be defined as an asset class**, whereas a minority reports preferring to approach infrastructure as an investable bundle of factor exposures;
3. Most respondents perceive infrastructure investment's **unique feature to be either its potential for portfolio diversification or for harvesting risk premia**, whereas it is less frequently believed that infrastructure has *unique* interest rate or inflation hedging properties;
4. Investors and managers **define infrastructure in terms of long-term contractual arrangements and monopoly regulation** and acknowledge that industrial sectors are a much less informative way to categorise such investments. In the same spirit, the stability of long-term contracts and the role of counter-party risk are perceived to be the most important and unique characteristics of infrastructure firms (compared to other firms). Finally, "Brownfield" (existing) and "contracted" infrastructure is reported to be the most attractive to investors, closely followed by brownfield regulated utilities;
5. **Expected returns follow a clear pattern** determined by the "business model" (contracted, merchant or regulated) and the lifecycle (Greenfield or Brownfield) of infrastructure firms, with Greenfield merchant investments requiring higher returns than Brownfield regulated and contracted infrastructure;
6. Despite viewing infrastructure as characterised by long-term stable contracts and being most attractive once it has been built, **most investors and their**

5. Conclusions and Discussion

managers expect relatively high returns. A majority considers that infrastructure assets should **not** be "expensive" and requires equity returns ranging from the high single digits to the low teens. Asset managers systematically report higher expected returns than asset owners.

7. More than **half of participating asset owners declare investing in emerging markets or wanting to**, and be willing to increase their current allocation. SWFs and pensions plans are the most involved and willing types of investors investing or aiming to invest emerging market infrastructure;
8. The main reported reasons to expand into emerging market infrastructure are **higher returns and country risk diversification**, while the main concerns of investors are public policy reversals and the enforceability of contractual claims.
9. Required returns in emerging markets are higher but otherwise follow the same patterns than in OECD markets. However, the **emerging market premium on returns varies for different types of infrastructure projects**: investments in the contracted and regulated categories command much higher spreads (above the OECD required returns), particularly at the brownfield stage, whereas emerging market merchant risk is perceived to be almost equivalent to OECD merchant risk.

5.1.2 From homogenous to heterogenous beliefs

These results highlight the degree to which investors agree or disagree about what to expect from investing in infrastructure equity or debt.

Infrastructure has long been considered difficult to define as an investment proposition but a consensus view is emerging amongst market participants about the nature of infrastructure business, and what drives risk and performance in such investments. Hence, what qualifies or not as "infrastructure" is now better understood, as the recent debate around the definition of infrastructure investment in the context of the Solvency-II directive has shown.

As a result, investors express views about expected returns which are coherent with the risk matrix proposed in Blanc-Brude et al. (2014) and Blanc-Brude and Hasan (2015) for instance, by which systematic risk in infrastructure investment can in part be broken down according to a simple 3×2 matrix made up of three business models (contracted, merchant and regulated) and two key moments in the lifecycle of infrastructure projects (greenfield and brownfield).

A third dimension of the risk profile of infrastructure investments is country or jurisdiction risk, which is confirmed by the reported returns required by investors for emerging market infrastructure. Interestingly however the 3×2 pattern described above is not changed by the addition of

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emerging market risk: relatively speaking, Greenfield risk is still attracting higher returns than Brownfield and contracted infrastructure but less than projects exposed to merchant risk.

However, the premium reported for taking emerging market risk is driven by considerations that are specific to these jurisdictions: the lower end of the risk spectrum in OECD infrastructure (brownfield contracted and regulated infrastructure) is what attracts the highest relative premium in emerging markets.

This validates the focus on contracts as the determinants of the risk profile of infrastructure investments: the higher risks found in emerging markets spring from – respondents report – the quality of the contracting framework and the ability to enforce contractual claims.

Hence, the more infrastructure investments rely on contracts (when it belongs to the "contracted" business model and in the long-term i.e. at the brownfield stage) the more they attract *relatively* higher risk premia in emerging markets.

While the asset pricing implications make sense, these results are also striking from a public policy perspective: countries that have a bad track record at respecting and enforcing contractual claims pay a significant premium on their privately financed infrastructure; one that – in all likelihood – renders uneconomic many potential private investment projects in these jurisdictions.

Beyond the homogeneity of investors' beliefs in terms of the risk and returns components of infrastructure investments, survey results also highlight the **heterogeneity of views** around these fundamental building blocks. Different types of asset owners tend to report different preferences and views are also highly heterogeneous between individual investors of the same type.

That investors require a range of returns for comparable risk profiles (i.e. within one family of infrastructure investments) is congruent with the notion discussed in Chapter 2 that in incomplete markets, the law of one price does not apply and large bid/ask spreads remain. In this survey, the reported range of expected returns is considerable, with similar risk profiles attracting return requirements ranging from less than five to more than 15 percent.

Finally, the fact that asset managers systematically report higher expected returns than asset owners can also be interpreted as a reflection of the agency issues found between investors (limited partners or LPs) and general partners (GPs) which we discuss at length below.

5.2 Products and Objectives

5.2.1 Key findings

With respect to available investment options and the objectives pursued by asset owners investing in infrastructure, key findings of this survey include:

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1. The immense majority of asset owners are rather **dissatisfied with existing infrastructure investment products**;
2. Fee levels is the first reason for this state of affairs and in second place, is the absence of **well-defined investment objectives of the various infrastructure funds and platforms**;
3. Even **co-investment** alongside managers or banks is considered by almost half of asset owners to be **only a second best option** i.e. they would rather have access to the investment products they need and want.
4. The immense majority of asset owners consider the classic closed-ended **private equity infrastructure fund model** to be "outdated" and "not adding value";
5. The majority of investors also declare that they are either "concerned" or "very concerned" about the accumulation of "dry powder" in numerous infrastructure fund mandates, because it could lead to a **deterioration of investment/underwriting standards**, if not the creation of "Ponzi units";
6. Most respondents concur in saying that infrastructure investment only really makes sense as **a long-term strategy** (beyond ten years), and a majority declares itself willing to **buy and hold infrastructure investments until maturity**. Logically, but perhaps surprisingly, most investors report not being particularly concerned by the absence of liquidity of such investments.
7. Most investors declare **preferring investing in privately-held infrastructure** debt or equity – as opposed to public stocks or bonds – but they are evenly divided between those who **prefer direct investment and those who would rather delegate to a manager**.
8. Overall, the objectives pursued through infrastructure by the majority of investors are linked to **improving diversification and achieving higher performance**. Other objectives that are intuitively associated with infrastructure investing such as **hedging inflation or interest risk are less present** in the series of objectives currently being pursued. However they are amongst the highest ranked objectives that investors **would like to be able to achieve** through infrastructure investing (along with stable cash flows and illiquidity premia).

5.2.2 Market failure?

Combined with the most recent reports on infrastructure fund raising – which is at historic heights – these results reveal something like a quandary: at least half of investors would like to invest through a manager but the immense majority of them complain that existing products are too expensive and not designed to help them achieve their goals. As we report in the next section, more than half of them do not even trust the performance metrics reported by infrastructure asset managers.

The market to provide access to infrastructure investment through investment funds is large and growing, and the number

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of asset managers active in this space is also significant. It can be surprising that competition between general partners (GPs) for the attention of limited partners (LPs) does not lead to a more aggressive levelling of fees or the design of different types of infrastructure funds. In effect, a small number of asset managers do offer longer, less aggressive and less expensive infrastructure funds than the mainstream infrastructure PE funds, but they represent a minority of the total fundraising.

Why do asset owners continue to invest in infrastructure funds that 80 percent of them considers to be "outdated and not adding value"?

When institutions allowing market participants to trade without restriction on prices or volumes are in place and the expected benefits of competition fail to materialise, market mechanism can be considered to be failing. In effect, it can be argued that the market for delegated investment management in the infrastructure sector is at least partly failing to create the kind of products that investors need, let alone at a fair price.

Next, we discuss why a market can be stuck in a suboptimal equilibrium, in which investors only have access to inadequate and expensive products.

Say a market for investment management services is characterised by different types of service providers (in this case, infrastructure asset managers): these managers can be more or less *capable*, that is, more or less able to select and manage infrastructure debt and equity investments **to build a portfolio that has certain characteristics of interest to asset owners**.

The different types of managers can also be distributed more or less evenly: for instance there could be a few capable managers and many less capable ones.

Asset owners who need to choose an infrastructure asset manager are then faced with a simple problem: they do not know which ones are the capable ones and which ones are not. They are said to be facing the problem of **adverse selection**.

Next, say that asset managers also have the option to make a **certain effort** to create the kind of infrastructure investment product that investors would prefer. This effort is **costly** to the manager but it leads to the creation of better products e.g. better defined duration and risk factor exposures. Hence, investors are also faced with a case of **moral hazard**: they need to create incentives to induce asset managers to exert a costly effort to deliver the kind of **products that best utilises the characteristics of infrastructure assets to achieve their investment objectives**.

If the capable managers do make this effort and propose better investment products, investors can choose the products they need and maximise their long-term utility. If the less capable asset managers made the same

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costly effort, they would go out of business and be forced to exit the market.

With perfect information about manager type and what investment products can be created by investing in infrastructure, competition would work as expected: investors would require the products that are best suited to their needs and the capable managers would provide them, and competition in the market would be limited to the capable types.

The difficulty arises from the absence of information (e.g. benchmarking) for asset owners, who do not know exactly what infrastructure investing can do for them and cannot easily discriminate between different types of managers.

Without perfect information however (the asset owners will have no knowledge of the managers' type), capable managers can simply **mimic the less capable ones**, make no costly effort to design better investment products and provide the same "outdated" products like any other providers. What drives up costs in this case is not the absence of competition, but the tendency for all managers to "pool together" and behave like the least capable ones.

The presence of asymmetric information between buyers and sellers affects the functioning of markets and can lead to market failure: either the absence of trade (investors exit the market and decide to internalise infrastructure investment i.e. the so-called Canadian model) or a very suboptimal trade characterised by the pooling of manager types (all managers provide the same products). In this last case, asset owners buy investment products that are not what they need and at a high price given the utility they derive from them, and even the more capable managers tend to offer standardised, relatively inadequate products, while they could achieve a greater market share by offering advanced investment solutions.

Next, we discuss both cases in more details.

5.2.3 The costs of rejecting delegation

Faced with the kind of market failure described above, a first group of participants chooses to exit and address agency issues under asymmetric information by internalising the investment function, in this case by building up internal capability to source and execute infrastructure transactions, manage infrastructure firms throughout their lifecycle and receive the benefits of direct control, asset selection and transaction timing, including – as the majority of survey respondents declared – the option to hold investments to maturity.

Borrowing from the vocabulary of behavioural studies in the retail pension sector, these do-it-yourself investors also tend to be the most "engaged" and sophisticated ones, whereas others, probably smaller investors, for whom infrastructure may be a much newer theme, can be described as "passive". [9]

9 - Still, it is also possible for large direct investors in infrastructure to retreat from the DIY approach and to return to managed infrastructure mandates. The Victoria Fund Management Corporation is one such recent example.

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For engaged investors to be better off following the DIY approach than delegating to a specialist manager, they must be able to deliver results which are at least as good as those products provided by the best managers in the market (net of costs).

The net benefits from choosing direct investing are thus determined by three factors:

1. **Investment costs**: with limited effects of competition between managers on fees, some asset owners have come to the conclusion that internalising infrastructure investment can be worthwhile. Nevertheless, a fully fledged infrastructure team is only available to large investors. Such teams may also encounter their "lifecycle" issues as investors buy infrastructure firms (transaction structuring and execution) and operate them on a buy-to-hold basis (asset [10] management), the required skill-set must change over time. It is also possible that some agency issues that exist between asset owners and managers are simply re-created internally between the strategic asset allocation level and the investment level.
2. **Diversification benefits**: Building a direct portfolio of infrastructure assets is long-term goal in itself. The recent experience of some Australian or Canadian investors suggests that it can take at least ten to 15 years. Even so, the resulting portfolio of 20 to 25 investment is unlikely to be well diversified and may even include very concentrated exposures (i.e. a few very large firms). Of course, the main diversification benefits of infrastructure investment accrue to the portfolio as a whole, as survey responses suggest, but less diversification of the infrastructure portfolio itself can be considered a straight loss. In principle, investors should be able to diversify better by investing across a range of infrastructure funds, themselves exposed to a range infrastructure business models, lifecycle stages and jurisdictions. The extent of the failure of the market for delegated investment in infrastructure is highlighted by this fact: a growing number of large investors prefer forgoing diversification benefits in favour of a more concentrated, internally managed portfolio.
3. **Portfolio construction**: Against these costs (fees and lower diversification) investors expect benefits that are themselves dependent on what portfolio of infrastructure assets each one of them can build. Different investors have different objectives and liability profiles which cannot be answered *ex ante*. Full control over the investment process may allow asset owners to build infrastructure portfolios that are more in line with their objectives. However, if a well-functioning market for investment delegation led to the creation of better-defined investment products using infrastructure debt and equity to target a given set of financial metrics, the potential contribution of such products may outweigh the benefits of control

10 - The infrastructure asset

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on asset selection and infrastructure portfolio construction.

Thus, the net benefits of internalising long-term investment in infrastructure are **not self-evident once the possibility to improve investment products is taken into account**.

These issues hinge around the absence of sufficient information about **what can be achieved** through infrastructure investment and **who can commit** to achieving such goals.

5.2.4 Market solutions: benchmarking and signalling

Why aren't the more capable infrastructure asset managers offering different products than the classic two-and-twenty, closed ended PE fund? In the classic adverse selection model, the more capable type of manager is simply better-off in the short-term mimicking the less capable type, and making no costly effort to deliver better service.

But it can also be the case that the most competent managers would be better off providing more advanced products (they would gain market share) but **cannot effectively articulate and demonstrate** the added-value of they could create by designing different forms of infrastructure investment products.

If information asymmetry is too strong then what might be achievable through new forms of infrastructure investment products may be very challenging to communicate effectively to asset owners, who remain faced with the Scylla of DIY investing and the Charybdis of infrastructure PE funds.

There are however solutions to minimise the effect of information asymmetry in market dynamics. To avoid the *pooling* of managers, market participants can create "sorting devices" (Spence, 1973; Rothschild and Stiglitz, 1992) or "revelation mechanisms" (Laffont and Martimort, 2002) to facilitate the processing of information from uninformed to informed participants. [11]

The more capable asset managers may also try to *signal* their ability to to create better products to asset owners through various devices (e.g. certification schemes).

In economics, this problem is typically modelled as a market with adverse selection and competitive search, where some agents post terms of trade (contractual terms) and others aim to screen the other side of the trade by agent type (see for example Guerrieri et al., 2010). In such models, the informed side of the trade (here the asset manager) can move first and signal to the market what terms they can offer, or the uninformed side can move first and request a bid for a given "menu of contracts".

In other words, either asset owners could request bids in an auction for a limited number of well-defined investment products, or asset managers could choose to highlight the different products that are available through the kind of performance

11 - For example, Hellwig (1987) discusses the role of deductibles in insurance contracts and how the choice of deductible can be used by insurers to infer the probability of accident of a given individual.

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reporting standard, valuation approaches and performance benchmarks that we discuss next.

5.3 Benchmarking

5.3.1 Key findings

On the topic of benchmarking the performance of infrastructure investments, the main findings of the survey are:

1. Investors' current use benchmarks for their infrastructure investments are as likely to be relative or absolute, nominal or real, or relative to a market or a macroeconomic index. There is **no clear market practice**;
2. In fact, the immense majority of investors and managers agree that currently available benchmarks are inadequate and that **proper infrastructure investment benchmarks just do not exist**;
3. Survey respondents confirm that **risk metrics in particular are not documented** and that **valuations** are sufficiently problematic to cast doubt on any measure of returns as well. More than half of asset owners reckon that they either **do not trust** or do not know if they can trust the **valuations reported by the infrastructure asset managers.**

5.3.2 Towards better benchmarks

Roadmap and recent progress

In June 2014, Blanc-Brude (2014) put forward a roadmap for the creation of infrastructure investment benchmarks. This roadmap integrates the question of data collection upfront, including the requirement to collect information known to exist in a reasonably standardised format and limited to what is necessary to implement robust asset pricing and risk models. It puts forward the following steps:

1. Defining the relevant instruments
2. Developing a relevant asset pricing framework
3. Defining the necessary data
4. Building a global database of cash flows and investment characteristics
5. Building reference portfolios of infrastructure equity and debt

The implementation of this roadmap is described in details in Blanc-Brude (2014) and recent progress in Blanc-Brude et al. (2015).

Defining infrastructure investments from a financial perspective —the only relevant perspective to build investment benchmarks —is a necessary first step. As the results of this survey and the recently proposed definition put forward by European regulator of pension plans and insurance companies [REF] suggest, defining infrastructure investment from an investment perspective has progressed considerably. The growing consensus reflected in this survey around the limited role of industrial sector categories in explaining and predicting performance, and the much more significant role played by contracts and by different infrastructure "business models" such as "merchant"

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or "contracted" infrastructure, or various forms of utility regulation, is encouraging.

Once the financial instruments that correspond to infrastructure investment are usefully defined, the second necessary step is to design a performance and risk measurement framework that can provide robust answers to the questions identified above. Again, our survey responses confirm the urgent need to improve the current methodologies to evaluate private assets given the increasingly important they play in investors' portfolios.

Privately-held, infrastructure equity and debt instruments are not traded frequently and cannot be expected to be fully "spanned" by a combination of public securities. Hence, they are unlikely to have unique prices that all investors concur with at one point in time.

A two-step approach to measuring performance is therefore necessary:

1. Documenting cash flow distributions (debt service and dividends) to address the fundamental problem of unreliable or insufficiently reported NAVs or losses given default (LGDs);
2. Estimating the relevant (term structure of) discount rates, or required rates of returns, and their evolution in time.

Here too, progress has been made and recent research provides a framework addressing both steps, taking into account the availability of data, while applying best-in-class models of financial performance measurement (see for example Blanc-Brude et al., 2014; Blanc-Brude and Hasan, 2015, for applications to the private debt and equity case).

Based on this new asset pricing and risk measurement technology, a list of data items required to implement adequate methodologies can be drawn that can be used to collect data and populate the necessary database but also to determine a minimal reporting framework for investors to require from infrastructure managers. These data collection requirements are described in Blanc-Brude et al. (2015).

The active collection of the necessary data and publication of the relevant investment benchmarks has begun to be implemented with the creation of the EDHEC Infrastructure Institute in Singapore in February 2016 and is planned to take place incrementally until 2020 and beyond.

Benchmarking as signalling

In this survey and in others before, asset owners highlight high fees, insufficient performance reporting and inadequate valuation methods as some of the main issues found in delegated private investment.

In recent years, however, asset owners have begun to question the level of investment fees and to achieve substantial reductions in the overall level of investment management fees, through self-organisation as well as with the help of the regulator .

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As we argued above, high fees are only the result of the information asymmetry that exists between asset owners and managers. The crux of the matter hinges around reported valuations. The valuation of private assets is the primary source of information asymmetry between managers and asset owners. Hence, with the argument to lower fees gradually being won by LPs, **the next big issue to open for review is asset valuation**.

Private asset valuation has long suffered from numerous flaws, in particular the classic stale pricing problem and the corollary smoothing of asset returns (see Blanc-Brude and Hasan, 2015, for a review of the literature on the subject applied to infrastructure). As we suggested above, a number of technical improvements are possible that allow better measurements of risk-adjusted performance in private infrastructure investments. In due course, further development in applied academic research will allow for even more robust and advanced methods to be implemented.

The matter of reporting adequate performance data and applying state-of-the-art valuation methodologies is also relevant to the "sorting mechanisms" or "signalling" that we discussed above when suggesting solutions to the market failures found in delegated investment management. When information asymmetries are so significant that asset owners cannot know which managers are the capable or the less capable ones, they could require managers to adopt a certain reporting framework and to implement advanced valuation methods to make the more competent managers "reveal their type". Likewise, individual managers could offer to adopt an equivalent reporting and valuation framework to make asset owners aware of their type.

Once, the more capable managers have agreed to reveal their type or have been identified by asset owners, it becomes possible for the latter to require that they exert the kind of effort that should lead to the creation of better investment products. Note that revealing their types for the better managers is not free and that – in the standard solution to the principal agent problem with adverse selection and moral hazard – the incentive compatible contract between the client and the service provider requires that a premium be paid to the agent of the desirable type. However, the net (after fee) benefits to asset owners should now be much higher (if not, then internalisation – the DIY option – remains the preferred route).

Beyond type revelation or discovery, the last missing element in the relationship between principal and agent is for asset owners to actually **know what to ask the better managers to do for them** through infrastructure investment.

Infrastructure investment benchmarks are at the heart of this issue: with fully fledged benchmarks, **what is achievable** for investors through infrastructure investment can be known (e.g. what combination of factor exposures infrastructure investment

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can create) and only then can asset owners request their managers to build infrastructure portfolios for them that are fully integrated into a long-term investment solution for them.

In effect, private infrastructure investment benchmarks can improve most issues of information asymmetry between investors and managers since they can be used both to determine what investors should require and to signal what managers can or cannot deliver.

5.4 ESG

5.4.1 Key findings

Regarding the environmental, social and governance impact of infrastructure investment, asset owners responses suggest that:

1. Investors acknowledge the relevance of ESG considerations but a majority considers ESG to be a second order problem i.e. one that does not trump first order questions like strategic asset allocation;
2. Nevertheless, 17 percent of owners consider ESG to be a first order question;
3. Most respondents also expect ESG to be positively related to investment returns.

5.4.2 Does ESG mean more or less risk?

Institutional investors all have well-defined mandates to, for example, ensure the delivery of pension benefits, the solvency of insurance schemes or the preservation of national wealth. Respecting these different mandates means achieving a series of nominal or real wealth objectives at certain horizons and preserving the funding level (liabilities vs. assets) of each institution at each point in time. In other words, it means focusing on risk-adjusted financial performance, which is, in turn, the result of strategic asset allocation decisions.

This is every asset owner's first order problem.

To the extent that investors also want to avoid investing in certain types of infrastructure projects (e.g. coal-fired power plants) or ensure that the social consequences of new projects (e.g. hydro-electric dams) are limited and well managed, the considerations must nevertheless remain subordinated to achieving long-term financial objectives.

It does not mean that investors "do not care" about investing in less sustainable businesses or projects. But simply that they have to meet certain objectives first, and that ESG investing would be self-defeating if it undermined their ability to achieve these goals. In fact, being able to pay the pensions and life insurance policies of millions of individuals is nothing short of a very worthy social goal.

Still, in this survey, 17 percent of asset owners consider that ESG *is* nevertheless a first order problem. Moreover, it is likely that this number has been increasing and that

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even more investors would give this answer in a future iteration of this survey.

ESG investing can be modelled as a form of "guilt aversion" – a notion developed in behavioural economics – by which investors could be willing to forgo some level of performance or future income to avoid investing in certain types assets. In this case, there is a mostly negative trade-off with performance and ensuring a minimal threshold of ESG-quality in new investments can also be understood as a form of risk management: new infrastructure projects that are less likely to create environmental or social issues may also be less likely to experience regulatory or policy shocks in the future. If this is the case then, higher ESG criteria should be synonymous with *lower* expected returns.

Still, the majority of respondents believe that there is a positive link between returns and ESG quality, implying higher risk taking in such projects. For instance, investing in renewable energy and reducing carbon emissions qualifies as having a positive environmental impact but also rests on publicly-sponsored tariff subsidy schemes that are prone to change over the decades that each wind or solar farm investment is supposed to last. Recent evidence of changes in wind farms feed-in-tariff, sometimes retro-actively, is plentiful in European markets for instance.

Another aspect of ESG in the context of infrastructure investments is job creation. While this can be considered a positive in regards to the social and political acceptance of private infrastructure investment (the so-called "social licence to operate" of the private sector), committing to employing a certain workforce may create long-term issues regarding operational efficiency given the impact of technological change over several decades. The impact of containerisation in the port sector is a good example or a sector that had to let go most of its workforce over a couple of decades.

If investors expect higher returns from ESG compliant investments, it may be interpreted as an increase in risk aversion vis-a-vis an economic future which changing environmental and social issues make increasingly uncertain or, perhaps more simply, the recent drive towards ESG could be seen as part of a broader increase in investor risk appetite in a low yield environment.

References

References

- Amenc, N., F. Goltz, A. Lodh, and L. Martellini (2014). Towards smart equity factor indices: Harvesting risk premia without taking unrewarded risks. *Journal of Portfolio Management 40*(4).
- Ang, A. and J. Liu (2004, December). How to Discount Cashflows with Time-Varying Expected Returns. *The journal of finance 59*(6), 2745–2783.
- Ben-Horim, M. and N. Sivakumar (1988, December). Evaluating capital investment projects. *Managerial and Decision Economics 9*(4), 263–268.
- Blanc-Brude, F. (2013). Towards efficient benchmarks for infrastructure equity investments. *EDHEC-Risk Institute Publications*, 88.
- Blanc-Brude, F. (2014, June). Benchmarking Long-Term Investment in Infrastructure. *EDHEC-Risk Institute Position Paper*.
- Blanc-Brude, F., R. Delacroce, M. Hasan, C. Mandri-Perrot, J. Schwartz, and T. Whittaker (2015). Data collection for infrastructure investment benchmarking: objectives, reality check and reporting framework. *EDHEC Business School Working Paper*.
- Blanc-Brude, F. and M. Hasan (2015). The valuation of privately-held infrastructure equity investments. *EDHEC-Risk Institute Publications January*.
- Blanc-Brude, F., M. Hasan, and O. R. H. Ismail (2014). Unlisted Infrastructure Debt Valuation & Performance Measurement. *EDHEC-Risk Institute Publications July*.
- Blanc-Brude, F., S. Wilde, and T. Whittaker (2015). The performance of listed infrastructure equity: a mean-variance spanning approach. *EDHEC Business School Working Paper*.
- Brealey, R. A. and S. C. Myers (2014). *Principles of Corporate Finance* (eleventh ed.). McGraw Hill.
- Fabozzi, F. J. and H. Markowitz (2011). *The Theory and Practice of Investment Management* (2nd ed.). Hoboken, New Jersey: John Wiley & Sons.
- Guerrieri, V., R. Shimer, and R. Wright (2010). Adverse selection in competitive search equilibrium. *Econometrica 78*(6), 1823–1862.
- Haley, C. W. (1984). Valuation and risk-adjusted discount rates. *Journal of Business Finance & Accounting 11*(3), 347–353.
- Hellwig, M. (1987). Some recent developments in the theory of competition in markets with adverse selection. *European Economic Review 31*(1), 319–325.

References

- Jenkinson, T., M. Sousa, and R. Stucke (2013). How Fair are the Valuations of Private Equity Funds? *SSRN Electronic Journal*.
- Kaplan, S. N. and R. S. Ruback (1995). The valuation of cash flow forecasts: An empirical analysis. *The Journal of Finance 50*, 1059–1093.
- Kaplan, S. N. and A. Schoar (2005). Private Equity Performance: Returns, Persistence, and Capital Flows. *The Journal of Finance 60*(4), 1791–1823.
- Laffont, J. J. and D. Martimort (2002). *The Theory of Incentives: The Principal Agent Model*. Princeton University Press.
- Ljungqvist, A. and M. Richardson (2003). The cash flow, return and risk characteristics of private equity. *Working Paper*, 1–43.
- Martellini, L. and V. Milhau (2015). Factor investing: A welfare-improving new investment paradigm or yet another marketing fad. *EDHEC-Risk Institute Publication*.
- Moody's (2015). Default and recovery rates for project finance bank loans, 1983-2014. Technical report, Moody's Investors Service.
- Newell, G., H. Peng, and A. De Francesco (2011). The Performance of Unlisted Infrastructure in Investment Portfolios. *Journal of Property Research 28*(1), 59–74.
- OECD (2014). Annual survey of large pension funds and public pension reserve funds. Technical report, Organisation for Economic Co-operation and Development, Paris, France.
- Peng, H. and G. Newell (2007). The significance of infrastructure in Australian investment portfolios. *Pacific Rim Property Research Journal 13*(4), 423–450.
- Phalippou, L. (2008). The hazards of using IRR to measure performance: the case of private equity. *Available at SSRN 1111796*.
- Phalippou, L. (2013). Yale's Endowment Returns: Case Study in GIPS Interpretation Difficulties. *The Journal of Alternative Investments 15*(4), 97–103.
- Phalippou, L. and O. Gottschalg (2009). The performance of private equity funds. *Review of Financial Studies 22*(4), 1747–1776.
- Phalippou, L. and M. Zollo (2005). What drives private equity fund performance. *Unpublished working paper*.
- Rothschild, M. and J. Stiglitz (1992). *Equilibrium in competitive insurance markets: An essay on the economics of imperfect information*. Springer.

References

- Spence, M. (1973). Job market signaling. *The quarterly journal of Economics 87*(3), 355–374.

About Global Infrastructure Hub

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In November 2014, G20 Leaders agreed 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, 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 the EDHEC Infrastructure Institute-Singapore

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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.

A Profound Knowledge Gap

Institutional investors have set their sights on private investment in infrastructure equity and debt as a potential avenue towards 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 monitoring 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 amongst 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 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 investors with valuable insights about their strategic asset allocation choices to infrastructure, as well as 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 EDHECinfra 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 EDHECinfra'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

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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 investors' investment decisions.

Partners of EDHEC*infra*

Monetary Authority of Singapore

In October 2015, the 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:

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 organisation have already recognised the value of this project and have joined or are committed to joining the data collection effort. They include:

- 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 :

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

Origins and Recent Achievements

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.

Significant **empirical findings** already include:

- The first empirical estimates of construction risk for equity and debt investors in infrastructure project finance;
- The only empirical tests of the statistical determinants of credit spreads in infrastructure debt since 2008, allowing controlling for the impact of market liquidity and isolating underlying risk factors;
- The first empirical evidence of the diversification benefits of investing in greenfield and brownfield assets, driven by the dynamic risk and correlation profile of infrastructure investments over their lifecycle;
- The first empirical documentation of the relationship between debt service cover ratios, distance to default and expected default frequencies;
- The first measures of the impact of embedded options in senior infrastructure debt on expected recovery, extreme risk and duration measures;
- The first empirically documented study of cash flow volatility and correlations in underlying infrastructure investment using a large sample of collected data covering the past fifteen years.

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Key **methodological advances** include:

- A series of Bayesian approaches to modelling cash flows in long-term investment projects including predicting the trajectory of key cash flow ratios in a mean/variance plane;
- The first fully-fledged structural credit risk model of infrastructure project finance debt;
- A robust framework to extract the term structure of expected returns (discount rates) in private infrastructure investments using conditional volatility and initial investment values to filter implied required returns and their range at one point in time across heterogeneous investors.

Recent **contributions to the regulatory debate** include:

- A parsimonious data collection template to develop a global database of infrastructure project cash flows;
- Empirical contributions to better calibrate prudential regulation for long-term investors.

Infrastructure Research Publications at EDHEC

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EDHEC Publications

- Blanc-Brude, F., T. Whittaker and M. Hasan. Cash Flow Dynamics of Private Infrastructure Debt (March 2016).
- Blanc-Brude, F., T. Whittaker and M. Hasan. Revenues and Dividend Payouts in Privately-Held Infrastructure Investments (March 2016).
- Blanc-Brude, F., and M. Hasan. The Valuation of Privately-Held Infrastructure Equity Investments (January 2015).
- Blanc-Brude, F., M. Hasan and O.R.H. Ismail. Performance and Valuation of Private Infrastructure Debt (July 2014).
- Blanc-Brude, F., Benchmarking Long-Term Investment in Infrastructure (June 2014).
- Blanc-Brude, F., and D. Makovsek. How Much Construction Risk do Sponsors take in Project Finance. (August 2014).
- Blanc-Brude, F. and O.R.H. Ismail. Who is afraid of construction risk? (March 2013)
- Blanc-Brude, F. Towards efficient benchmarks for infrastructure equity investments (January 2013).
- Blanc-Brude, F. Pension fund investment in social infrastructure (February 2012).

Books

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

Peer-Reviewed Publications

- F. Blanc-Brude, S. Wilde, and T. Witthaker, "Looking for an infrastructure asset class Definition and mean-variance spanning of listed infrastructure equity proxies", 2016 (*forthcoming*)
- Blanc-Brude, F., M. Hasan, and T. Witthaker, "Benchmarking Infrastructure Project Finance - Objectives, Roadmap and Recent Progress", Journal of Alternative Investments, 2016 (*forthcoming*)
- R. Bianchi, M. Drew, E. Roca and T. Whittaker, "Risk factors in Australian bond returns", Accounting & Finance, 2015

Infrastructure Research Publications at EDHEC

- Blanc-Brude, F. "Long-term investment in infrastructure and the demand for benchmarks," JASSA The Finsia Journal of Applied Finance, vol. 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, vol. 141, no. 1st Quarter, pp. 149–180, 2013.
- Blanc-Brude, F. , H. Goldsmith, and T. Valila, "A comparison of construction contract prices for tradition- ally procured roads and public–private partnerships," Review of Industrial Organization, vol. 35, no. 1-2, pp. 19–40, 2009, ISSN: 0889-938X. DOI: 10.1007/s11151-009-9224-1.
- Blanc-Brude, F. , H. Goldsmith, and T. Valila, "Public-private partnerships in europe: an update," EIB Economic & Financial Reports, p. 24, 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, vol. 19, no. 4, pp. 94–106, 2007.
- Blanc-Brude, F. , H. Goldsmith, and T. Valila, "Ex ante construction costs in the european road sector: a comparison of public-private partnerships and traditional public procurement," EIB Economic & Financial Reports, vol. 2006/1, 2006.
- O. Jensen and F. Blanc-Brude, "The handshake: why do governments and firms sign private sector participation deals? evidence from the water and sanitation sector in developing countries," World Bank Working Papers, Wold Bank Working Paper Series, no. October 2005, p. 25, 2006.

For more information, please contact:
Karen Sequeira on +65 6438 0030
or e-mail: karen.sequeira@edhec.edu

EDHEC Infrastructure Institute-Singapore
EDHEC Business School Asia-Pacific
One George Street - #07-02
Singapore 049145
Tel.: +65 6438 0030

edhec.infrastructure.institute