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Investor Perceptions of Infrastructure, 2017

From investment plans to price discovery

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About the Authors



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

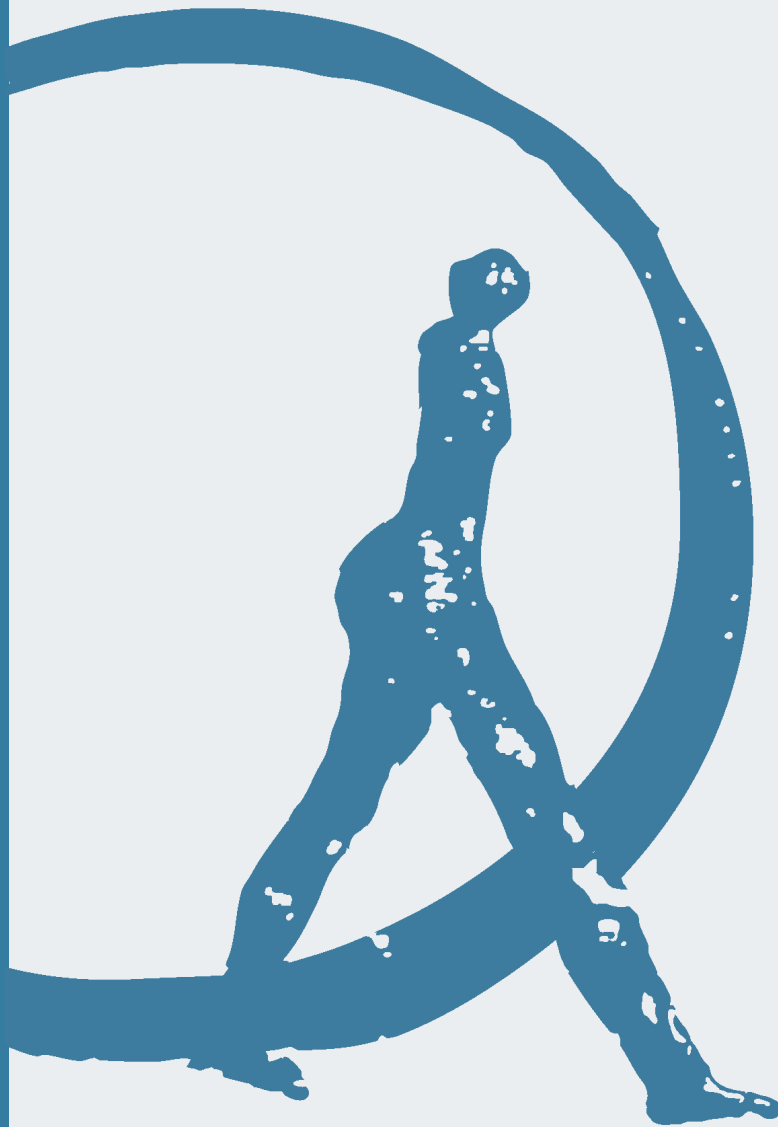


Tim Whittaker is an Associate Research Director at the EDHEC Infrastructure Institute and Head of Data Collection. He holds a Master of Business (Financial Management) and a PhD in Finance from Griffith University.



Jing-Li Yim is a Senior Corporate Analyst at EDHEC Infrastructure Institute. She has prior experience in a major accounting firm analysing financial statements of electronics and technology companies. She holds a Bachelor of Commerce (Accounting and Finance) from the University of Queensland and is an associate member of CPA Australia.

Executive Summary



Executive Summary

This paper presents the results of the 2017 EDHEC/GIH survey on investor perceptions of infrastructure, revealing infrastructure investors' medium-term investment intentions, views on market developments, and the efficacy of national infrastructure plans. It also introduces the findings of a new approach to determining the required returns on infrastructure investments required by investors.

The survey provides an annual insight into investors' perceptions of infrastructure, capturing the changes in their views of the market, expectations of returns, and determining which government/ private initiatives or services are useful to them, or not. It builds on the 2016 instalment and where relevant, provides a comparison to the findings from last year.

Our survey questions were sent to 500 infrastructure investment practitioners identified by EDHEC*infra*, termed the *infra500*. These individuals have had numerous years of involvement in infrastructure investment decisions. Those working in a strategy or investment function, such as in CIO or Head of Infrastructure positions, made up almost 60% of respondents. 23% worked in a top executive function and the remaining in advisory roles.

This paper reports the views of 186 of these individuals. More than half of the respondents represent asset managers and asset owners (insurers, pension plans, sovereign wealth funds). The remaining

38% represent commercial and international banks, consultancies, government agencies and rating agencies. Respondents from asset managers make up the largest group (36%).

The asset owners that participated in this survey have combined assets under management of approximately USD 7 trillion, representing 10% of the global total. They represent some of the largest investors in the world and have allocations to infrastructure that are higher than the norm. Thus, the views taken in this survey on investment intentions, represent that of more active and sophisticated investors.

Survey highlights

- 90.3% of asset owners intend to increase their investment in infrastructure in the next 3-5 years;
- While the majority still do not plan on investing in emerging-market infrastructure, 81.8% of those already investing in emerging markets intend to increase their investment.
- Most respondents believe that the US is the next big infrastructure market, followed by Latin America.
- There is strong consensus that infrastructure investment will eventually be accessible through individual pension accounts or life insurance products.
- Respondents are more well aware of national infrastructure plans in the OECD compared to emerging markets. However those who are well-versed in the plans

Executive Summary

are more positive about the potential of plans in emerging markets to improve the attractiveness of infrastructure in the country.

- The majority of respondents who have taken part in projects supported by project preparation facilities created by MDBs agree that the assistance is of value.
- Respondents believe there is value in benchmarking operational performance. The reporting of traffic/demand data was identified as potentially the most useful, followed closely by construction-risk metrics and operational efficiency;
- When it comes to benchmarking financial performance, respondents identified time-weighted returns and risk-adjusted returns as the most important.¹
- The lower and upper bounds on the required return on equity for infrastructure investment in OECD markets are 10% and 12%, respectively. These results are on par with the broad market EDHEC*infra* equity index;
- The mean emerging-market private infrastructure equity premium is between 6% and 7%;
- The mean equity bid-ask spread is about 200bps in OECD infrastructure markets, whereas in emerging markets it reaches 270bps;
- Among all the variables we tested (geographic region, project life cycle, business model, investor type), regulated emerging-market infrastructure produced the widest range of mean required equity IRR, with 5.2% between the lower and upper bounds² of mean

required IRR.

- For "core" and "core plus" infrastructure PE Funds in the OECD - the most common type of private infrastructure investment vehicle - asset managers (the GPs) declare requiring 12% but asset owners require 13%;
- Only a third of respondents find terminology inherited from the real estate sector such as "core" and "core plus" confusing or unhelpful when used to refer to different infrastructure investment profiles.
- For a long-term infrastructure equity fund, investing in greenfield and brown-field infrastructure with no additional leverage: Asset owners declare requiring 12% returns and asset managers between 9.6% and 12.9%;
- For a private project-debt coinvestment platform: Investors require fixed-rate returns in the 4.2-5% range.
- Only 10% of respondents find issues with the approach taken by credit rating agencies to rate infrastructure project finance debt.

Greater expectations for national infrastructure plans in emerging markets

1. Respondents are more well-versed in the national infrastructure plans of OECD countries;
2. The Juncker/EU Infrastructure Investment Plan (2015-17) and the UK's National Infrastructure Delivery Plan (2016-21) are the national infras-

1 - The EDHEC*infra* infrastructure benchmarks fill this particular "data gap" and are currently freely available online at edhec.infrastructure.institute.

2 - The lower bound represents the mean IRR below which investors would not agree to invest, and the upper bound represents the mean IRR above which investors would agree to invest

Executive Summary

structure plans respondents are most well aware of in the OECD - 35% and 22% of respondents, respectively, considered themselves to know these plans very well;

3. Respondents were not as well aware of national infrastructure plans in emerging markets; Saudi Arabia's National Transformation Program (2020) and India's Twelfth Five-Year Plan (2012-17) were the plans known in the greatest level of detail; only 15% and 9% of respondents, respectively, know these plans very well;
4. However, respondents were more positive about the impact of the emerging-market plans compared to the OECD plans. The average proportion of respondents who believe that the plan improves the attractiveness of infrastructure in the country was roughly 49% for the emerging-market plans, and 42% for the OECD plans;
5. The plans believed to bring about the most improvement to attractiveness of the country's infrastructure were Saudi Arabia's National Transformation Program (2020) for emerging markets, and Chile's Agenda De Concesiones (2014-20) for the OECD.

No greenfield premium demanded for private infrastructure equity investments

1. We used the method of contingent valuation which is often used to estimate the willingness to pay or willingness to accept a certain price or situation in non-market goods. With private infrastructure, investments are largely illiquid and investor preferences are seldom revealed in market transactions. Thus, asking investors to state their preferences can be a valid approach to understanding the formation of prices for infrastructure assets.
2. Questions were tailored to the respondent's self-identified infrastructure expertise (debt/ equity, OECD/ emerging-market, assets/ products). Projects/ products were described to respondents and they were able to indicate their willingness to invest for a set range of IRRs.
3. Of the traditional views on risk/ return trade-off in infrastructure investing surrounding geographical region, business model, and project life cycle, the views on geographical region and business model were confirmed by the results i.e. investments in private infrastructure in emerging markets invited a higher equity premium compared to investments in OECD markets (between 6% and 7%), and investors demand a premium to invest in merchant infrastructure (about 150 bps for both emerging market and OECD);
4. However, we did not find that investors required a premium for greenfield projects, over brownfield;
5. Questions juxtaposing greenfield and brownfield investments in a single question would naturally yield a different required return for each project life cycle, as the question framing implies that the two investments must be different.

Executive Summary

- However when such question framing is removed, as done in this year's survey, respondents no longer report a required premium for greenfield investments;
6. Firstly, construction risks while a significant consideration to investors, may not necessarily demand risk premia. For instance, equity investors in project-finance transactions are mostly protected from construction risk by a fixed price, date-certain construction contract, and cost overruns at the project company level have been shown to be close to zero on average;
 7. Next, the size of construction risks and any related premium, may not be larger than risk premia associated with risks in the post-construction phase of infrastructure projects (e.g. traffic risk or regulatory changes);
 8. Finally, construction risks are almost entirely idiosyncratic.
3. Respondents required the highest mean IRR for the hybrid infrastructure fund;
 4. A lower mean IRR was required by investors for the long-term infrastructure equity fund compared to the traditional infrastructure private equity fund;
 5. Additionally, for the long-term infrastructure equity fund, the required returns for asset managers were found to be significantly different from that of asset owners, likewise between asset managers and banks;
 6. Asset managers consider that investors in long-term infrastructure equity funds should be happy to receive returns between 9.6% and 12.9%, whereas asset owners express narrower expectations of 12%;
 7. The wider price bounds for asset managers could be due to expected fee levels, on top of differences in risk preferences.
 8. For the traditional infrastructure equity fund and the coinvestment infrastructure debt platform, mean required returns were not found to be significantly different between the different investor types.

Divergence in mean required returns between asset owners and asset managers for investment products

1. The contingent valuation method was also used to determine investors' required returns for infrastructure investment products;
2. We asked respondents about 4 products: a traditional infrastructure equity fund, a long-term infrastructure equity fund, a coinvestment infrastructure debt platform, and an index-tracking hybrid infrastructure fund.

1. Introduction



1. Introduction

In this paper, we report the answers of 186 asset owners and managers, lenders, and consultants who responded to the 2017 EDHEC/GIH Investor Survey, a set of questions about the dynamics of the private infrastructure investment market and the required level of returns in infrastructure investment.

This second iteration of the EDHEC/GIH survey focused on a target group we call the *infra500*, individuals who play a significant role in infrastructure investment at organisations ranging from large asset owners, asset managers, commercial and international banks, rating agencies, and major consultancies.

Their pooled knowledge of prevalent investment beliefs in the private infrastructure sector can give us a unique perspective on an otherwise opaque and very illiquid market segment. Hence, while too few infrastructure transactions are observable to create time series of market prices, the *infra500* can be a powerful proxy of this market.

In this survey, this is exactly what we attempt: reformulating the classic "willingness-to-pay" contingent valuation techniques used to evaluate goods that never or cannot trade, we derive a "willingness-to-invest" survey methodology, by which we ask our respondents to agree or disagree with a series of bid prices (returns) corresponding to hypothetical but also quite familiar investment scenarios.

The rationale behind this methodology is that if you have ever bought a USD500mn combined-cycle gas turbine power generator in an OECD country with a 15-year power purchase agreement using 75% senior leverage, you probably have some idea of what equity returns are reasonable, too low, or too good to be true in similar transactions.

While survey respondents may not know the exact return they would require based on reading a short synopsis of an investment, they should have a good sense of where *good deal bounds* on value should lie.

More formally, private markets like the one for infrastructure equity stakes are typically *incomplete* markets where large bid-ask spreads can survive for a long time (infrastructure projects cannot be shorted!).

In incomplete markets, investor preferences have a direct influence on transaction prices (i.e., the law of one price does not apply). Hence, not all respondents have the same view on what the reasonable bounds on investment returns should be.

The methodology we implement in this survey allows estimating an average bid-ask spread and comparing it across project types and investor types.

To our knowledge, this is the first time that this kind of experimental research has been implemented in the private infrastructure investment space.

1. Introduction

The results are very promising, and we look forward to implementing this approach again in the 2018 survey.

This survey was also an opportunity to ask what investors thought of the various national infrastructure plans that have been announced around the world and whether they were perceived as addressing the procurement bottlenecks that prevent private infrastructure markets from growing faster, including in emerging markets.

As we do each year, we also asked infrastructure investors about their allocation and investment intentions in markets around the world and what they think about intermediation and, following the release of the EDHEC*infra* benchmarks, what data gaps remain to support the growth of private infrastructure investment.

The rest of this survey is organised thus: Section 2 presents the respondents to the survey by size, category, geographic origin, and self-declared area of expertise.

We then present the survey responses in two distinct parts.

In section 3, we review the responses to questions relative to the evolution of the infrastructure investment sector, including the role of national infrastructure plans in swaying investors toward infrastructure.

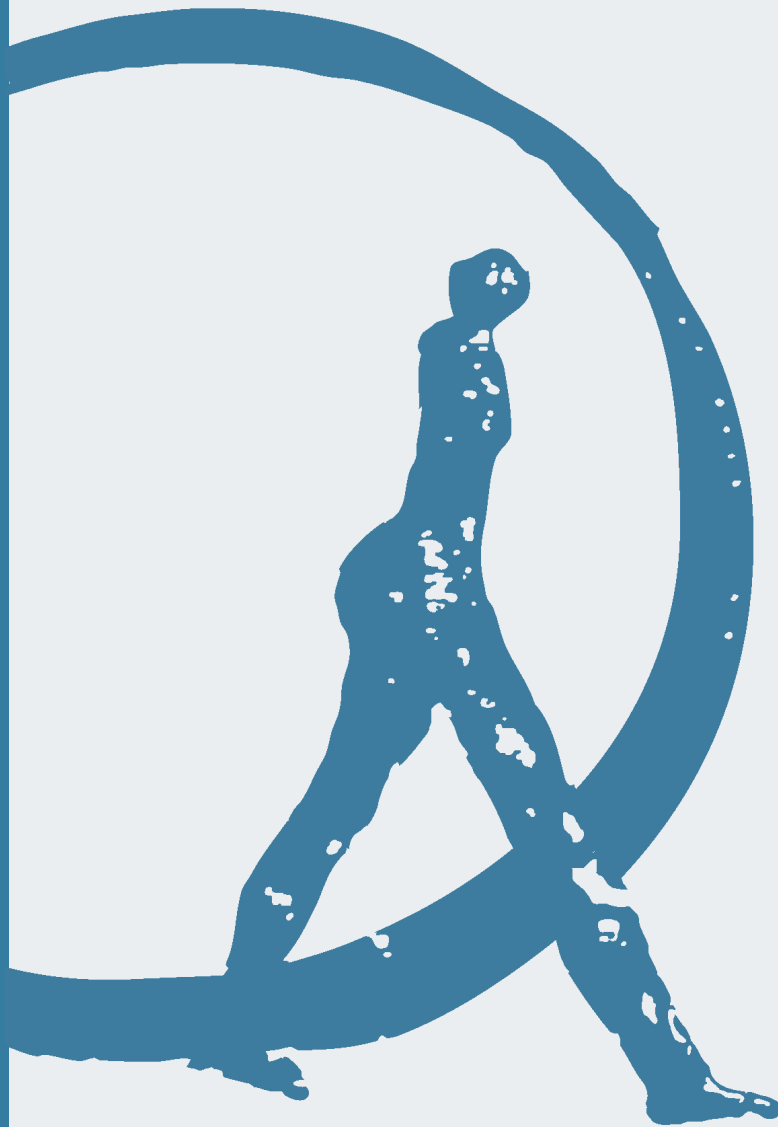
In a second part, we discuss respondents' views on required returns in infrastructure investment, including the level of returns

required by investors to engage in certain types of projects and the bid-ask spread (or price bounds) found in different types of transactions.

Section 4 describes the methodology used to design the questions and analyse the responses, and section 5 presents and discusses our findings.

Section 6 briefly summarises our findings and concludes.

2. Survey Respondents



2. Survey Respondents

Survey questions were sent to the *infra500* group: 500 infrastructure investment practitioners identified by EDHEC*infra*, including CIOs; investment directors; heads of infrastructure; or sector specialists working for asset owners and managers, banks, government organisations, key consultancies, and rating agencies.³

We received a total of 186 qualifying responses. Asset owners in the sample represent USD 7 trillion of assets under management, or 10% of the global total (Della Croce and Yermo, 2013).

2.1 Respondent Types

In this section, we describe respondents by type and size of organisation as well as by location of the organisation's headquarters.

2.1.1 All Respondents

The 186 respondents can be split into four categories: The two largest categories are "asset managers" (comprising infrastructure fund managers and asset management firms) and "asset owners." Responses from banks have been classified under a third category, "commercial and international banks," which includes investment and development banks engaged in project financing. The final category, "other," includes consultancies, government agencies, and rating agencies.

Figure 1 and figure 2 show the number and proportion of respondents by type of organisation. About 36% (67 individuals) represent asset managers, 26% (48

represent asset owners, 18% (34) represent commercial and international banks, and the remaining 20% (37) correspond to the "other" category described above.

In figure 3 and figure 4, respondents are classified, by the location of their organisation's headquarters, into three regions. The Americas include North America, Canada, Mexico, and South America. Asia-Pacific includes East Asia, India, Southeast Asia, and Australia. EMEA includes Europe, the Middle East, and Africa.

About 51% (95) of respondents are categorised under EMEA, 26% (48) fall under the Americas, and 23% (43) are classified under Asia-Pacific.

2.1.2 Asset Owners

First, we look at asset owners by organisation type. Insurance firms and pension plans make up the majority of our asset-owner population (75%). There is also a small proportion of respondents who are sovereign wealth funds. Under "other," we have included other direct owners of power and transport assets, such as project sponsors.

Figure 6 shows the distribution of asset owners represented in this survey by size, that is, assets under management (AUM).

In total, asset owners who responded to this survey represent USD 7 trillion in AUM.

Asset-owner respondents are large investors. More than half have AUM

³ - A pilot survey was also done with 8 of EDHEC*infra*'s Advisory Board Members.

2. Survey Respondents

Figure 1: Number of survey respondents by organisation type

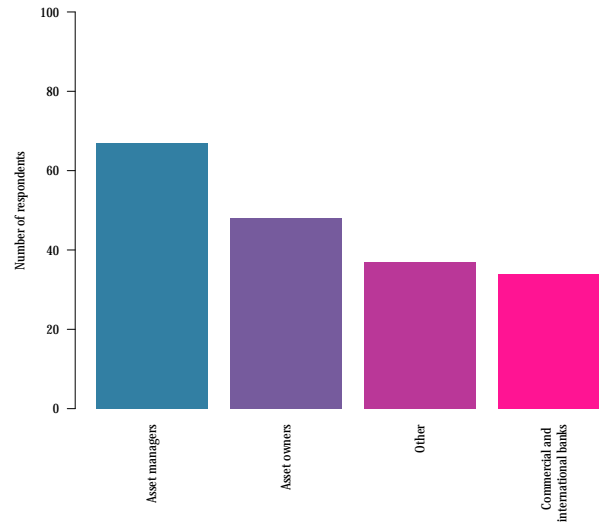
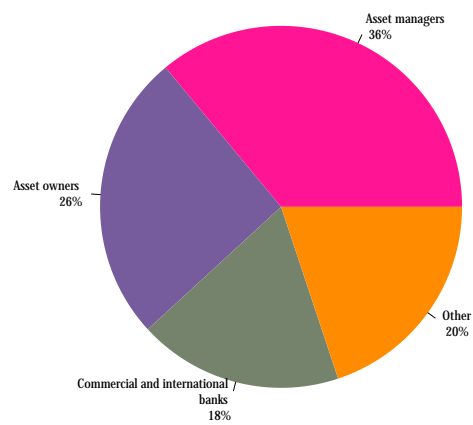


Figure 2: Proportion of survey respondents by organisation type



2. Survey Respondents

Figure 3: Number of survey respondents by region

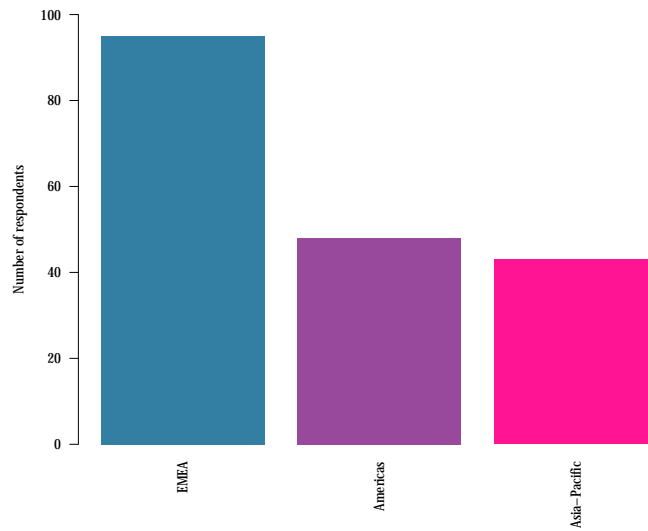
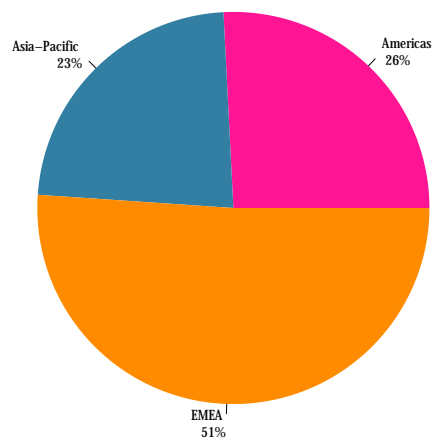


Figure 4: Proportion of survey respondents by region



2. Survey Respondents

Figure 5: Proportion of asset owners by organisation type

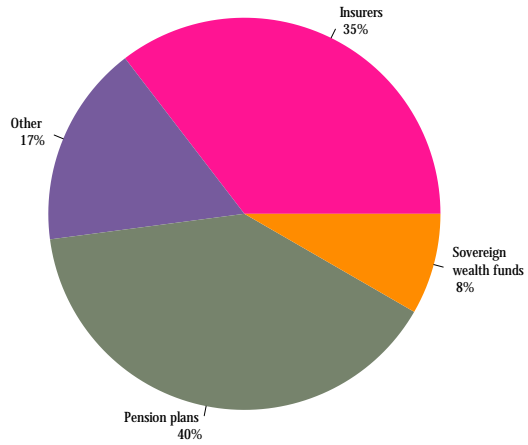
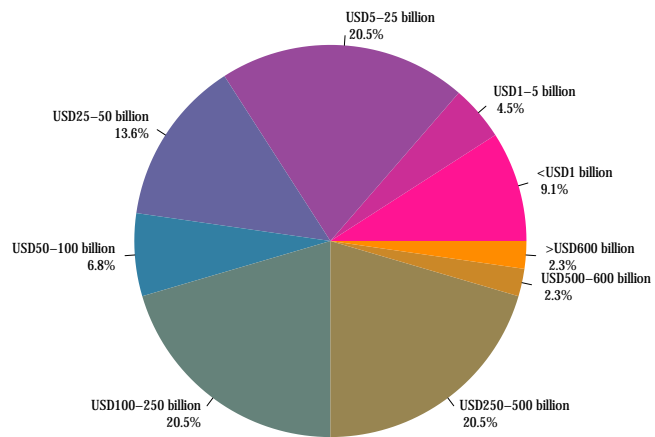


Figure 6: Proportion of participating asset owners by assets under management (AUM)



2. Survey Respondents

above USD 50bn. The largest group lies in the USD 250-500bn bracket, followed by those in the USD 5-25bn bracket and the USD 100-250bn bracket.

Asset owners from EMEA⁴ make up the majority of respondents who declared AUM above USD 250bn. These are mainly in the insurance, pension fund, and sovereign wealth fund categories.

Next, figure 7 reports asset owners' allocation to infrastructure as a percentage of AUM. The mean allocation was 6.03%. The majority of the asset owners report an allocation between 5-10% of AUM, which is high by global standards.

2.2 Respondent Positions

Now we look at the different positions of respondents. Those in a strategic function (CIO, Head of Investments, Head of Finance, CRO) make up the biggest proportion of respondents at 37%. Those at the top executive level (CEO, CFO, MD, Executive director) represent 23%. Those in an investment function (Head of Infrastructure, Investment Director) also represent roughly 23% of respondents. The remaining 17% is represented by other functions (advisory, banker, portfolio manager).

The breakdown of respondents by organisation type as well as position is shown in table 1. Most of the respondents from asset owners are either in the strategy or investment function. Respondents

from asset managers, are mainly in a top executive function or strategy function. For respondents from banks, as well as other, most of them are in a strategy function.

Thus, there is a good representation of respondents in the strategy function and investment function who are closely involved with infrastructure investment.

2.3 Geographic, Investment, and Transaction Focus

Before answering questions on required returns for infrastructure projects and products, respondents were able to customise the questions they received to best suit their expertise.

This allows us to better understand what individual respondents to this survey know about.

Contingent-valuation questions were prepared using a matrix of region, project lifecycle, and business model categories, as well as differentiation between debt or equity, and investment in projects or products.

Respondents were asked to choose which questions they felt they had the best investment and transaction expertise to answer.

When identifying their geographic and investment expertise, they were given the option to answer questions on OECD markets, emerging markets, or both,

4 – The categorisation of respondents by region was detailed in section 2.1.1 under the explanation for figure 3 and figure 4

2. Survey Respondents

Figure 7: Current allocation to infrastructure as a percentage of AUM, asset owners only

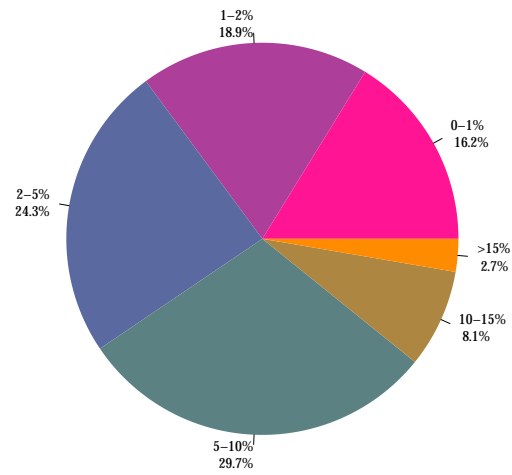
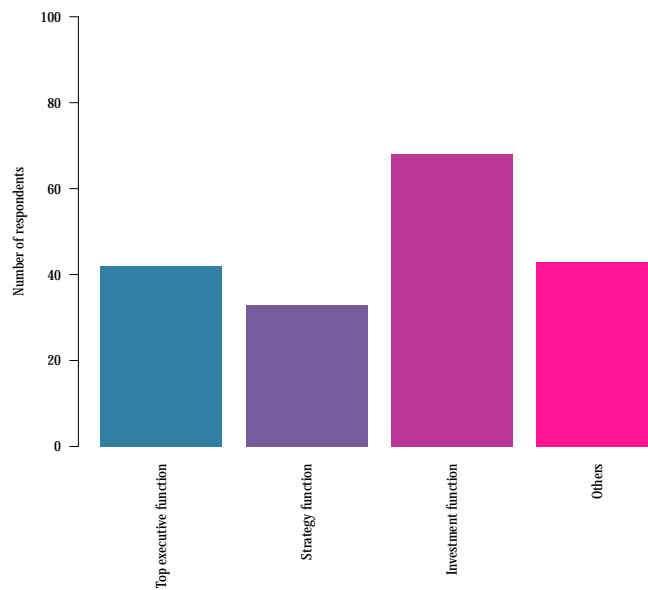


Figure 8: Survey respondents by position

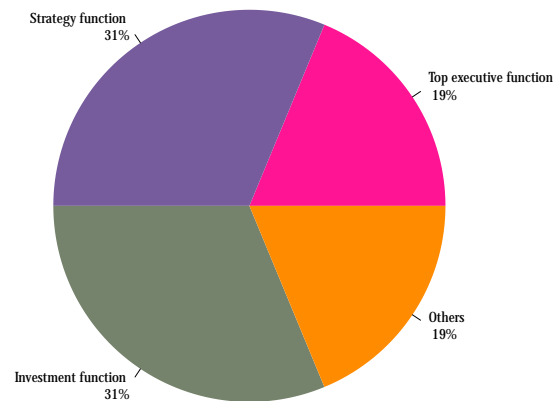


2. Survey Respondents

Table 1: Number of respondents by organisation type and position

Position	Asset owners	Asset managers	Comm. and int'l banks	Other	Total
Top executive function	9	23	3	8	43
Strategy function	15	21	16	16	68
Investment function	15	17	5	5	42
Others	9	6	10	8	33
Total	48	67	34	37	186

Figure 9: Proportion of asset owners by position



and either infrastructure debt or equity. Respondents could also choose whether to answer questions on infrastructure projects, products, or both.

Geographies (OECD or emerging-market), investment type (debt, equity), project lifecycle (greenfield, brownfield), and business model (contracted, merchant, regulated) were equally represented in the pool of infrastructure-project questions.

Similarly, the infrastructure-products question pool included an equal number

of products focusing on OECD countries, emerging markets, debt, and equity.

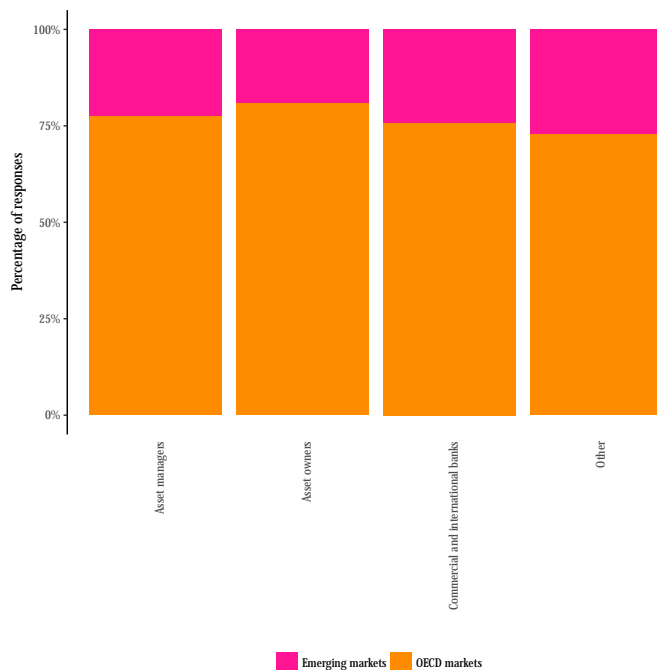
Figures 10, 11, and 12 show the areas of expertise declared by respondents. The selection represents the expertise of the respondent and may not reflect the focus of their organisation.

2.3.1 Geographic Focus

Irrespective of their organisation type, the majority of respondents expressed much greater familiarity with infrastructure investment in OECD markets (77%), with the remainder being more familiar with

2. Survey Respondents

Figure 10: Geographic focus by respondent type



emerging markets. Asset-owner respondents expressed the least familiarity with emerging markets.

2.3.2 Investment Focus

Respondents all showed a very clear focus on their investment expertise, all choosing either infrastructure debt or equity as a specialisation, and none selecting both.

The majority of respondents were more knowledgeable about infrastructure equity (60%) than debt.

Asset-owner respondents were the most likely to select equity, while respondents from commercial and international banks selected this expertise the least. Bankers who selected equity as their area of expertise worked for international development banks.

In line with last year's results, asset-owner respondents still express greater focus on infrastructure equity over infrastructure debt, compared to asset managers and, obviously, banks.

2.3.3 Transaction Focus

Finally, roughly half (46%) of respondents declared themselves as familiar with the return of both projects and investment vehicles such as equity or debt funds.

Among the remaining experts, 39% were more knowledgeable about infrastructure projects solely, and the remaining 15% selected infrastructure investment vehicles as their forte.

2. Survey Respondents

Figure 11: Investment focus by respondent type

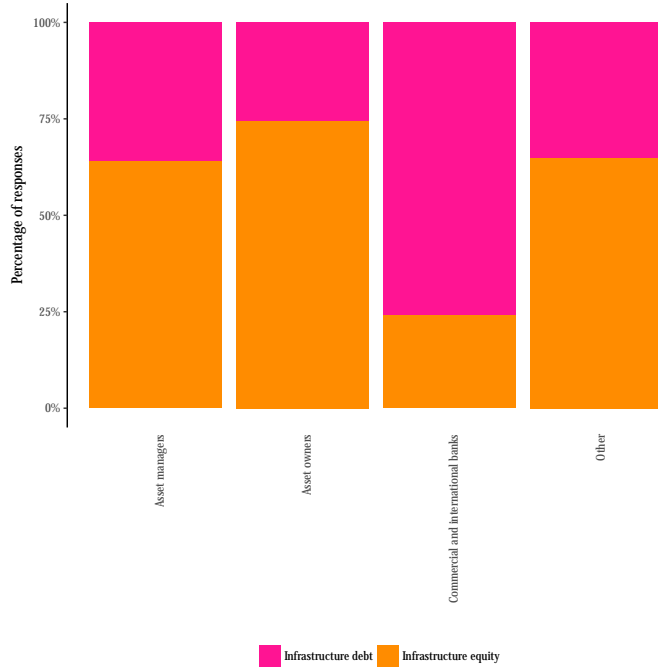
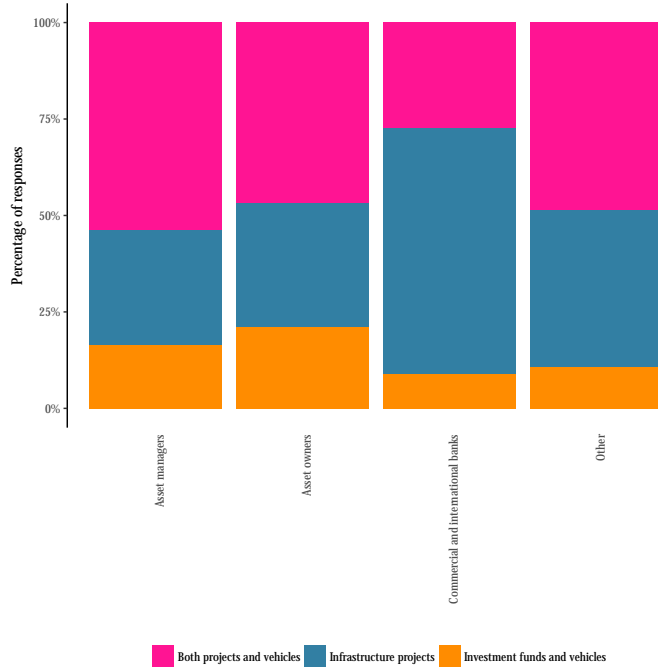


Figure 12: Transaction focus by respondent type



2. Survey Respondents

2.4 Conclusion

By design, this survey captures the views of individuals who have been involved for numerous years with infrastructure investment decisions of large asset owners and managers, as well as specialised lenders, and a few consultants / ratings agencies.

Compared to the average asset owner (OECD, 2015), the asset owners represented in this survey have disproportionately large allocations to infrastructure. By focusing on the *infra500* group of respondents, this survey achieves an even stronger bias toward larger, more sophisticated investors than the 2016 EDHEC/GIH survey.

With total AUM of more than USD 7 trillion, the asset owners represented in this survey account for roughly 10% of global assets under management (Della Croce and Yermo, 2013). More than 50% of respondents had AUM of more than USD 50 billion. Thus, the largest institutional investors in the world are disproportionately represented.

The recent history of the sector is also visible in respondents' self-declared areas of expertise. Most investors and their managers know about investing equity in OECD infrastructure, either at the project level or the fund level.

Next, we discuss respondents' views on market evolutions in section 3.

3. Investment Beliefs



3. Investment Beliefs

In this section, we discuss our findings on respondents' views on four areas of infrastructure investment: investment intentions and market developments (section 3.1), national infrastructure plans (section 3.2), quality of intermediation (section 3.3), and data gaps (section 3.4).

3.1 Market Developments

3.1.1 Allocation Trends

The following three questions discussed pertain to asset owners only.

We first asked asset owners whether they intended to invest more in infrastructure in the next few years, including in emerging markets.

We already know from the asset owners' profile that their allocation to infrastructure assets is comparatively high. Figure 13 shows that their medium-term investment intentions are also rather positive.

None of the asset owners surveyed expect to reduce their infrastructure investments over the next three to five years.

In this group of asset owners, 90% reported an intention to increase their investment, while the remaining 10% intend to keep their investment at its current level. Those expecting to keep their infrastructure investment unchanged are large pension funds and sovereign wealth funds.

These results are much more positive compared to last year's results, where

65% of asset owners reported an expected increase in their infrastructure investment and 24% intended to keep their investment unchanged. Furthermore, 1% reported intentions to reduce their infrastructure investment, and 2% intended to stop investing in infrastructure entirely.

With regards to emerging-market infrastructure, the majority of asset owners (43%) still do not invest in infrastructure in these markets, and they do not intend to.

Nevertheless, 38% report currently investing in emerging-market infrastructure, while 15% express an interest to take on such investments. The remaining 5% remain undecided.

The emerging-market infrastructure investment dynamic seems to be accelerating compared to our 2016 survey results.

In 2016, only 20% reported investments in emerging-market infrastructure. Currently, insurance firms make up those interested in investing in emerging-market infrastructure.

For asset owners currently investing in emerging-market infrastructure, 82% expect their allocation to increase, as shown in figure 15. Most of the asset owners in this group expect the increase to be moderate, with a small proportion expecting a significant increase. The remaining 18% of asset owners were unsure.

3. Investment Beliefs

Figure 13: Infrastructure investment intentions for the next 3 to 5 years, asset owners only

In the coming 3–5 years, you intend to invest in infrastructure . . .

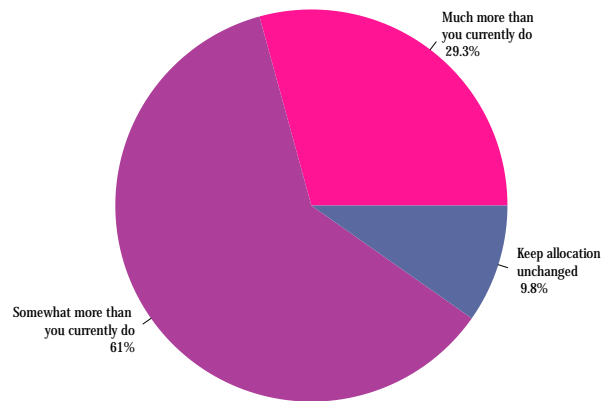
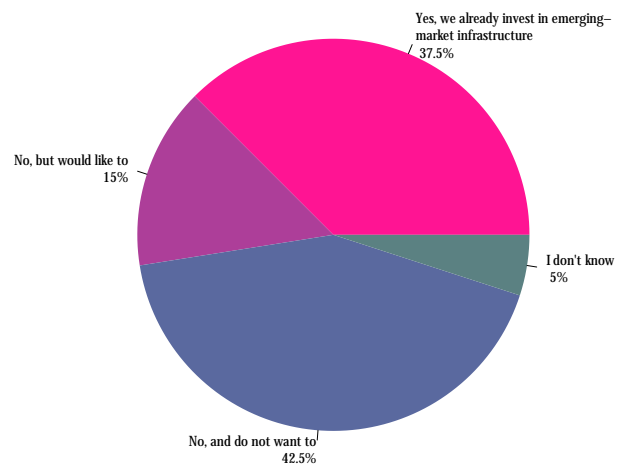


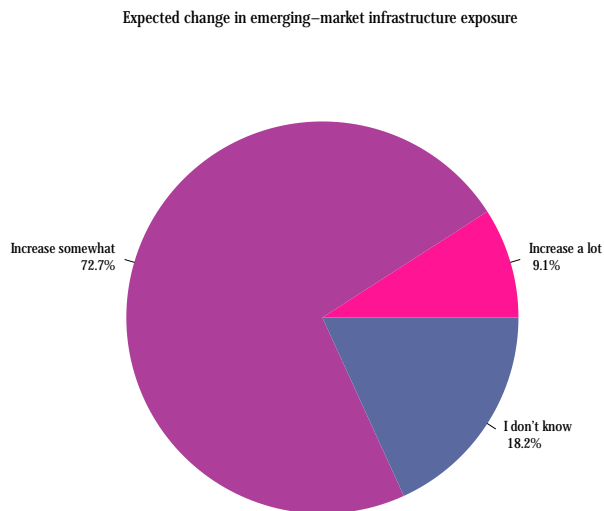
Figure 14: Current allocation to emerging-market infrastructure, asset owners only

Do you already invest in infrastructure in emerging markets?



3. Investment Beliefs

Figure 15: Future allocation to emerging-market infrastructure, asset owners only



Last year's results showed that 70% of asset owners expected an increase in their allocation and 4% expected a decrease.

Those who expect it will grow make up 35% of respondents, while the remaining 9% expect it to shrink.

The remaining questions discussed below were asked to all respondents.

Asset managers make up the majority of those who believe that the pipeline will shrink, reflecting the difficulties experienced by a number of asset managers in OECD markets, where higher prices often mean returns at or below the hurdle rate of private infrastructure equity funds, making new transactions more difficult to execute.

The deal flow

Investors often express concerns over the lack of a pipeline for bankable infrastructure projects. We asked respondents to express their views on the future pipeline of infrastructure projects in OECD countries and in emerging markets.

Moving to the infrastructure deal flow in emerging markets, respondents are much more positive, with 85% expecting the future infrastructure pipeline to grow. A small proportion of respondents, consisting mainly of banks, believe it will shrink. Again, this reflects the experience of commercial banks involved in infrastructure project

Most (56%) respondents do not expect existing bottlenecks to be removed anytime soon, and they believe that the future infrastructure deal flow in OECD countries will remain stable in comparison with the past three to five years.

3. Investment Beliefs

Figure 16: Infrastructure deal flow in OECD countries

In the OECD the future infrastructure deal flow or pipeline in comparison with the past 3–5 years is . . .

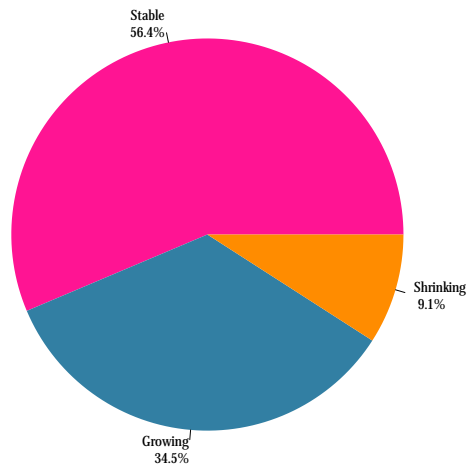
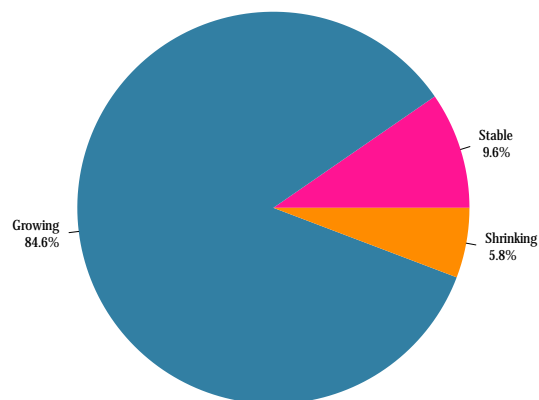


Figure 17: Infrastructure deal flow in emerging markets

In emerging markets, the future infrastructure deal flow or pipeline in comparison with the past 3–5 years is . . .



3. Investment Beliefs

financing in emerging markets, where prevailing loan-pricing conditions and covenant requirements can often make project financing commercially nonviable.

We also asked respondents which national markets they were most-active in and which they saw as the most promising.

The regions listed in figure 18, figure 19, and figure 20 are defined in the previous chapter, under the explanation for figure 3 and figure 4.

Regarding which OECD infrastructure markets respondents considered to be the most-active, most respondents selected countries or regions in EMEA. Going by country, the United States and the United Kingdom were clear leaders. Responses naming the United States or United Kingdom made up the overwhelming majority, and the remaining responses were split across several other countries - in order of highest selection, these countries include Australia, France, and Canada. The rest of the markets listed consisted mostly of European countries.

However, for most-active infrastructure markets in emerging markets, respondents mainly selected countries or regions in Asia-Pacific. By order of highest selection, Indonesia, India, China, Mexico, and Brazil came in as the top five. The other countries named by respondents were mainly from Africa and the Middle East.

Next, we consider the national or regional markets our respondents believe will be the "next big thing" for infrastructure investors.

The clear winner for the next big infrastructure market is the Americas. By country, the United States was once again the most-popular choice among respondents and Latin America was the second most selected region, behind Asia. Once again, the number of responses selecting the United States was significantly higher than for any other country/region named. Other countries named were mainly South East Asian and Middle Eastern countries.

Thus, our respondents are very focused on infrastructure investment in the United States, currently and in the future.

Infrastructure as a retail product

Finally, we asked about the future role of infrastructure in retail products.

Private infrastructure investment remains an opportunity solely accessible to institutional investors. But it could be envisaged to make private infrastructure debt and equity products available to life insurance policy owners or individual-account pension plan members.

We asked respondents if they believed that infrastructure investment –based on its investment profile and regulatory treatment– has the potential to become part of retail insurance and pension products.

3. Investment Beliefs

Figure 18: Most-active national infrastructure markets in the OECD, by region

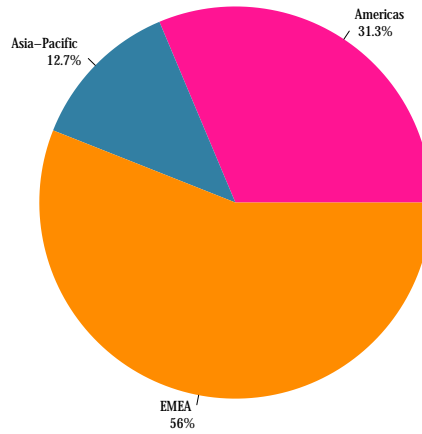
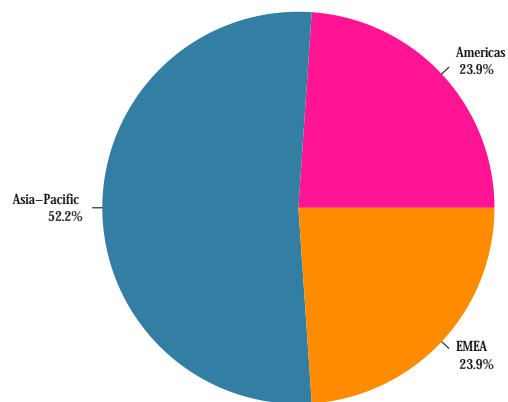


Figure 19: Most-active national infrastructure markets in emerging markets, by region



3. Investment Beliefs

Figure 20: National or regional markets which will be the next big thing for infrastructure investment, by region

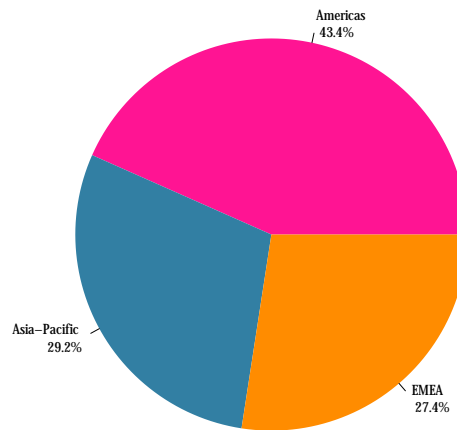
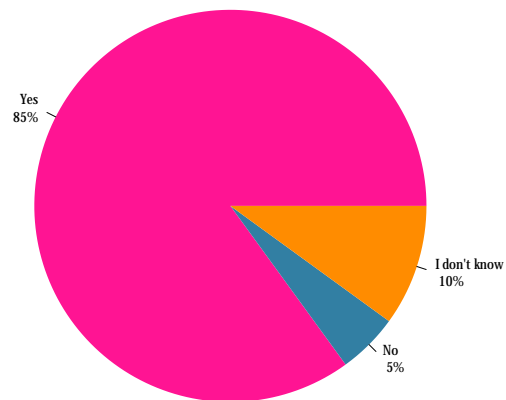


Figure 21: Infrastructure products as retail insurance and pension products

Can infrastructure become a significant allocation in retail insurance and pension products?



3. Investment Beliefs

Including a majority of respondents from the insurance sector, 85% of respondents believe that this is a possible development.

Offering individual members the opportunity to invest in long-term illiquid assets at the right moment in their lifecycle is obviously appealing, especially if such investment choices can become part of dynamic default options in defined contribution plans.

This prospect also raises questions on at least two fronts: first, the ability to invest on a well-diversified basis in large pools of infrastructure assets; second, the availability of underlying infrastructure assets to build such pools (without any deterioration of the current investment profile).

Both aspects of this future are related to the various infrastructure plans that have been put forward by governments around the world.

3.2 National Infrastructure Plans

National infrastructure plans have been announced in most major economies in the OECD and beyond. In an environment where investors say they want to own more infrastructure assets but also do not think the deal flow will increase very fast, such plans should provide a measure of comfort for investors, since they often promise numerous new investable infrastructure projects.

Hence, we asked respondents how well they know the major national infrastructure plans in OECD countries and emerging markets, as well as what impact they thought these plans would have.

The plans we queried our respondents about are listed in table 2.

Next, we review the responses for OECD plans, followed by emerging-market plans.

3.2.1 OECD National Infrastructure Plans

Notoriety

Among the OECD national infrastructure plans we listed, the most well-known plan among respondents was the Juncker/EU Infrastructure Investment Plan, where almost 35% selected the highest level of familiarity - very well aware.

For each of the plans more than 75% of the respondents had at least heard of them, signalling reasonable general awareness of these OECD plans. The only exception was Chile's Agenda De Concesiones⁵.

At the same time, of the total responses for all the OECD plans, roughly one-fifth were "never heard of it", and more than one-third were either "never heard of it" or "I have heard of it but not much more". Apart from Chile's Agenda De Concesiones, each of the other OECD national infrastructure plans are known in detail to a subgroup of between 13% and 35% of respondents.

When segregating respondents by regions⁶

5 - For Chile's Agenda De Concesiones, a smaller proportion of respondents had at least heard of the plan (51%). It was also the plan which respondents were most unfamiliar with in the OECD, with 49% reporting that they had never heard of the plan.

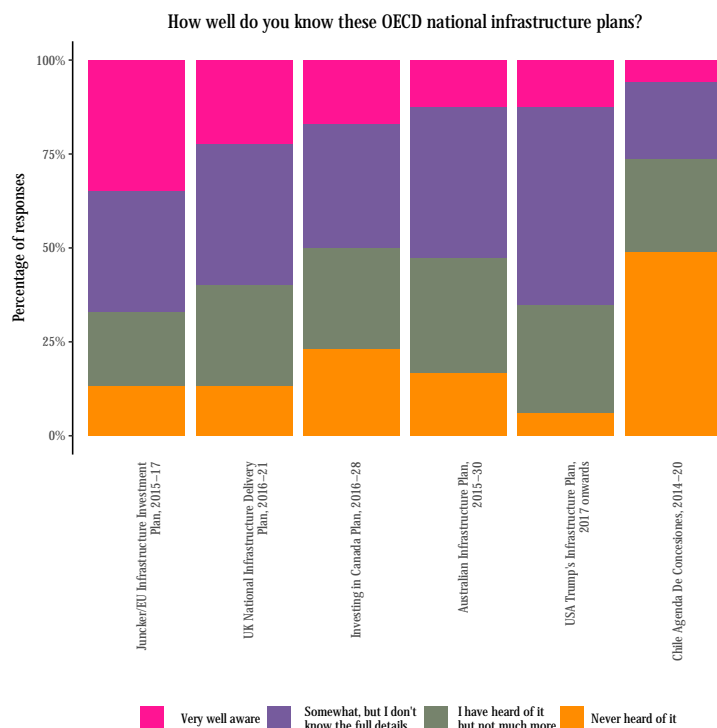
6 - The categorisation of respondents by region was detailed in section 2.1.1 under the explanation for figure 3 and figure 4

3. Investment Beliefs

Table 2: National infrastructure plans in OECD countries and emerging markets

OECD	Emerging markets
Australian Infrastructure Plan 2015-30	Brazil Projeto Crescer (Growth Project) 2014-18
Chile Agenda De Concesiones 2014-20	China plans for different sectors based on 13th Five-Year Plan 2016-20
Investing in Canada Plan 2016-28	India Twelfth Five-Year Plan 2012-17
Juncker-EU Infrastructure Investment Plan 2015-17	Indonesia National Medium-Term Development Plan 2015-19
UK National Infrastructure Delivery Plan 2016-21	Saudi Arabia National Transformation Program 2020
USA Trump's Infrastructure Plan 2017 onwards	South Africa National Infrastructure Plan 2013-17

Figure 22: National infrastructure plans, OECD countries



(the Americas, Asia-Pacific, and EMEA), based on location of the firms' headquarters, we see greater familiarity among respondents for plans relating to their region.

Respondents classified under the Americas are most well aware of the Investing in Canada Plan, with 38% of respondents from American organisations stating that they are very well aware of the plan. Trump's Infrastructure Plan (2017 onwards) and the

Juncker/EU Infrastructure Investment Plan (2015-17) tied at second place.

Respondents under Asia-Pacific are most well aware of the Australian Infrastructure Plan. This and the United States's plans were the most well-known in the region, with 92% of respondents having at least heard of both. None of these respondents reported being very well aware of Chile's Agenda De Concesiones.

3. Investment Beliefs

Figure 23: National infrastructure plans, OECD countries (respondents from America)

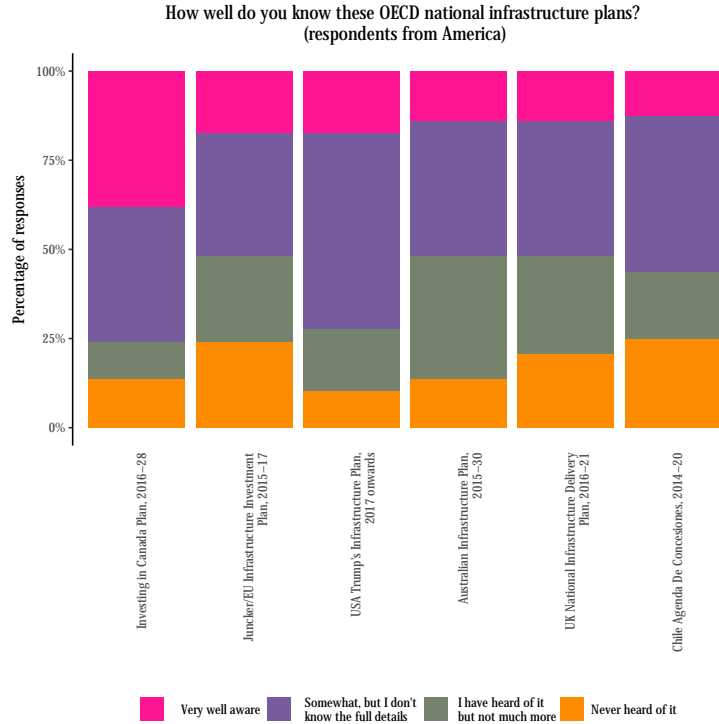
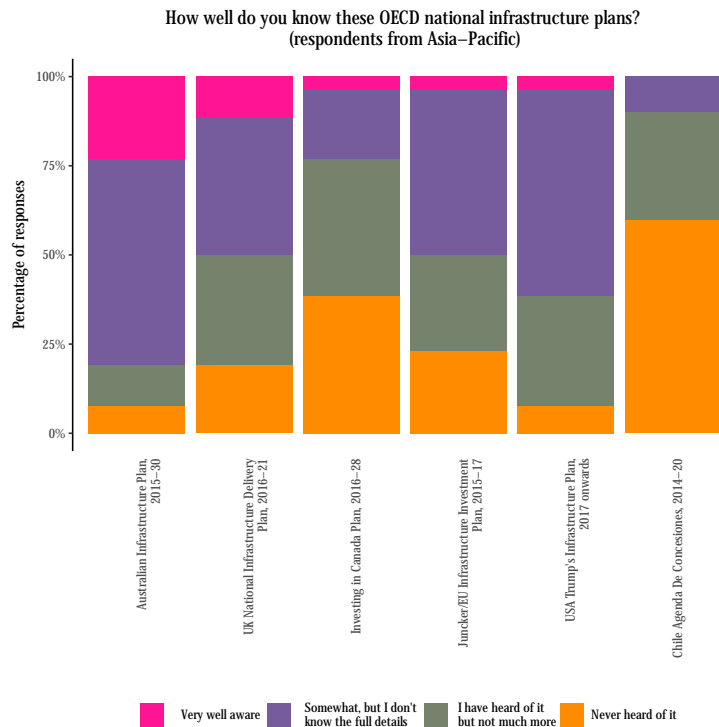


Figure 24: National infrastructure plans, OECD countries (respondents from Asia-Pacific)



3. Investment Beliefs

In EMEA, the most well-known plans were those of the United States and the EU, with 96% of respondents having at least heard of the plans. The plan respondents were most aware of was the Juncker/EU Infrastructure Investment Plan, with 58% of respondents stating that they knew it well. The UK's National Infrastructure Delivery Plan came in second at 32%.

Effectiveness

What impact can OECD infrastructure plans have on investment opportunities? We asked those respondents who stated that they knew at least something about each OECD plan if they felt these plans would impact investment opportunities, and in what way.

It is encouraging to note that there is a fair amount of support for all of the plans. Chile's plan had the strongest support and more than half of the respondents who knew the plan felt that it improved the attractiveness of Chile's infrastructure. Australia's, Canada's and the USA's plans also had a positive response from close to 50% of respondents. For the Juncker Plan and the UK's plan, around 30% of respondents each were convinced that they brought about improvement to the attractiveness of infrastructure in the countries. However, there is a significant proportion of respondents who do hold reservations about the effectiveness of most of the plans, and a small number even believe some of the plans create more risk.

Now we look at the results by respondent region.

For respondents classified under the Americas, the ranking of support for each plan is fairly similar to that in the discussion above. The plan that received the most positive response among this group was again Chile's Agenda De Concesiones. However, the proportion of support for the plan was almost matched by that for the Australian Infrastructure Plan (2015-30).

Respondents from Asia-Pacific organisations are significantly less convinced. None of the respondents felt that Chile's Agenda De Concesiones or the Juncker plan added to the attractiveness of investing in infrastructure. A small minority felt that Trump's infrastructure plan would create more unrewarded risk.

Respondents from EMEA organisations were the most positive about the plans. Chile's Agenda De Concesiones had the strongest support, with 83% of respondents stating that the plan improves the attractiveness of infrastructure investment, followed by Trump's Infrastructure Plan (2017 onwards) and the Investing in Canada Plan (2016-28) which both had more than 50% of positive views each.

Plans for the EU, UK, and US, attracted more polarised responses, with a larger but still minority group of respondents seeing more risk being created but not more rewards.

3. Investment Beliefs

Figure 25: National infrastructure plans, OECD countries (respondents from EMEA)

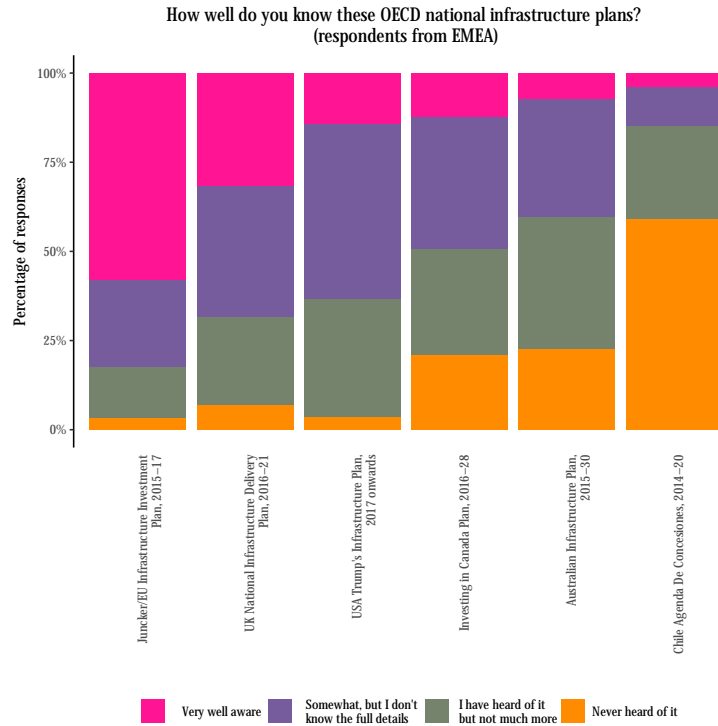
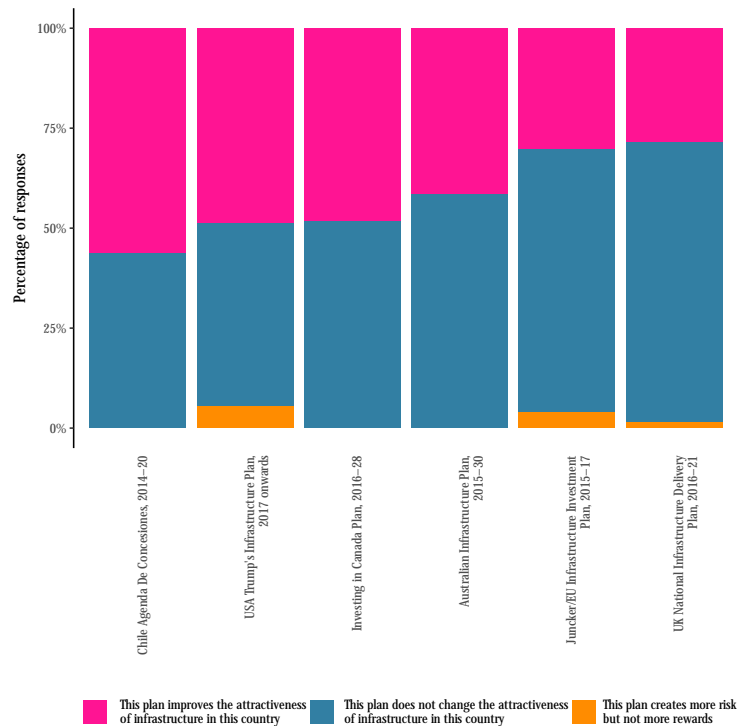


Figure 26: Potential impact of plans on investment opportunities in the country (OECD)



3. Investment Beliefs

Figure 27: Potential impact of plans on investment opportunities in the country (OECD), respondents from America

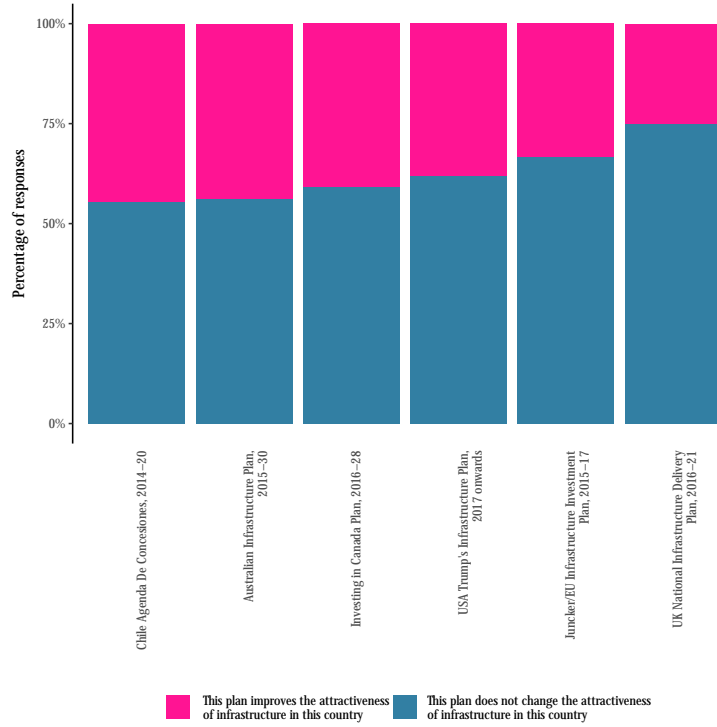
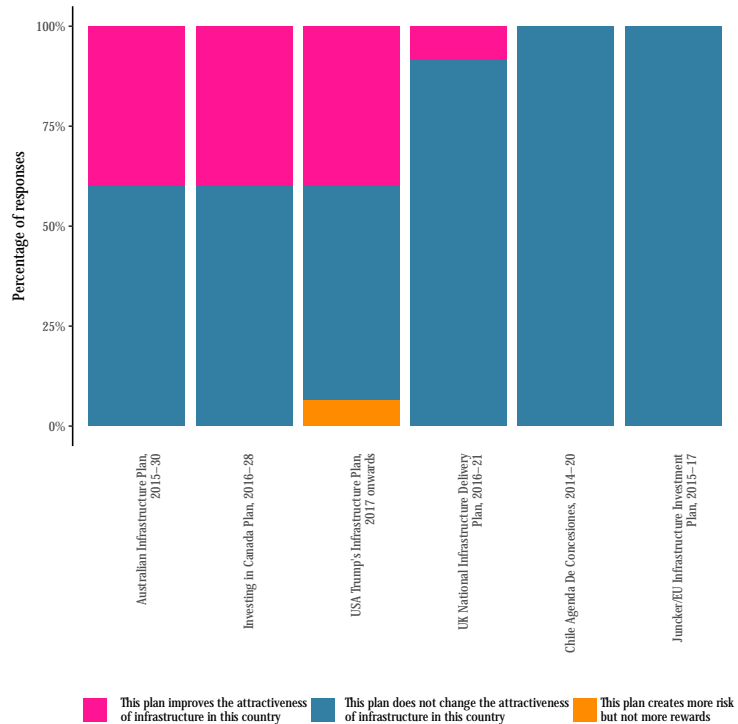
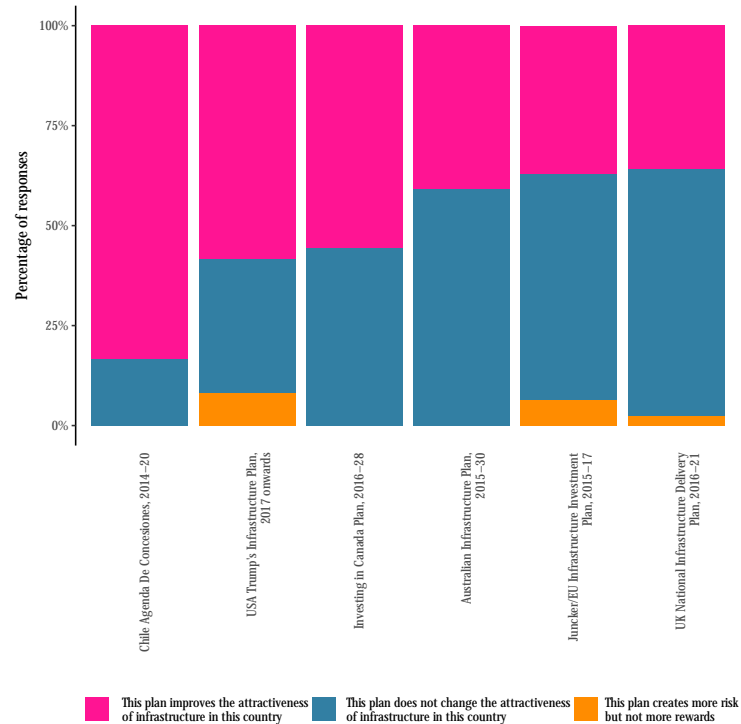


Figure 28: Potential impact of plans on investment opportunities in the country (OECD), respondents from Asia-Pacific



3. Investment Beliefs

Figure 29: Potential impact of plans on investment opportunities in the country (OECD), respondents from EMEA



Next, we turn to infrastructure plans in emerging markets.

3.2.2 Emerging-Market National Infrastructure Plans

Notoriety

Regarding national infrastructure plans in emerging markets, China's plans for different sectors based on the 13th Five-Year Plan was the most well-known among respondents, with 74% having at least heard of the plan.

However, when it came to being very well aware of plans, investors were most well aware of Saudi Arabia's National Transformation Program (15%). The rest of the plans had between 2% and 9% of respondents stating that they were very well aware of the plan. Respondents were

most unfamiliar with Brazil's Projeto Crescer (growth project), with almost 55% having never heard of it.

Below, we look at the results by region.

In the Americas, the best-known plan was China's plans for different sectors based on the 13th Five-Year Plan, with almost 88% of respondents having at least heard of them. When it came to the plan respondents knew very well, India's 12th Five-Year Plan ranked the highest. Saudi Arabia and South Africa's plans were not very well known by any of the respondents.

The results were very similar for respondents classified under Asia-Pacific. The most well-known plan was once again China's plans of different sectors based on the 13th

3. Investment Beliefs

Figure 30: National infrastructure plans, emerging markets

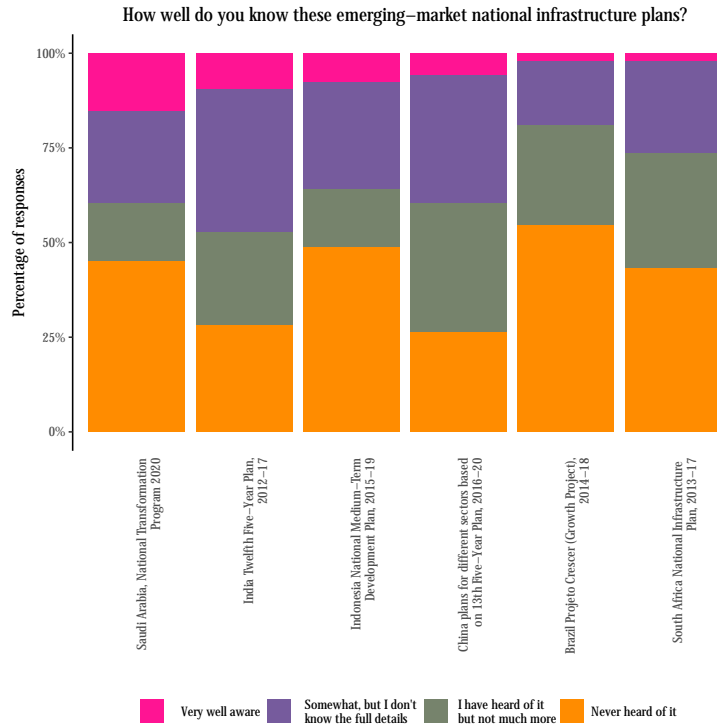
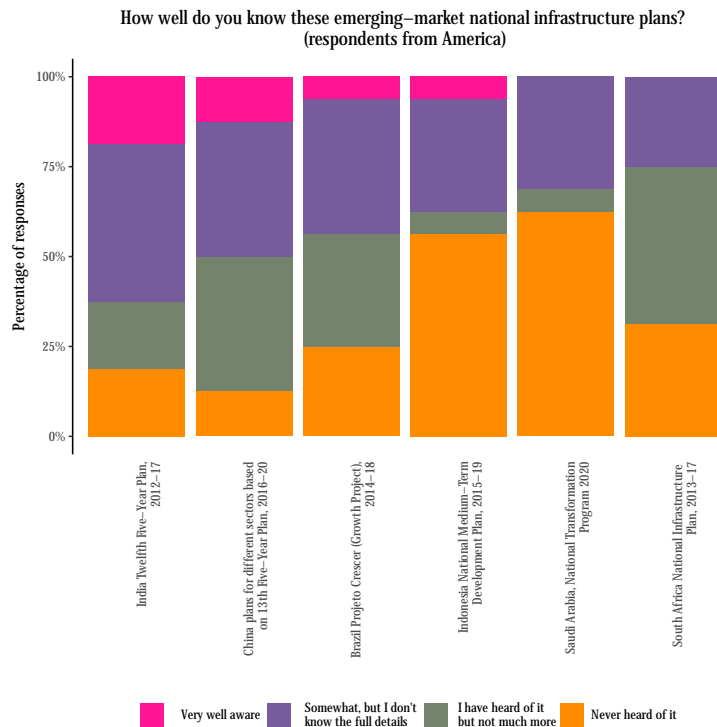


Figure 31: National infrastructure plans, emerging markets (respondents from America)



3. Investment Beliefs

Five-Year Plan (80%), and the plan respondents knew very well was India's 12th Five-Year Plan and Indonesia's National Medium Term Development Plan (20% for each). The plan least known in this region was Brazil's Projeto Crescer (Growth Project).

Respondents under EMEA were most aware of Saudi Arabia's National Transformation Program, with 70% having at least heard of it. This was also the plan that respondents were best versed in, with 26% stating that they knew the plan very well.

It was the only region where India's plan did not have the highest proportion of respondents knowing it very well. In fact, none of the respondents in the region knew the plan very well. Similar to respondents in Asia-Pacific, the least-known plan was Brazil's Projeto Crescer (Growth Project).

Effectiveness

Next, we turn to the potential impact of emerging markets' national infrastructure plans on investment opportunities in the respective countries.

The support shown by respondents for the plans in emerging markets is quite significant and even more so than that for the plans in OECD countries.

The percentage of respondents who felt that the plans improved the attractiveness of infrastructure in the country ranged between 42% and 64%. For Saudi Arabia's National Transformation Program more than half of the respondents (64%) were

convinced about the plan's effectiveness. There was also significant support for both Brazil's and South Africa's plans, with 50% of respondents for each plan stating that they felt the plans improved the attractiveness of infrastructure in the country.

A small percentage of the respondents felt that the plans in India, Indonesia, Saudi Arabia, and South Africa create more risks but not rewards.

The results vary quite significantly when responses are broken down by region.

Respondents classified under the Americas were equally split on whether the plans in China, Indonesia, and South Africa improved the attractiveness of infrastructure in the country. For India, Indonesia, and Saudi Arabia's plans, a small proportion of the respondents believed that the plans in fact create more risk.

Respondents in Asia-Pacific were extremely positive about South Africa's National Infrastructure Plan, with 100% of respondents believing in the plan's effectiveness. However, for India's and Indonesia's plans, some respondents felt that more risk was created. Respondents were neutral on the plans in Brazil and China, with all respondents agreeing that the plans neither had a positive nor negative impact on the attractiveness of infrastructure in the country.

3. Investment Beliefs

Figure 32: National infrastructure plans, emerging markets (respondents from Asia-Pacific)

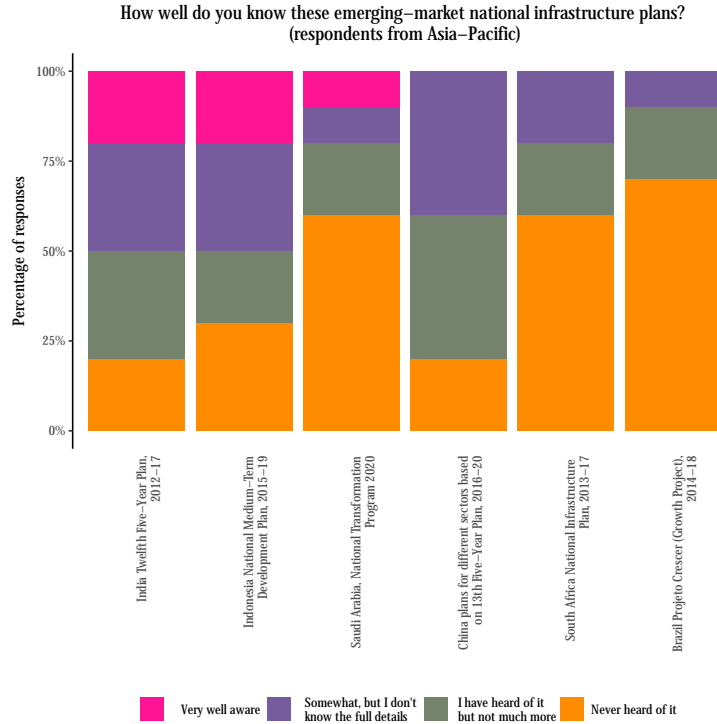
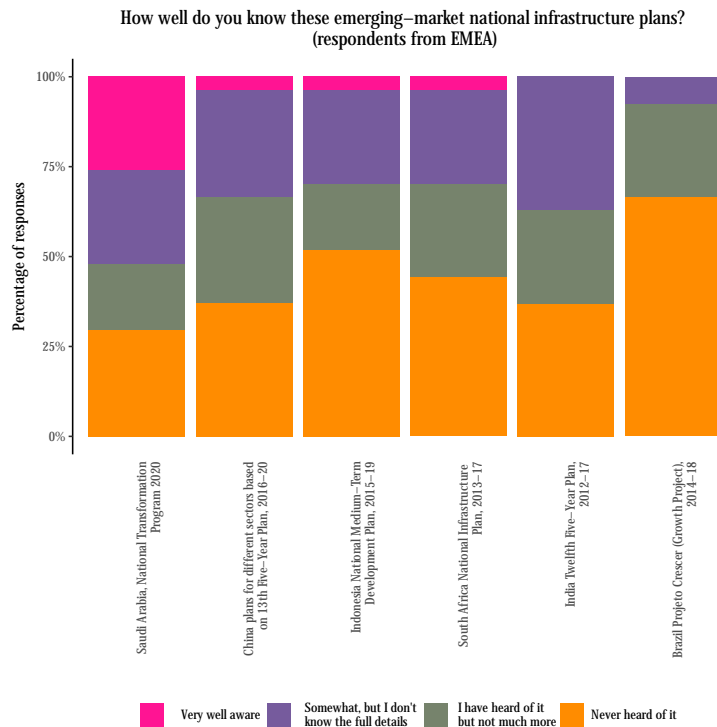


Figure 33: National infrastructure plans, emerging markets (respondents from EMEA)



3. Investment Beliefs

Figure 34: Potential impact of plans on investment opportunities in the country (emerging markets)

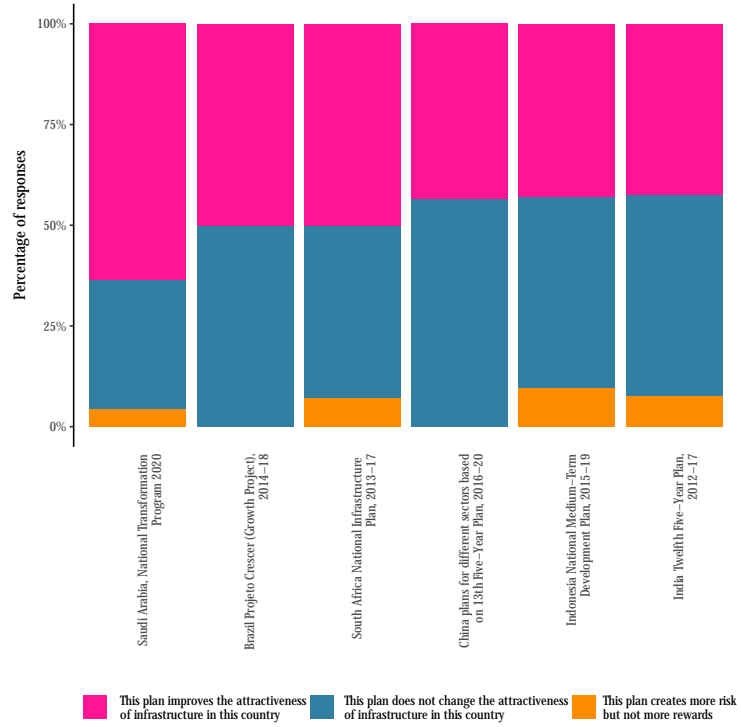
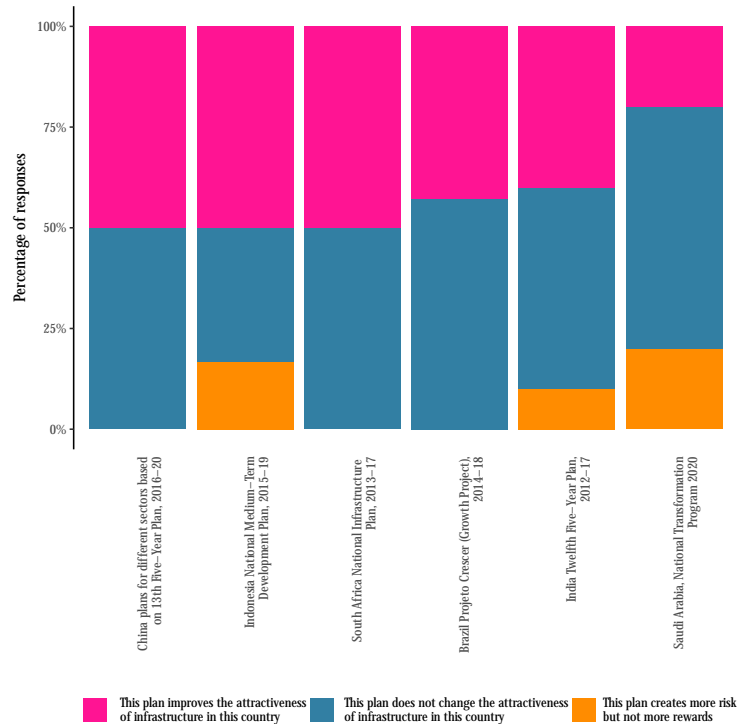
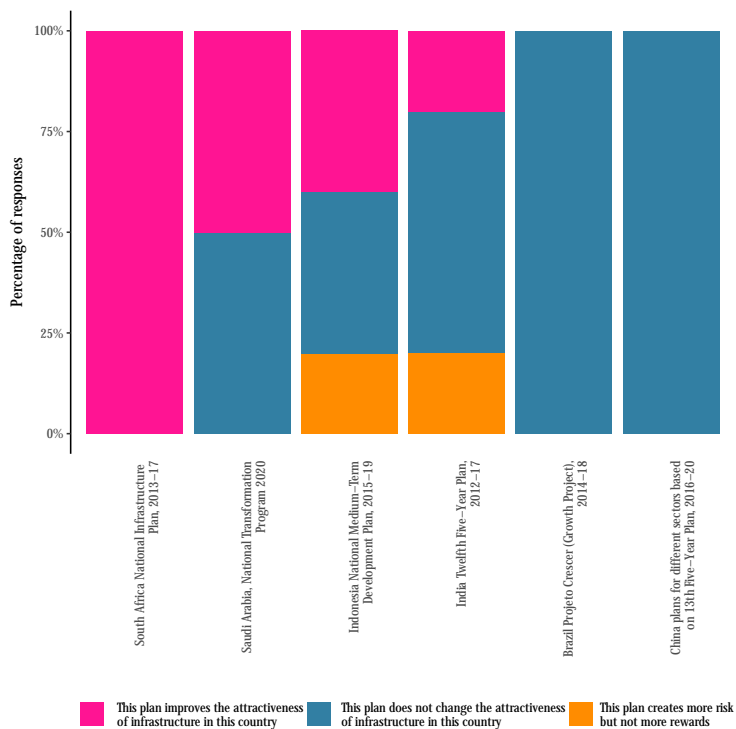


Figure 35: Potential impact of plans on investment opportunities in the country (emerging markets), respondents from America



3. Investment Beliefs

Figure 36: Potential impact of plans on investment opportunities in the country (emerging markets), respondents from Asia-Pacific



Lastly, respondents under EMEA were once again the most positive about the plans. Brazil's Projeto Crescer and Saudi Arabia's National Transformation Program had the most positive response, with 75% and 80% of respondents, respectively, stating that the plan is beneficial to the attractiveness of infrastructure in the country.

In conclusion, national infrastructure plans currently do not seem to be a main focus of most respondents when it comes to infrastructure investment. The proportion of respondents who are very well aware of the plans make up the minority. This is especially so when it comes to plans in emerging markets. However, when respondents are familiar with the plans they do show notable support for them, with most of the plans having close to or at least half

of the respondents stating that it improves the attractiveness of infrastructure in the country. In this aspect, respondents showed greater confidence in the plans of emerging markets, as opposed to those in OECD countries.

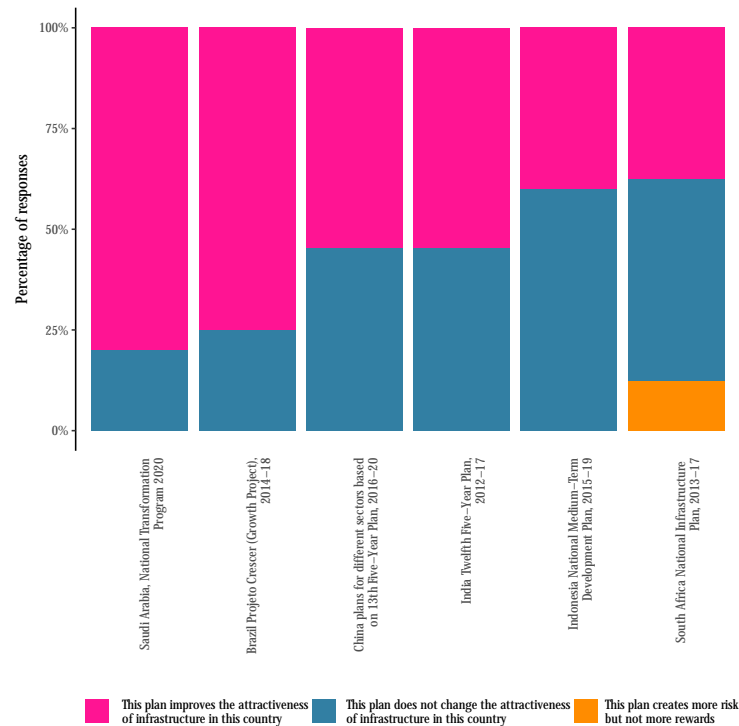
Thus, noting the support shown among respondents aware of the plans, there is significant potential in governments creating greater awareness of their national infrastructure plans.

3.3 Quality of Intermediation

In this section, we review the answers to three simple questions that touch on the quality of intermediaries for infrastructure investors, especially asset owners.

3. Investment Beliefs

Figure 37: Potential impact of plans on investment opportunities in the country (emerging markets), respondents from EMEA



We asked about the role of so-called preparation facilities created by multilateral development banks (MDBs) to help public-private partnerships (PPPs) take place in emerging markets. We also asked about confidence in credit rating agencies and also in the kind of terminology used to denote private investment categories.

3.3.1 PPP Preparation Facilities

Because multilateral development banks regard project preparation as critical to increasing the pipeline of infrastructure projects in emerging markets, it is useful to see how beneficial the assistance provided by these project preparation facilities (PPFs) has been.

The majority of respondents had not participated in a project supported by a multilateral development bank PPF.

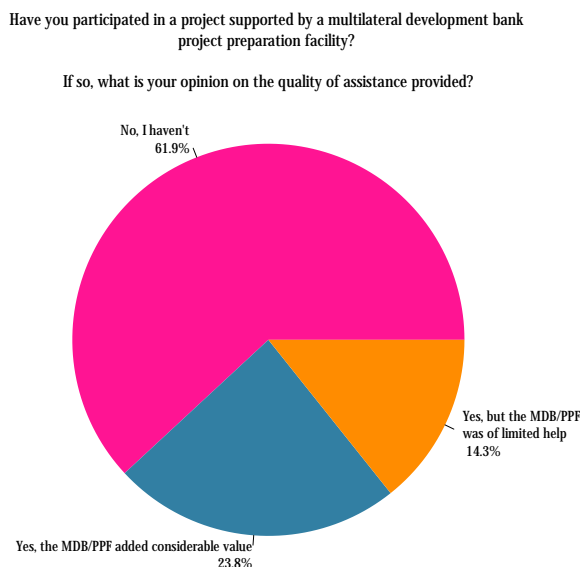
Of those who had, more than half felt that the MDB/PPF added considerable value, citing risk mitigation as a major reason why. Additionally, respondents felt that these intermediaries help to fill gaps where the governments do not have an organised project-preparation structure in place.

Respondents who felt these intermediaries were not as helpful raised concerns such as a greater need to tailor the assistance to the local context and the limitation of MDB's leverage to the central government level.

Focusing on respondents who selected emerging markets as their geographic focus,

3. Investment Beliefs

Figure 38: Quality of assistance in MDB/PPF supported projects



the majority felt that it was valuable to have assistance from the MDB/PPF in project preparation.

3.3.2 Ratings

Respondents' views on rating agencies' approach to rating infrastructure project finance debt was very consensual.

The approach of these agencies is not only relevant to individual issues but also to the creation of the next generation of infrastructure-project-debt-structured products, akin to CDO (collateralised debt obligation) structures, which will require a robust understanding of credit risk within a portfolio of private debt on the part of rating agencies.

We asked whether respondents believed in the assessment criteria used by rating

agencies and for views on the overall reliability of these ratings.

The majority of respondents were comfortable with the approach taken by rating agencies in rating infrastructure-project-finance debt.

However, respondents reflected concerns on the limitations of rating methodologies' comprehensiveness. For instance, there is a stronger focus on rating infrastructure projects in the OECD, which would limit usefulness when evaluating pooled infrastructure assets.

3.3.3 Core or Core Plus?

Finally, when it comes to defining infrastructure, certain terminologies can be more effective than others when reflecting the risk-and-return profile of assets.

3. Investment Beliefs

Figure 39: Infrastructure project finance ratings

Are you comfortable with ratings agencies' approach to rating infrastructure project finance?

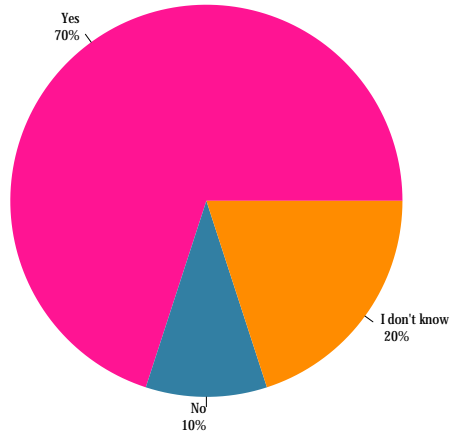
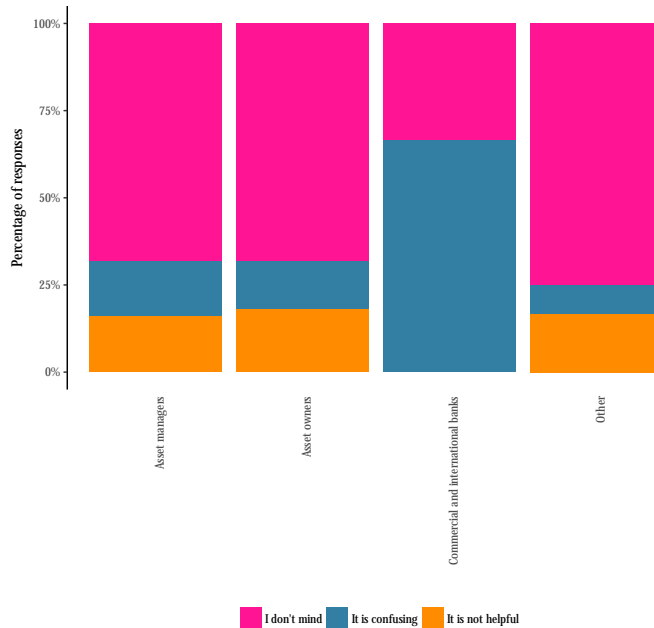


Figure 40: Infrastructure terminology

Usefulness of describing infrastructure as "core" or "core plus" over sectors or business models



3. Investment Beliefs

We asked about the use of “core” and “core plus” as standard labels attached by managers to infrastructure assets or investment strategies. Such terms can be a cause for concern on at least two counts:

1. They do not help with the integration of infrastructure investments at the total-portfolio level since they are not standardised financial metrics like the Sharpe ratio; and
2. They have often been directly translated from the real estate universe, and infrastructure does not share the economic characteristics of real estate. It is not a store of value, and investors often do not own the tangible infrastructure, instead their asset is a long-term contract with the public sector (see Blanc-Brude, 2013, for a detailed discussion).

Moreover, there is no universally agreed-upon definition of what “core infrastructure” is. It is easy to argue that the use of such terms contributes to increasing the information asymmetry between asset owners and their managers.

Still, about 70% of respondents “do not mind” such terms, while roughly 15% think they are not helpful and another 15% consider these terms to be actively “confusing.”

Perhaps surprisingly, these proportions are constant among asset owners and asset managers.

Only banks reported greater dissatisfaction with the terms, with more than 60% of respondents in this group finding this choice of terminology confusing.

3.4 Data Gaps

A last set of general questions focused on identifying improvements to infrastructure-investment metrics.

3.4.1 Operational Data

Just under half (46%) of respondents believe that the lack of operational, firm-level data can be a limiting factor for new investment in infrastructure.

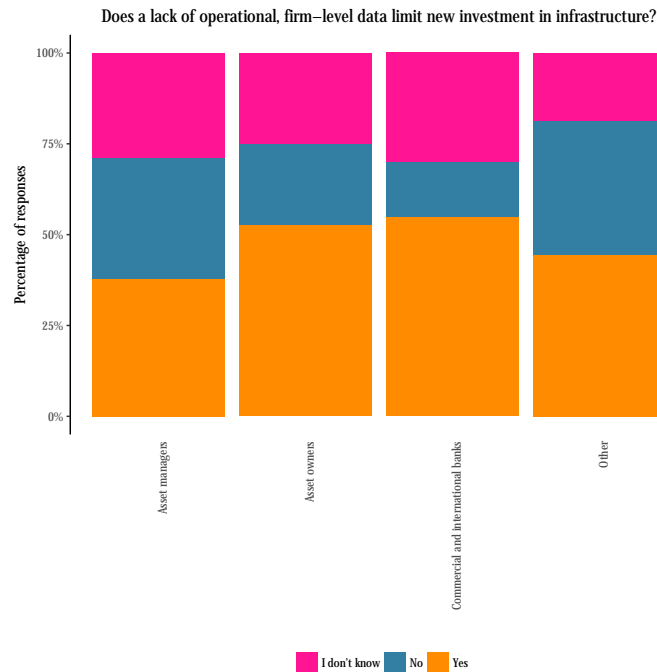
However, 28% do not, while the remaining respondents are undecided.

Asset owners and banks were most inclined to find that there is a lack of operational, firm-level data, a sentiment shared by more than 50% of each of those groups. This is consistent with the information needs of long-term direct investors who intend to keep assets for extended periods and therefore value operational data at the onset. Banks also need operational data to make lending decisions, which are often based on detailed financial models of the borrower.

Conversely, less than half of infrastructure asset managers felt that a lack of detailed operational performance was a pressure on new investments taking place.

3. Investment Beliefs

Figure 41: Operational, firm-level data



Still, a majority of respondents (84%) agree that benchmarking operational performance, on top of financial performance, would add value for infrastructure investors.

Next, we asked about which types of operational data would be most useful to infrastructure investors in increased availability.

The responses reported in figure 43 show that most respondents would like to see better data in all areas.

Traffic/demand data comes first by a small margin. Indeed, traffic risk is a well-documented source of failure in infrastructure projects. But construction risk, operating efficiency, or the cause and consequences of material events are equally

high on the list of topics that could be better documented.

3.4.2 Financial Performance Data

Finally, with regard to financial performance, respondents were asked to choose which financial-performance metrics are most needed for supporting the growth of the infrastructure asset class.

Here, responses are less balanced. Respondents selected time-weighted returns as the most important metric, followed by risk-adjusted returns (Sharpe ratio), and money-weighted returns. Extreme risk metrics such as value-at-risk or maximum drawdown also ranked high on the list.

Several respondents also indicated their need for better benchmarking of returns beyond individual project performance.

3. Investment Beliefs

Figure 42: Value of benchmarking operational performance

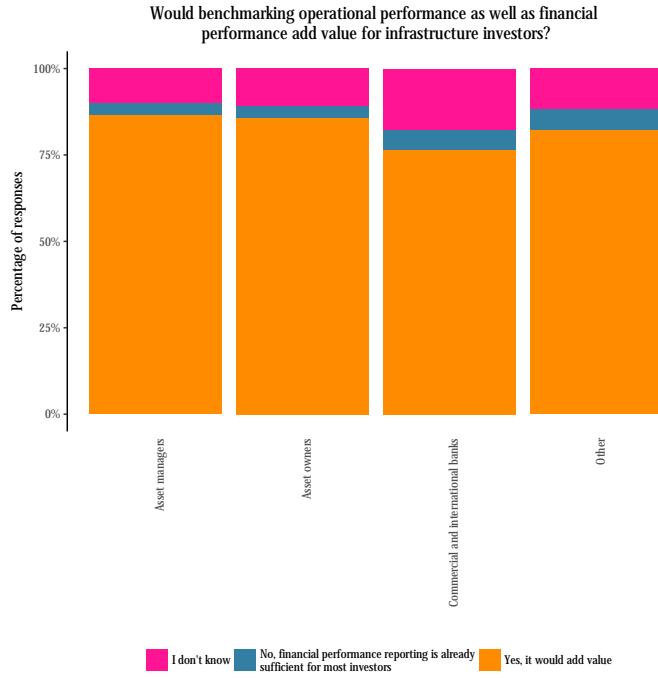
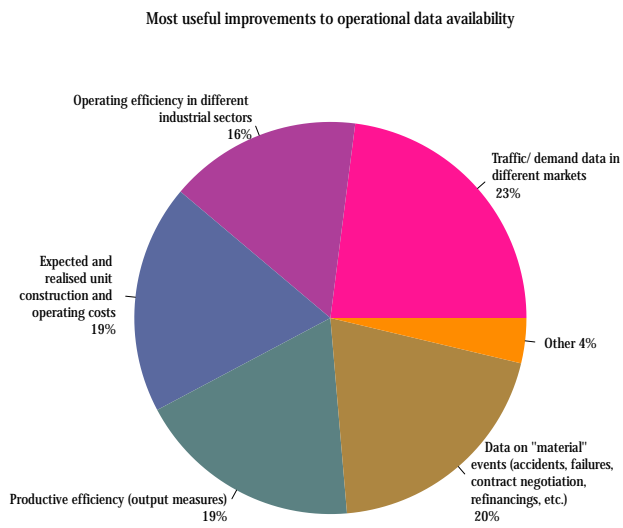
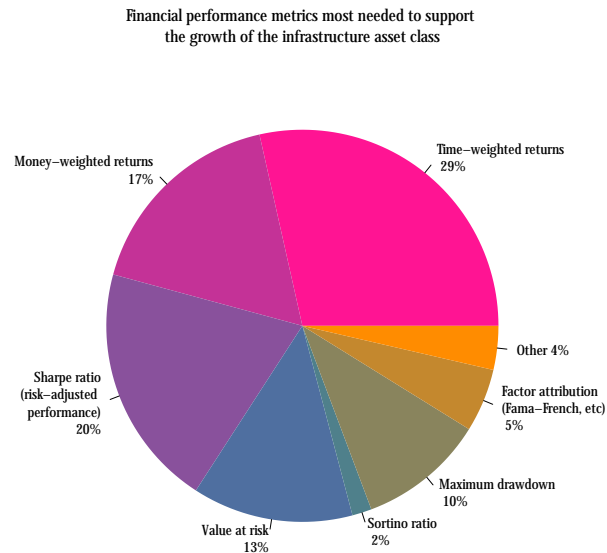


Figure 43: Operational data availability



3. Investment Beliefs

Figure 44: Financial performance metrics



Other general data gaps identified by respondents include data on the role and performance of public authorities in infrastructure projects. Data related to environmental and social governance (ESG) was also an important consideration for some respondents.

In conclusion, several improvements can be made to information availability on infrastructure investment and to promote infrastructure investment.

The majority of respondents believe that operational, firm-level data should be provided to encourage investment in infrastructure. Respondents would like to see better data in most dimensions of operational data.

In terms of financial metrics, the demand for proper metrics identified in the 2016 EDHEC/GIH survey remains, with a focus on producing time-weighted and risk-adjusted return measures.

This last data gap is now being filled with the launch of the EDHEC*infra* infrastructure equity and debt benchmarks which include all the relevant metrics of risk and financial performance mentioned by the respondents to this survey.

4. Willingness to Invest



4. Willingness to Invest

In this section, we provide a brief formalisation of the notion of contingent valuation (CV), specifically examining *willingness to invest* (WTI), that is, the decision for a representative investor i to agree to invest in a new asset at an expected rate of return of r^* .

This framework motivates our choice to design this survey to elicit responses about the level of investment returns required by investors of different kinds to agree to invest in infrastructure companies or products.

Very few examples of empirical WTI studies exist. Aguilar (2009) and Aguilar and Cai (2010) use ordinal utility models to examine investors' WTI. Aguilar (2009) examined what characteristics impact on the WTI in wood-based energy products in the United States. While Aguilar and Cai (2010) examine the characteristics that impact on the investment in different types of renewable energy. Neither studies examine the impact of returns on WTI or how the characteristics of the assets impact the return demanded by investors.

To our knowledge, this is the first study which applies this approach to private equity and debt investments.

In what follows, we briefly describe the standard CV willingness-to-pay (WTP) framework (4.1) and its extension to capture investors' willingness to invest (4.2). We then describe the survey design and methodology used to interpret the responses (4.3).

4.1 Stated Preferences and Willingness to Pay

When investors buy and sell assets at a given price, their decision to invest can be said to "reveal" their preferences about the risk/return trade-off of a given investment.

When assets are highly illiquid and seldom traded, as is the case of private infrastructure equity, investors' preferences are not revealed often enough to build time series of asset prices. However, we can rely on an alternative framework, aimed at eliciting "stated preferences" from investors.

Until now, this approach has been used to estimate the *willingness to pay* or *willingness to accept* a certain price or situation when no market exists to document individual preferences.

Typical examples have included cases of environmental degradation in which a loss of value had to be estimated by a court, or public policy decisions with respect to common goods such as the preservation of public parks or water bodies.

The CV willingness-to-pay methodology was first used in the 1950s to value outdoor recreation facilities. But it was only in the 1970s and 1980s that contingent valuation started to be widely accepted as a methodology to value nonmarket goods (see Bateman and Willis, 1999, for a review).

The Exxon Valdez disaster was instrumental in publicising and improving the methodology for the valuation of nonmarket goods.

4. Willingness to Invest

In their report on the disaster, Carson et al. (1992) were able to estimate the noneconomic use costs of the disaster by employing CV analysis WTP methodology.

WTP asks a respondent how much they are willing to forgo in order for a nonmarket good to be provided. After the Carson et al. (1992) report, issues were raised in the appropriateness of CV methodology to value nonmarket goods. In the United States, CV methods were used to assess damages, and it was important to establish that they were appropriate.

The National Oceanic and Atmosphere Administration (NOAA) then famously commissioned a report from Nobel Laureates Kenneth Arrow and Robert Solow. The Arrow et al. (1993) report validated the methodology and produced a set of guidelines to implement it. This qualified support of the CV methodology has resulted in a multitude of applications of the CV methodology. Carson (2012) identifies thousands of CV studies in over 130 different countries.

4.1.1 Economic Theory of Contingent Valuation

CV methods start with the assumption that all economic agents have a utility function that includes their preferences for market goods, X and nonmarket goods, Q .

This can be represented by a utility function given as $U = f(X, Q)$, where X and Q are vectors of market and nonmarket goods, respectively.

Income, y , is allocated to the purchase of market goods, with the agent maximising their utility for a given price vector, p , and level of nonmarket goods, Q .

The choice of X that maximises U is a function of prices, income, and desired level of Q , otherwise described as $X(p, Q, y)$.

Hence, the maximum utility available for the given level of prices, income, and level of Q demand is written:

$$U(p, Q, y) = f[X(p, Q, y), Q]$$

otherwise defined as the indirect utility function.

If the agent desires a higher level of the nonmarket good $Q^1 \geq Q^0$, then the following equation must hold:

$$U(p, Q^0, y) = U(p, Q^1, y - WTP)$$

WTP is thus the maximum level of income an agent is willing to forgo to ensure that the level of Q demanded of the nonmarket good remains at least as high as Q^0 . (see Carson and Willis, 1999, for a detailed discussion of the economic underpinnings of WTP models.)

In other words, WTP is the amount an economic agent is willing to forgo to maintain their current level of utility. We now extend this proposition to an investment framework.

4. Willingness to Invest

4.2 Willingness to Invest

While infrastructure investments are not, strictly speaking, nonmarket goods, they can be said to be very illiquid. Deal lead times are long, transaction costs are high, and at any point in time, few assets are available to invest in.

As a result, since investor preferences are seldom revealed in market transactions, asking investors to state their preferences can be a valid approach to understanding the formation of prices for infrastructure assets.

In particular, since private infrastructure markets can be said to be "incomplete," there typically exists a range of prices that apply to a single infrastructure investment, depending on investor preferences. In other words, in highly illiquid private markets, the law of one price does not apply, and the bid-ask spread can remain significant at all points in time.

WTP methods apply to *absent markets*: by definition there is no trading of nonmarket goods. Their application to incomplete markets, however, is straightforward, and if trading is very infrequent as is the case for infrastructure, they are equally powerful there.

Like the economic agents considered by Arrow et al. (1993), investors are expected utility maximisers and should be solely concerned with the risk-adjusted level of their portfolio returns, that is, the excess

return (above the risk-free rate) per unit of risk taken (Sharpe, 1964).

Say an investor has a time-invariant utility function U , and wealth at time t of W_t . At the beginning of the period (denoted by $t = 0$), expected utility from the consumption of the investor's wealth at the end of the period ($t = 1$) is written $U = U(W_1)$.

This wealth is invested, so $W_1 = W_0(1 + Rp)$ with Rp representing the return on the investor's portfolio over the period.

Hence, investor utility is a function of initial wealth W_0 and Rp , or $U = U(W_0, Rp)$.

The investor's willingness to invest in a new asset returning r^* can be captured by comparing the return of Rp with that of Rp^* , the portfolio of the investor including the new asset, written:

$$Rp^* = Rp + a(r^* - Rp)$$

where a is the weight in percentage (the proportion of wealth) invested in the new asset.⁷

For the investor to wish to invest in the new asset at the price P , its marginal contribution must be a nonnegative change in utility. The indifference condition is:

$$U(W_0, Rp) = U(W_0 - P_0, Rp^*)$$

where P_0 is the maximum price of the new asset at the beginning of the period. If we define

$$r^* = \frac{P_1 - P_0}{P_0}$$

7 - The new portfolio return is written $Rp^* = (1 - a)Rp + ar^*$. Since the weights add up to 1, we can easily write $Rp^* = Rp + a(r^* - Rp)$.

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we also have

$$P_0 = \frac{P_1}{r^*} - 1 = wti(r^*)$$

with $wti(\cdot)$, the investor's willingness-to-invest function, increasing in r^* .

Replacing the condition to accept a new investment, we have

$$U(W_0, Rp) = U(W_0 - wti(r^*), Rp^*)$$

where r^* is the minimum return acceptable to agree to invest in the new asset, given investor risk preferences.

Indeed, while investors always prefer a higher utility, they are also risk averse, that is, taking more risk reduces utility by some factor.

For a given level of Rp the investor always prefers a lower value of Sp , the portfolio risk measure. Sp is written:

$$Sp = \{\sigma_p + 2a(\rho - \sigma_p) + a^2(v1 - 2\rho + \sigma_{r^*})\}^{\frac{1}{2}}$$

where σ_p and σ_{r^*} are the risk measures of the initial portfolio and the new asset and ρ is the correlation measure.

The marginal risk contribution of the new asset to the portfolio, which will determine the WTI, is determined by its correlation ρ with the portfolio return and the riskiness of the new asset itself, σ_{r^*} .

Hence, given investor risk (and other) preferences, the marginal contribution of the new asset can be estimated by bidding successive price / expected-return levels until the condition defined above is satisfied.

4.3 Survey Design and Methodology

In this section, we describe the operationalisation of the simple theoretical framework highlighted above. We address two important aspects of the methodology, the integration of preference uncertainty in the question design and the statistical estimation of the results from the survey responses.

4.3.1 Uncertainty about Value

The conditions for an investor to agree to investing in a new asset described above imply that she knows exactly what the characteristics of her portfolio are, as well as those of the new asset, and thus can answer the question "would you agree to invest at the rate of return X?" without hesitation.

In practice, this is unlikely to be the case. In particular, when describing private infrastructure investment opportunities in the context of a CVM survey, we cannot provide respondents with metrics such as the investment's Sharpe ratio or its correlation with the initial portfolio.

Instead, we describe a realistic but generic private investment opportunity in infrastructure. Questions follow a matrix of key characteristics such as the type of business model, lifecycle stage, and geography that we wish to control for, as well as certain static parameters like company size and leverage; the rest of the question is generated randomly from a bank of project or product descriptions, including the investment country and sector.

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Thus, we remove potential respondent biases toward certain countries or sectors that might systematically impact responses.

For instance, Spanish toll roads experienced a wave of bankruptcies in recent years and this would be likely to bias responses if the OECD/equity/merchant infrastructure question is always a Spain question.

As a result, each question is about an investment proposal which can be too generic to answer with certainty (“Would you invest? yes or no”) at various levels of r^* .

Instead, respondents are presented with an investment proposal which is designed to trigger what you might call “risk reflexes” in seasoned infrastructure investors; for instance:

“Say that you are offered the opportunity to invest in a 25 km sewer tunnel in the UK. The construction is expected to take up to 8 years and will cost an estimated GBP 4.2 billion. Debt financing consists of a GBP 700 million, 35 year loan.”

or

“Say that you are offered the opportunity to invest in a wireless network asset in Nicaragua that has been operating for 16 years.

The government stake in the asset was sold to a private party 3 years ago. About a year later, the private party acquired almost all of the remaining share from other private investors, eventually holding a 99.03% stake in the company . . .

Would you be willing to invest equity in this project at the average expected nominal return (IRR) of . . .”

Given the nature of the question asked, most respondents would want to know more information before actually investing and would be uncertain about their precise, actual required rate of return.

Nevertheless, they should also be able to give reasonable return bounds given their investment experience, preferences, and the question being asked.

The premise behind our question design is that the average investor (with the average risk aversion) will be able to recognise a good deal (or bad one) when they see one.

4.3.2 Question Design

Questions asked were tailored to the respondents' self-identified expertise or interests.

As discussed in section 2, before the infrastructure questions were provided, respondents were asked to identify their interest in infrastructure markets, either debt or equity, emerging markets or OECD, and

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Figure 45: Example question format

	Definitely "Yes"	Probably "Yes"	Unsure	Probably "No"	Definitely "No"
13%	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11%	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9%	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7%	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
5%	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
3%	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

either infrastructure assets or infrastructure products.

The general form of the questions provided is displayed below in figure 45. The scenario provided a brief description of the project with a brief summary of important risk information regarding country, revenue risk, capital structure, and currency of returns.

Willingness to invest is expressed in terms of internal rate of return (IRR) since it remains a standard manner of presenting an investment proposition to an investor in the private asset space.

The question format allowed the respondent to select their preference for investing in the project for a given internal rate of return (IRR). A broad IRR range was intentionally set to ensure it encompassed all required possibilities.

These preferences ranged from "definitely no" to "definitely yes" with three other options that allowed the respondent to express uncertainty at a given IRR.⁸

This method is referred to as the multiple bounded discrete choice (MBDC) question format, borrowing from both payment-card and discrete-choice contingent-valuation approaches, both of which are widely recognised and mature methodologies employed in stated preference valuations (Welsh and Poe, 1998).

Hence, MBDC allows deriving cardinal utility measures from ordinal preferences, that is, a range of values that a respondent would be willing to pay for a certain nonmarket or illiquid good.

4.3.3 Response Coding

The zone where an investor reveals their willingness to invest is found at the point where they *switch* from being unwilling to being willing to invest.

For a given investment opportunity, for investor i , X_L^i is the lower bound of r^* below which the investor would **not agree** to invest.

X_U^i is the upper bound of r^* from which the investor **would agree** to invest. We can assume that wti_i lies between $[X_L^i, X_U^i]$.

8 - The responses collected are ordinal in nature. However, we need cardinal values to identify the WTI in highly illiquid private infrastructure assets. Welsh and Bishop (1993) show that cardinal contingent-valuation preferences can be obtained from ordinal preferences if a two-stage "referendum approach" is adopted. First, respondents are asked to select a

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Next, employing different switching intervals for the response choices allows controlling for levels of uncertainty and deriving valuation bounds.

The upper bound represents the IRR level at which an investor would be in agreement to buy the new asset.

We code it as responses “probably yes” and “definitely yes.” All other responses at the quoted IRRs for that investment can be taken to indicate that the investor is *not sure* he is willing to invest.

The lower bound represents the IRR below which investors are not willing to buy the new asset and have answered “probably no” and “definitely no” for a given IRR. All other responses at quoted IRRs for that respondent can be considered to indicate she *might be* willing to invest.

Thus, the bounds we derive have a direct interpretation as the bid and ask prices prevalent in a given market at the time of the survey, that is, these are the “good deal bounds” described in the theory of asset pricing in incomplete markets.

4.3.4 Probabilities Estimation

Following Welsh and Poe (1998), the log-likelihood function of allowing for the determination of the switching boundary is written:

$$\ln(L) = \sum_{i=1}^n \ln[F(X_U^i; \beta) - F(X_L^i; \beta)] \quad (4.1)$$

where L is the log-likelihood and $F(X_U^i; \beta) - F(X_L^i; \beta)$ is the probability that the WTI falls between a range of an upper bound, $F(X_U^i; \beta)$, and a lower bound, $F(X_L^i; \beta)$.

To estimate the WTI, a logit regression is conducted on the data using the following form:⁹

$$Indicator = \alpha_i + \beta_{0,i}X + \beta_{1,i}Y \quad (4.2)$$

where *Indicator* is a binary-choice variable taking the value 0 for “no” or 1 for “yes,” when the respondent is willing to accept a given level of IRR; X is the quoted IRR that the respondent chose; Y is matrix of control variables for respondent types.

Once the logit regression results have been obtained, regression coefficients give us two outputs.

The first is the mean WTI, given by the formula:

$$\overline{WTI} = \frac{-\bar{X}\beta' + \alpha}{\beta_0} \quad (4.3)$$

where $-\bar{X}\beta'$ is the sum of the average value of the observed control variables in the sample multiplied by their regression coefficients, and β_0 is the regression coefficient for the IRR variable in the regression. α , in this case is the intercept of the logit regression.¹⁰

To estimate the WTI for specific target groups, we replace the average value of the

9 - A logit regression uses categorical data as the dependent variable. For this analysis 0 or 1 is employed as the dependent variable indicating whether or not an IRR was selected.

10 - To develop confidence intervals for the mean WTI, we apply the Krinsky and Robb (1986a) and Krinsky and Robb (1986b) bootstrapping approach.

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observed control variable with that of the value for the specific target group's variable. For instance when estimating the WTI for a greenfield asset, we replace the average of all the greenfield indicator dummies with that of one to estimate the WTI.

The second output from the regression allows inferring the probability of observing a positive willingness to invest among the sample of respondents at different levels of expected returns. The predicted probability of investment is given by:

$$Pr(Invest)_X = 1 - \frac{1}{1 + \exp^{-(\alpha + \beta_0 X + \beta_1 Y)}} \quad (4.4)$$

where α , β_0 and β_1 are the regression intercept, coefficient on the IRR, and coefficients for the control variables, and X and Y are defined as above.

In the next section of this paper, we present both the mean WTI and probability of investment occurring at set levels of IRRs. Regression coefficients are provided in the Appendix.

5. Return Preferences



5. Return Preferences

In this chapter, we present the results of the contingent valuation questions about the level of returns required by different investors for different types of infrastructure investment.

We report the bounds defined in section 4.3.3: a lower bound of r^* , below which investors would **not agree** to invest (prices are too high); and an upper bound of r^* , from which the investor **would agree** to invest (prices are "good deals").

The results presented here focus on the willingness to invest of the different groups of survey respondents in OECD and emerging-market project equity, across business models and the project lifecycle (5.1); as well as in different kinds of debt and equity investment products (5.2).

5.1 Willingness to Invest in Infrastructure Project Equity

We first report the WTI results for infrastructure equity in either OECD or emerging markets, as shown in tables 3 and 4.

On average, in OECD markets the mean lower and upper bounds for the required private infrastructure equity IRR are 10.6% and 12.4%.

The similar range of required returns in emerging markets is a low IRR bound of 16.9% and a high bound of 19.6% before investors are willing to invest in private infrastructure equity.

As these are statistical estimates, they are themselves uncertain. The 95% confidence interval of each mean bound value suggests a maximum required-return range of 9.9% to 13.7% for OECD infrastructure, and of 15.7% to 22.4% in emerging markets.

As discussed in the previous chapter, this range can be interpreted as the bid-ask spread that applies to these assets in a highly illiquid and incomplete market where investor preferences determine required returns as much as market forces.

In the OECD, the private infrastructure equity bid-ask spread is less than 200 basis points, whereas in emerging markets it is closer to 270 basis points.

Investors thus report a broad-market emerging-market equity premium (over OECD infrastructure equity) in the 6-7% range, which is significant.

Finally, we note that required returns for OECD private equity are very much in line with the realised returns of the EDHEC*infra* private broad market European infrastructure index for 2016.¹¹

While each set of results was obtained using completely different and independent methodologies, the mean broad market equity return estimated from stated preferences (the survey) matches the one derived from revealed preferences (the EDHEC*infra* index).

¹¹ - Freely available online at edhec.infrastructure.institute.

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Figure 46: Proportion of respondents willing to invest at the required IRR, OECD infrastructure.

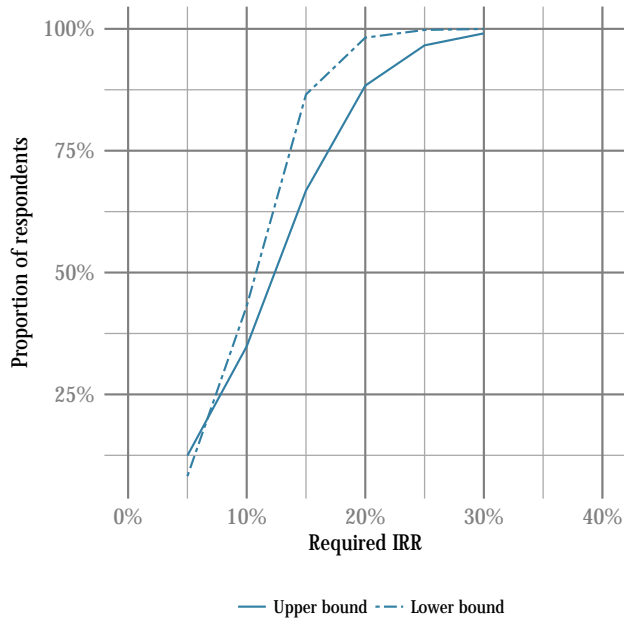
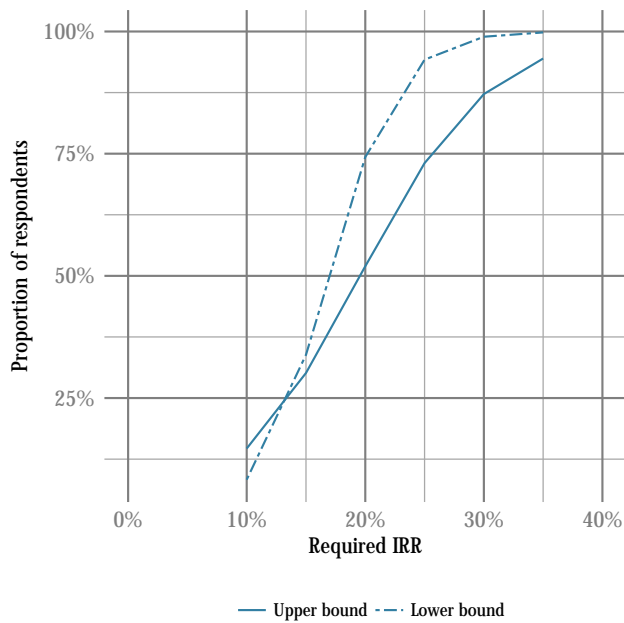


Figure 47: Proportion of respondents willing to invest at the required IRR, emerging-market infrastructure.



5. Return Preferences

Table 3: This table presents the mean and 95% confidence intervals for the IRR demanded by equity investors for an investment in OECD infrastructure.

	Lower	Upper
Mean WTI	10.6%	12.4%
95% CI	9.9% - 11.4%	11% - 13.7%

Table 4: This table presents the mean and 95% confidence intervals for the IRR demanded by equity investors for an investment in emerging-market infrastructure.

	Lower	Upper
Mean WTI	16.9%	19.6%
95% CI	15.7% - 18.2%	16.9% - 22.4%

As discussed in section 4.3.4, the raw willingness-to-pay data allows computing a series of probabilities to invest for each proposed IRR level.

Figures 46 and 47 show upper and lower limits of the probability that a survey respondent is willing to invest at a given IRR in OECD or emerging-market infrastructure equity, respectively. The data for the results shown in figures 46 and 47 and others below can be found in the appendix.

The bounds we find are typical of the persistent bid-ask spread phenomenon discussed earlier. At very low levels of return, most market participants agree that they would not invest, irrespective of their nature or preferences or of the details of the transactions.

At the other end of the return spectrum, the immense majority of respondents agree that they would invest in infrastructure equity beyond a certain return threshold (e.g., in the OECD, beyond 30% return, 100% of respondents are willing to invest equity in *any* of the different categories of infrastructure firms that were included in the survey).

In between, differences in investor preferences create a bid-ask spread which varies in size. As we will see in the rest of the paper, sometimes this bid-ask spread can be very narrow.

We now turn to examining whether the individual characteristics of infrastructure assets affect the IRR demanded by investors.

We examine the impact of the project lifecycle, business model, and investor type. To ensure our results are not biased, we only use respondents that answered all of the same "family" of questions.

5.1.1 Project Life Cycle

To test for a project-lifecycle effect, respondents were asked about identical scenarios in terms of business model and geography, with the only variation being whether the investment proposed was greenfield or brownfield. We defined greenfield assets as entirely new assets and brownfield assets as existing assets.

It is usually believed that the greenfield stage of infrastructure projects carries higher risks and therefore higher risk premia. A number of surveys, such as Blanc-Brude

5. Return Preferences

et al. (2016), thus ask a question reflecting this *a priori* belief and juxtaposing the two options in the same question, for example, "What is the range of expected returns in a/ Greenfield infrastructure and b/ Brown-field infrastructure?" Respondents typically answer that they expect greenfield risk premia.

However, this *a priori* should be qualified for several reasons. First, while construction risks are nontrivial in infrastructure projects, they do not necessarily impact investors requiring risk premia. For instance, equity investors in project-finance transactions are mostly protected from construction risk by a fixed price, date-certain construction contract, and cost overruns at the project-company level that have been shown to be close to zero on average (see Blanc-Brude and Makovsek, 2014, for an empirical analysis using *ex ante* and *ex post* construction costs).

Second, the size of construction risks and any related premium, may not be larger than risk premia associated with risks in the postconstruction phase of infrastructure projects, such as traffic risk or regulatory changes.

A review of the literature on the sources of failure of infrastructure projects (Blanc-Brude, 2013) or of the determinants credit spreads in project debt (Blanc-Brude and Ismail, 2013) confirms the view that construction risks are not the main cause of failure nor the driver of the cost of debt in projects.

Finally, and perhaps most fundamentally, construction risks are almost entirely idiosyncratic. As such, they are unlikely to be driving the risk pricing of the average investor, since they can, in principle, be diversified away.

Thus, from a portfolio perspective, it can be argued that the construction risks associated with the greenfield phase of infrastructure investments are only one source of idiosyncratic volatility among others, which does not tend to affect equity investors (at least in project finance). Neither is it the largest source of investment risk for investors.

Looking at the survey results, the average willingness to invest in greenfield (GF) or brownfield (BF) infrastructure equity is shown in tables 5 and 6.

Survey respondents report continuing to be willing to invest between 10.5% and 12.4% with no noticeable greenfield premium. The regression results in table 15 in the appendix confirm that the greenfield variable has no statistically significant explanatory power.

In emerging markets, this average return is still between 16.9% and 19.8% with, again, no discernible premium for greenfield investments.

Figures 48 and 49 demonstrate the lack of difference between greenfield and other infrastructure investments. The lines either overlay each other or the difference is very small.

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Figure 48: Proportion of respondents willing to invest at the required IRR, OECD, greenfield or other infrastructure.

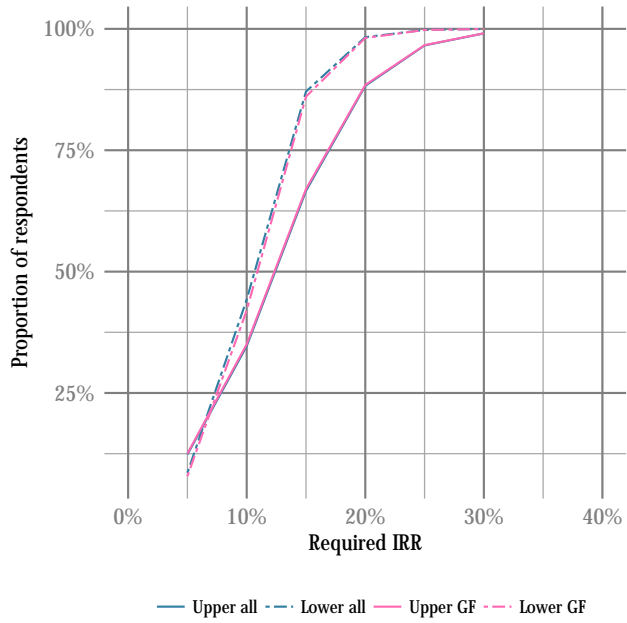
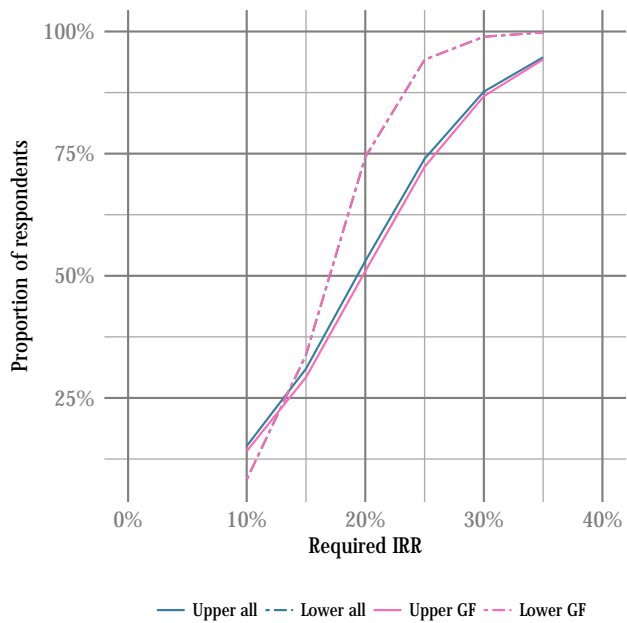


Figure 49: Proportion of respondents willing to invest at the required IRR, emerging markets, greenfield, or other infrastructure.



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Table 5: This table presents the average IRR demanded by investors for an investment in greenfield or brownfield OECD infrastructure equity.

	Lower all	Upper all	GF lower	GF upper	BF lower	BF upper
Mean WTI	10.6%	12.3%	10.8%	12.3%	10.5%	12.4%
95% CI	9.9% - 11.4%	11% - 13.7%	9.7% - 11.8%	10.4% - 14.2%	9.5% - 11.6%	10.4% - 14.3%

GF denotes greenfield, BF denotes brownfield.

Table 6: This table presents the average IRR demanded by investors for an investment in greenfield or brownfield emerging-market infrastructure equity.

	Lower all	Upper all	GF lower	GF upper	BF lower	BF upper
Mean WTI	16.9%	19.6%	16.9%	19.8%	16.9%	19.4%
95% CI	15.7% - 18.2%	16.8% - 22.4%	15.3% - 18.6%	15.9% - 23.8%	15.2% - 18.8%	15.5% - 23.3%

GF denotes greenfield, BF denotes brownfield.

This result will surprise many readers, since it contradicts the a priori view that greenfield infrastructure investment should always carry an additional risk premium.

However, for the reasons highlighted above, we believe that this is a correct representation of investors' *actual* risk preferences. Construction risk is project specific, and it is not necessarily large compared to other factors impacting the overall business risk of the firm, such as demand risk.

Why then do respondents to the standard "greenfield vs. brownfield" question give a positive value to a supposed greenfield premium, including in the 2016 EDHEC/GIH survey?

First, it is not typically the case that such surveys test for the statistical significance of any reported difference between greenfield and brownfield investment. Our 2016 survey was guilty of the same flaw.

Most importantly, the answer can be found in the field of behavioural sciences: question framing. In other words, by asking respon-

dents to give two expected return rates for two types of infrastructure investments, the question implies that they must be different. Indeed, the notion that construction risks are high is widespread among infrastructure practitioners and justifies the framing.

In this survey, instead of juxtaposing the idea of greenfield and brownfield investments in a single question and asking respondents to confirm the a priori belief that is reinforced by the structure of the question itself (why ask otherwise?), we ask respondents to express their views about detailed investment propositions, including whether or not they are greenfield projects, and to express their price preferences on an investment-by-investment basis, randomising most of the rest of the text in the question.

We derive the bounds within which investors value infrastructure projects, greenfield or not, and find that whatever greenfield risk premia some investors may require (or not), remains within the price bounds for all possible investments.

5. Return Preferences

As argued above, from a theoretical perspective, and relying on peer-reviewed empirical research, the null hypothesis should be that the construction-risk premium is, on average, zero. Our survey results confirm that this hypothesis cannot, so far, be rejected.

We next examine the effect the infrastructure project's business model has on the returns demanded by investors.

5.1.2 Business Models

The idea that infrastructure investments should be categorised by business models and not by industrial sectors was first put forward in Blanc-Brude (2014).

The argument draws from simple finance theory: business models can be expected to correspond to systematic sources of risk in infrastructure investments whereas industrial sectors cannot.

This view has since become widely adopted by investors and prudential regulators (see for instance EIOPA, 2016).

Simply put, infrastructure firms can derive a contracted, merchant, or regulated income stream, and their size, financial structure, debt covenants, and *in fine* their business-risk profile can be expected to reflect this.

In the 2016 EDHEC/GIH survey, respondents reported a higher rate of return for merchant infrastructure over both contracted and regulated infrastructure. Likewise, this question suffered from a

degree of framing driven by the a priori belief that business models carry different levels of systematic business risk.

This a priori, however, is supported by finance theory.

We also find support for this conclusion in this survey: the range of IRRs demanded by investors to make them willing to invest in merchant infrastructure is significantly higher than for contracted or regulated infrastructure.

Tables 7 and 8 show the mean values of the lower and upper IRR bounds for the three business models for OECD and emerging-market infrastructure, respectively.

Investors demand a premium of about 150 basis points to invest in merchant infrastructure in both emerging market and the OECD. This is consistent with our 2016 survey results in which respondents reported a very small, possibly insignificant difference in expected returns between OECD and emerging-market merchant infrastructure.

Figures 50 and 51 illustrate these results and show that at each required IRR level there is a lower probability that any respondents would be willing to invest in merchant infrastructure rather than all other infrastructure types.

5.1.3 Investor Type

Next, we examine the expected returns required by different types of investors for

5. Return Preferences

Figure 50: Proportion of respondents willing to invest at the required IRR, OECD, merchant or other infrastructure.

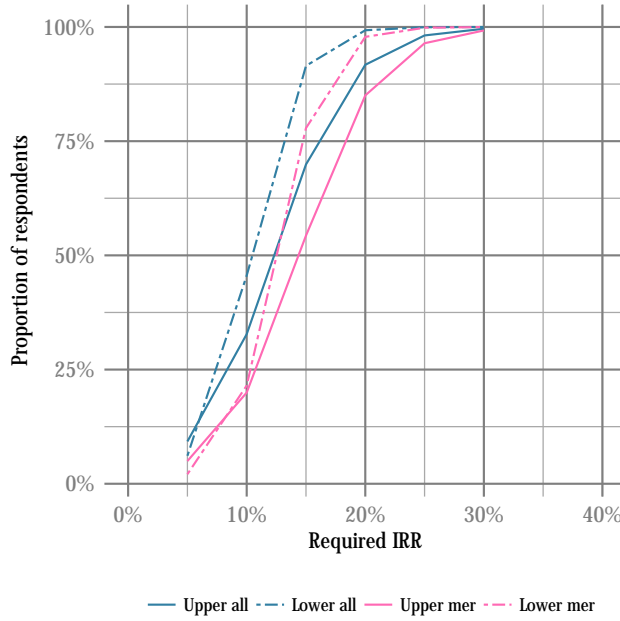
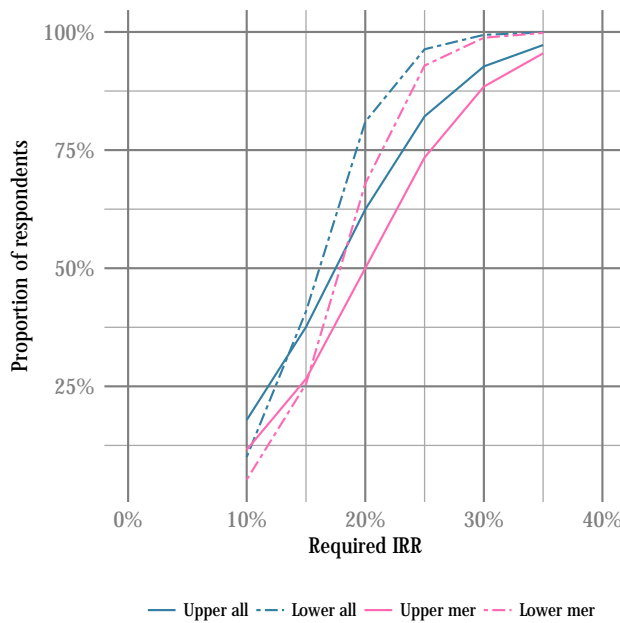


Figure 51: Proportion of respondents willing to invest at the required IRR, emerging markets, merchant or other infrastructure.



5. Return Preferences

Figure 52: Proportion of respondents willing to invest at the required IRR in OECD infrastructure

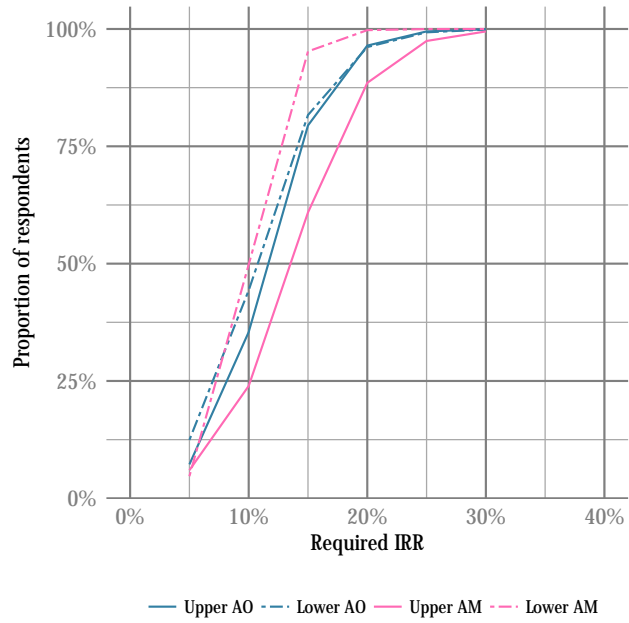
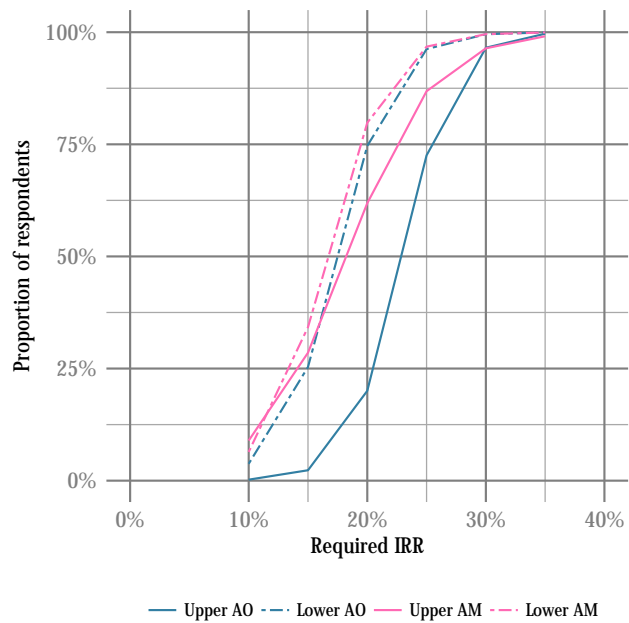


Figure 53: Proportion of respondents willing to invest at the required IRR in emerging-market infrastructure



5. Return Preferences

Table 7: This table presents the average IRR demanded by investors for an investment in OECD infrastructure equity by business model.

	Lower all	Upper all	Con lower	Con upper	Mer lower	Mer upper	Reg lower	Reg upper
Mean WTI	10.7%	12.4%	10.3%	12.3%	12.2%	13.8%	11.4%	12.6%
95% CI	10.1% - 11.3%	11.2% - 13.6%	9.3% - 11.4%	10.3% - 14.4%	10.9% - 13.4%	11.5% - 16.1%	9.5% - 13.3%	9% - 16%

Con denotes contracted infrastructure; Mer is merchant infrastructure; and Reg is regulated infrastructure.

Table 8: This table presents the average IRR demanded by investors for an investment in emerging-market infrastructure equity by business model.

	Lower all	Upper all	Con lower	Con upper	Mer lower	Mer upper	Reg lower	Reg upper
Mean WTI	16.9%	19.7%	16%	17.5%	18.2%	21.3%	18.7%	23.9%
95% CI	15.8% - 18.1%	17.1% - 22.2%	14% - 18.1%	13.3% - 21.8%	16% - 20.4%	16.4% - 26.2%	15.2% - 22.2%	16.2% - 31.6%

Con denotes contracted infrastructure; Mer is merchant infrastructure; and Reg is regulated infrastructure.

Table 9: Average required equity IRR in OECD infrastructure, by investor type

	Lower all	Upper all	AO lower	AO upper	AM lower	AM upper	Other lower	Other upper
Mean WTI	10.7%	12.3%	10.7%	11.5%	10%	13.6%	10.4%	11.7%
95% CI	9.9% - 11.4%	11.1% - 13.6%	7.3% - 14.1%	10.3% - 12.8%	8.8% - 11.3%	11.6% - 15.6%	9.3% - 11.6%	9.8% - 13.6%

AO is asset owners; AM is asset managers; and Other denotes all other respondents.

Table 10: Average required equity IRR in emerging-market infrastructure, by investor type

	Lower all	Upper all	AO lower	AO upper	AM lower	AM upper	Other lower	Other upper
Mean WTI	16.9%	19.5%	17.5%	22.9%	16%	18.7%	16.7%	18.3%
95% CI	15.8% - 18.1%	17.2% - 21.9%	15.2% - 19.8%	18.5% - 27.4%	14.4% - 17.6%	15.7% - 21.8%	10.3% - 23.1%	16% - 20.7%

AO is asset owners; AM is asset managers; and Other denotes all other respondents.

private infrastructure equity in OECD and emerging markets.

In both geographies, we find a statistically significant difference between the IRR required by asset owners and that required by asset managers (See tables 23 and 25 in the appendix).

Table 9 shows the mean Equity IRR bounds demanded by asset owners and managers for OECD infrastructure. Asset owners price bounds are rather tight and between 10.75% and 11.5%, whereas bounds reported by asset managers, between 9.65% and 14%, are much broader and

completely include asset owners' return preferences.

Figure 52 illustrates this point even better at different levels of required return: the bid-ask spread of the asset-owner category is in fact rather narrow and only significant at the lower end of the return spectrum, where asset owners are equally likely to invest at differing levels of expected returns. For instance, there is one chance in three (33% probability) that asset owners would be willing to invest between 8% and 10% IRR.

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The bid-ask spread reported by asset managers is however much wider, and explains most of the observed range of prices shown in figure 46. As the likelihood of investment increases, so does the bid-ask spread: at a 75% chance that an asset manager would agree to invest in OECD infrastructure equity, the required return can vary between roughly 12.5% and 17.5%, a 500-basis-point difference.

At the same probability of agreeing to invest, asset owners almost unanimously require a 14% return.

This difference could be the result of several nonexclusive effects, including:

1. Asset managers are infrastructure specialists and have better information about the riskiness of the different investments proposed, hence they are more granular in their answers;
2. Individual asset managers correspond to a heterogeneous group of strategies, from investing in low-risk contracted solar power, to high-risk merchant toll roads, whereas asset owners would be exposed to all these strategies simultaneously and require broad market returns.

For emerging markets, the picture of asset owners and managers is very different, as shown in table 10. The mean IRR demanded by asset owners is between 17.5% and 22.9%, while asset managers require returns between 16% and 18.7%.

As shown in figure 53, the degree of consensus and the likelihood of an investment decision are very different than for OECD infrastructure.

Asset owners have a wide range of views on required returns in emerging-market infrastructure, and even at the 75% positive investment-decision probability, the bid-ask spread again exceeds 500 basis points.

Asset managers exhibit a narrower, perhaps more accurate view of required equity returns in emerging-market infrastructure. They are happy to invest at a lower average level of returns.

Asset owners required emerging-market premium (over OECD infrastructure equity) range between 7% and 11.5%, whereas asset managers are content with a premium of 5-6%.

Such differences in stated preferences of required returns in emerging-market infrastructure suggest that asset managers are able to intermediate such investment for only a fraction of asset owners: those requiring equity returns in line with what asset managers deem achievable. Alternatively, asset managers will have to take higher risks to meet the return requirements of asset owners.

This finding also illuminates the fact that while many asset owners declare wanting to invest in emerging-market infrastructure, much fewer actually already do. The discrepancy between what asset managers

5. Return Preferences

report to be achievable and what asset owners require may partly explain the slow pace with which institutional investors have entered emerging-market infrastructure.

5.2 Willingness to Invest in Infrastructure Investment Products

Finally, survey respondents had the option to answer CVM questions about infrastructure investment “products,” as opposed to single investment projects. A product can simply be a private equity fund or a coinvestment facility, structured product, etc.

In what follows, we report answers for product types that already exist: a classic infrastructure private equity fund, (5.2) a long-term infrastructure equity fund, (5.2) and a private debt coinvestment platform; (5.2) we also describe the responses to a product that does not yet exist: a hybrid index-tracking infrastructure fund (5.2).

A traditional infrastructure equity fund

The question proposed becoming a limited investment partner (LP) in a closed-ended private equity fund that would target “brownfield ‘core’ and ‘core+’ infrastructure in the OECD.”

The fund would have a 10-year life and three transactions were expected to require 50% of the invested capital.

The general partner would charge a 1.5% management fee, with 20% cost of carry over a 7% hurdle rate.

The general partner was also able to leverage the fund for the investments.

This kind of fund is the most common and widely available type of infrastructure investment vehicle available to asset owners who do not wish to invest directly. It is also a type of product that 80% of respondents to the 2016 EDHEC/GIH survey declared to be “obsolete and not adding value.”

This kind of fund is in fact so well known to investors that there is a great degree of consensus among respondents about required returns: we find that all investors, on average, would be willing to invest if the promised IRR was between 12.2% and 13%.

The regression analysis, reported in the appendix in table 27, shows that no investor is statistically significantly different from another within this sample. There is no significant bid-ask spread: all respondents agree about their willingness to invest for a given level of required return.

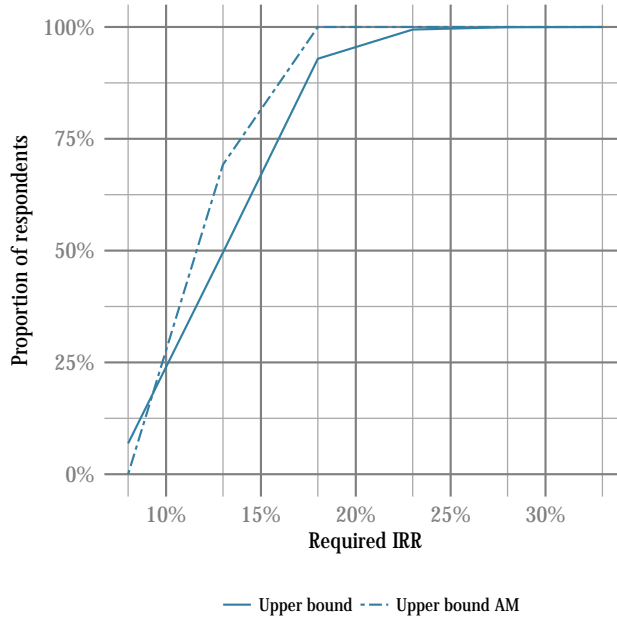
Hence, the mean required IRR reported in table 11 is 12.2%, with asset owners (here the LPs) requiring 13% on average, whereas asset managers (the GPs) are happy to invest an average return of slightly less than 12%. This is also evident from figure 54.

A long-term infrastructure equity fund

Long-term infrastructure equity funds contrast significantly with the traditional private equity style infrastructure funds described above.

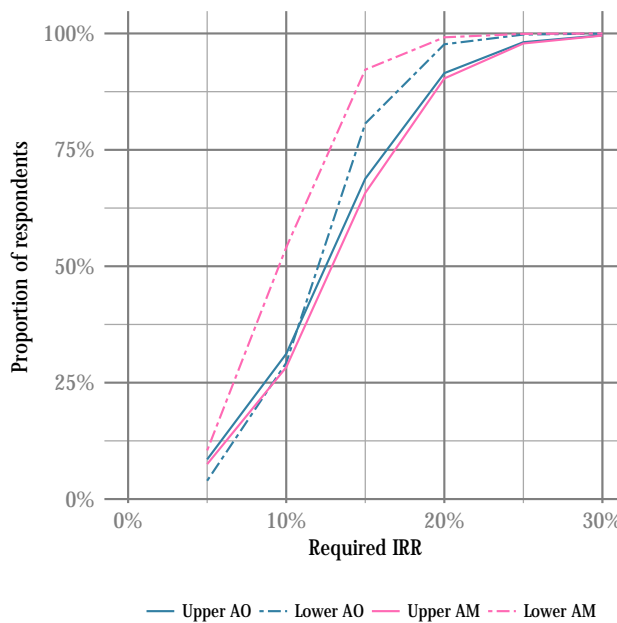
5. Return Preferences

Figure 54: Proportion of respondents willing to invest at the required IRR into a traditional infrastructure equity fund



AO is asset owners and AM denotes asset managers.

Figure 55: Proportion of respondents willing to invest at the required IRR into a long-term infrastructure equity fund



5. Return Preferences

Table 11: Average required equity IRR for a traditional infrastructure equity fund, by investor type

	All	AO	AM	Other
Mean WTI	12.2%	13%	11.7%	11.8%
95% CI	10.8% - 13.7%	10.8% - 15.2%	9.1% - 14.2%	9.1% - 14.5%

Table 12: Average required equity IRR for a long-term infrastructure equity fund, by investor type

	Lower all	Upper all	AO lower	AO upper	AM lower	AM upper	Other lower	Other upper
Mean WTI	10.3%	12.6%	11.9%	12.5%	9.6%	12.9%	9.5%	12.4%
95% CI	9.3% - 11.3%	10.8% - 14.4%	10% - 13.9%	9.1% - 15.8%	8% - 11.4%	9.6% - 16.2%	7.8% - 11.3%	9.8% - 15%

The question posed to respondents asked what IRR they would require to be willing to invest in an infrastructure fund that had a 25-year life and an investment mandate for both greenfield and brownfield infrastructure.

The underlying infrastructure projects would all be "contracted" with only 30% of the invested capital being allocated to greenfield infrastructure and no fund-level leverage.

Investors would be locked in for the life of the fund, but the fund manager would focus on providing regular payouts to the investors.

For this type of product investment, respondents do have a range of views and demand a lower mean required IRR than for a infrastructure private equity fund, between 12.3% and 12.6%.

Regression results also show that there is a statistically significant difference between respondents from both banks and asset managers on the one hand and asset owners on the other (see table 29 in the appendix).

Table 12 and figure 55 shows that, as was the case above when comparing these two investor types, the preference bounds expressed by asset owners are themselves bounded by those expressed by asset managers.

Asset managers consider that investors in long-term infrastructure equity funds should be happy to receive returns between 9.6% and 12.9%, whereas asset owners express narrower expectations with a midpoint at 12%.

As expressed above, the wider price bounds of asset managers could be the result differences in risk preferences but also in expected fee levels.

A coinvestment infrastructure debt platform

Infrastructure debt coinvestment, alongside originating banks or debt funds, is becoming more mainstream as an infrastructure investment alternative.

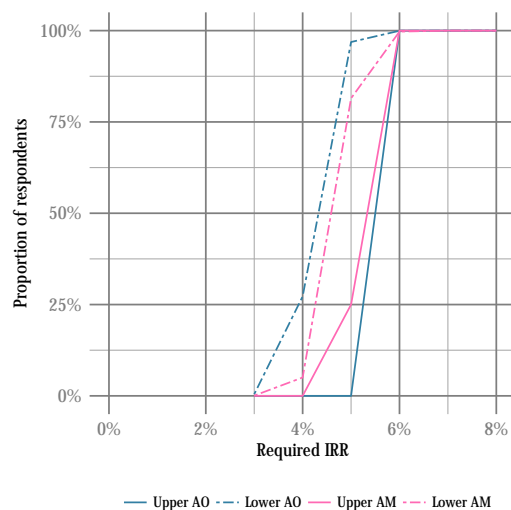
With this question, respondents were asked what yield to maturity (YTM) they would demand if they were to coinvest in a

5. Return Preferences

Table 13: Average required YTM for an investment in a debt coinvestment platform, by investor type

	Lower all	Upper all	AO lower	AO upper	AM lower	AM upper	Other lower	Other upper
Mean WTI	4.51%	5.08%	4.2%	5.5%	4.66%	5%	4.5%	5%
95% CI	4.2% - 4.8%	4.1% - 6.17%	3.7% - 4.9%	NA - 12%	4.11% - 5.09%	5% - 5%	3.99% - 5%	5% - 5%

Figure 56: Proportion of respondents willing to invest at the required YTM in a debt coinvestment platform



portfolio of project-finance loans alongside a commercial bank.

The bank would originate and structure the loans and would act as a servicing agent.

The investor would receive a fixed-rate tranche of the debt with a tenor between 12 and 18 years.

The debt would be unrated, and the underlying projects would be 50% contracted and 50% merchant globally.

Respondents reported a required YTM between 4.4% and 5.2%.

We observe no significant difference between asset owners and managers

or banks (see regression table 31 in the appendix).

Table 13 shows the mean required return for all groups examined.

Figure 56 indicates that investors are willing to coinvest at a YTM between 4% and 6%.

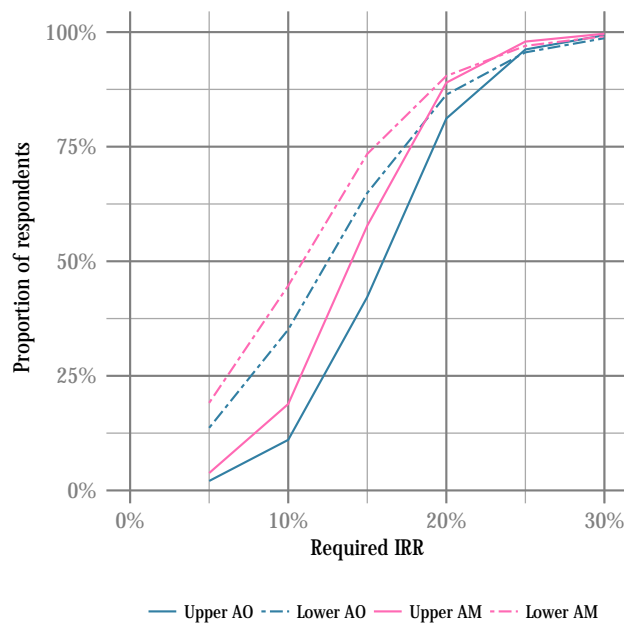
At 6%, 100% of the respondents would coinvest. This is a clear indication that in this low-interest-rate environment, investors are looking at alternatives to obtain yield.

5. Return Preferences

Table 14: Average required IRR for an index-tracking hybrid infrastructure fund, by investor type

	Lower all	Upper all	AO lower	AO upper	AM lower	AM upper	Other lower	Other upper
Mean WTI	12.4%	13%	12.5%	15.9%	10.9%	14.1%	13.1%	11.2%
95% CI	5.5% - 20.3%	8.4% - 18%	NA - 27.5%	6.9% - 25.5%	NA - 23.9%	5.3% - 23.6%	3.3% - 25%	5.3% - 18.4%

Figure 57: Proportion of respondents willing to invest at the required IRR in an index-tracking hybrid infrastructure fund



An index-tracking hybrid infrastructure fund

The final infrastructure investment product we consider is a novel type of infrastructure fund.

Respondents were asked what IRR they would require to invest in a unit trust that invests in both listed and unlisted infrastructure assets.

The fund's objective would be to optimise investor liquidity while minimising the tracking error with an EDHEC emerging-market private infrastructure equity index.

The listed infrastructure portion of the portfolio would aim to replicate some of the investment factors estimated in the unlisted infrastructure portfolio.

Investors would be able to redeem their investment, but there were gates and liquidity fees.

Survey respondents would demand a mean IRR between 12.4% and 13.0% to invest in this fund, as shown in table 14.

Given the innovation inherent in this fund, as it provides both liquidity and exposure to infrastructure, it is interesting to observe no statistically significant difference between

5. Return Preferences

asset managers, asset owners and banks in the mean WTI. Only "other" respondents have a different expectation of an appropriate IRR for this investment (see table 33 in the appendix). "Other" respondents would require an IRR between 12.76% to 14.9%.

Figure 57 shows that the vast majority of investors would choose to invest in this hypothetical fund if offered a 20% return. This is higher than both types of equity funds described above at the same level of probability, which can be surprising since this product would offer more liquidity and propose to track a documented index with a track record.

However, the fact that this type of product has never been bought or sold before by survey respondents (it is the only truly nonmarket good we consider) suggest that respondents may have a less intuitive idea of what this product actually is.

6. Conclusions



6. Conclusions

In this paper, we have reported the results of the 2017 EDHEC/GIH survey of infrastructure investors' investment beliefs and return preferences.

Survey questions were answered by 186 asset owners and managers, commercial and international banks, consultants, rating agencies, and public-sector figures among our list of *infra500* leaders.

The asset owners among them represent some of the largest investors in the world and have allocations to infrastructure investment largely above the norm. Hence, this survey represents the views of the more sophisticated and active part of the institutional space. Together, the asset owners who took this survey represent more than USD7 trillion assets under management (i.e., 10% of global AUMs).

The survey had two main components: first, it covered investment intentions, market developments, and the role of national infrastructure plans for infrastructure investors; second, it implemented for the first time a contingent valuation approach to documenting investors' return expectations and their range (the bid-ask spread).

6.1 Market Developments

Key findings

1. Most investors plan to increase their investment in infrastructure. However, this is likely to be focused on infras-

tructure in OECD markets as a significant proportion of asset owners still do not plan on investing in emerging-market infrastructure;

2. Nevertheless, the number of investors who want to invest in emerging-market infrastructure is increasing, and among those who do invest already, most want to increase their allocation.
3. Respondents think that the infrastructure deal flow in emerging markets is likely to grow at a much faster pace than in OECD countries, where it is mostly expected not to grow;
4. Still, most respondents agree that the next big thing is the US market, followed by Latin America.
5. There is also widespread agreement that infrastructure investment will eventually find its place among retail products accessible through individual pension accounts or life insurance products.

6.2 National Infrastructure Plans

Key findings

1. Currently, the majority of respondents do not focus greatly on national infrastructure plans (NIPs), with the majority knowing little about them;
2. Respondents are more familiar with NIPs in their region, but they are also more critical of them as a result;
3. In the OECD, the Juncker plan, and the UK plan come first and second as NIPs that respondents were better aware of. However, these were also the plans with the least proportion of respondents

6. Conclusions

stating that they improved the attractiveness of infrastructure investment in the country;

4. In emerging markets, respondents are more confident in the potential of NIPS to make a positive impact on the attractiveness of infrastructure investment in these countries;
5. Overall, the support shown among respondents who know the plans well is close to or at least 50% for more than half of the plans.

6.3 Quality of Intermediation

Key findings

1. As most respondents' geographic expertise lies in OECD countries, rather than emerging markets, the majority of respondents have not taken part in projects supported by one of the project preparation facilities created by MDBs. However, when they had, the experience had been mostly positive;
2. The majority of respondents did not think that terminology inherited from the real estate sector, such as "core" and "core plus," often used by asset managers to refer to different infrastructure investment profiles, was particularly problematic. One-third of respondents did however find these terms to be unhelpful or even confusing;
3. A majority of respondents also did not see any problem with the approach taken by credit rating agencies to rate infrastructure project finance debt. 10% were "not comfortable" with these methods.

6.4 Benchmarking

Key findings

1. Most respondents believe that better operational, firm-level data would support infrastructure investment;
2. They also agree that there is value in benchmarking operational performance, identifying the reporting of traffic/demand data in different markets as potentially the most useful, closely followed by construction-risk metrics and operational efficiency;
3. With respect to benchmarking financial performance, respondents identified time-weighted and risk-adjusted returns as the most important to them.

On this last point, we note that the publication of the EDHEC*infra* infrastructure benchmarks fills this particular "data gap." These broad market infrastructure indices allow investors to understand the risk-adjusted performance of the private infrastructure investment debt and equity markets.

6.5 Required Returns

Key findings: infrastructure projects

1. The lower and upper infrastructure equity return bounds in OECD markets are on par with the broad market EDHEC*infra* equity index, between 10% and 12% annual returns. These results are obtained using completely different and independent methodologies and

6. Conclusions

provide a powerful validation of the approach taken in both studies;

2. The mean emerging-market (EM) private infrastructure equity premium is between 6% and 7%. However, asset owners require higher EM premia, from 7% to 11% above OECD required returns, whereas asset managers' required EM premium is in the 5-6% range.
3. The mean equity bid-ask spread is about 200bps in OECD infrastructure markets, whereas it reaches 270bps in emerging markets;
4. The average greenfield premium is zero: neither asset owners nor asset managers declare requiring higher returns for greenfield projects, in OECD and EM alike. We argue that is correct: construction risk is idiosyncratic and not necessarily very high for equity investors relative to other sources of systematic risk. As a result, it is not priced. We argue that previous survey results that report a greenfield premium suffer from a classic "framing" problem and only reinforce an a priori misconception;
5. Merchant projects carry a systematic return premium of approximately 150 basis points, both in OECD and EM markets;
6. In OECD private infrastructure equity markets, asset owners' returns bounds are themselves bounded by the returns required by asset managers. There is a greater degree of consensus on expected returns between asset owners than between managers. We argue that this could be the result of information asymmetries between the two groups,

but it could also be the result of a more structural difference, by which asset managers tend to be single-strategy investors whereas asset owners rely on multiple managers and require better diversified broad-market returns.

Key findings: infrastructure products

1. "Core" and "core plus" infrastructure PE Funds in the OECD: the most common type of private infrastructure investment vehicle benefits from a greater consensus among investor groups. We could not detect a meaningful bid-ask spread among respondents and only report a single expected rate of return. Asset managers (the GPs) declare requiring 12% (ci: 9.1-14.2%) mean returns to agree to investing in such a fund, but asset owners, perhaps mindful of fee levels, require 13% (ci: 10.8-15.2%) on average to agree to investing in such structures;
2. A long-term infrastructure equity fund, investing in greenfield and brown-field infrastructure with no additional leverage: this products requires lower returns to be agreeable to investors. Asset owners require 12% and asset managers between 9.6% and 12.9%. Once again, asset owners' return bounds are themselves bounded by asset managers' bounds.
3. A private project-debt coinvestment platform: with debt products, investors' pricing habits are different and pricing is much tighter. Investors require fixed-rate returns in the 4.2-5% range.

6. Conclusions

4. A novel type of fund that would combine private infrastructure equity with listed-factor exposures to maximise a certain investment profile while providing limited liquidity and would track a broad market private infrastructure index would need to return between 12.5% and 15.9% to attract asset owners, and between 10.9% and 14.1% to get a positive investment decision from asset managers surveyed.

7. Appendix



7. Appendix

Table 15: Coefficients from the willingness-to-invest regression for OECD greenfield assets

	Lower	Upper
Intercept	4.5117 ***	3.286 ***
std error	0.6086	0.5934
IRR	-42.8072 ***	-26.5189 ***
std error	5.4772	4.3957
Greenfield	0.0906	-0.0169
std error	0.3091	0.3471

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 16: Probability of willingness to invest for OECD infrastructure assets for stated IRRs

IRR	Lower all	Upper all	Upper GF	Lower GF
0.05	0.12346	0.08538	0.1253	0.07857
0.1	0.34657	0.44251	0.35041	0.42028
0.15	0.66637	0.87095	0.67011	0.86041
0.2	0.88265	0.98287	0.88439	0.98128
0.25	0.9659	0.99795	0.96645	0.99776
0.3	0.99071	0.99976	0.99087	0.99974

Table 17: Coefficients from the willingness-to-invest regression for emerging-market greenfield assets

	Lower	Upper
Intercept	5.8695 ***	3.5659 ***
std error	1.0586	0.9503
IRR	-34.6423 ***	-18.4335 ***
std error	6.0558	4.6303
Greenfield	-0.0063	0.0833
std error	0.4044	0.456

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 18: Probability of willingness to invest for EM infrastructure assets for stated IRRs

IRR	Lower all	Upper all	Upper GF	Lower GF
0.1	0.15154	0.08277	0.14114	0.08325
0.15	0.30984	0.33779	0.29231	0.3392
0.2	0.53016	0.74249	0.50936	0.7437
0.25	0.73933	0.94219	0.72295	0.94253
0.3	0.87698	0.98926	0.8677	0.98933
0.35	0.94714	0.99808	0.94281	0.9981

Table 19: Coefficients from the willingness-to-invest regression for OECD assets by business model

	Lower	Upper
Intercept	5.2831 ***	3.8445 ***
std error	0.7038	0.6874
IRR	-51.0619 ***	-31.2508 ***
std error	6.3266	5.0355
Merchant	1.1179 ***	0.6693
std error	0.4251	0.4606
Utility	-0.576	-0.5816
std error	0.3902	0.4437

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 20: Probability of willingness to invest for OECD infrastructure assets for stated IRRs by business model

IRR	Lower all	Upper all	Upper mer	Lower mer
0.05	0.09263	0.06122	0.04967	0.02088
0.1	0.32752	0.45588	0.1996	0.21504
0.15	0.69912	0.91499	0.54333	0.77873
0.2	0.91726	0.99282	0.85022	0.97836
0.25	0.98144	0.99944	0.96439	0.99828
0.3	0.99605	0.99996	0.99232	0.99987

7. Appendix

Table 21: Coefficients from the willingness-to-invest regression for emerging-market assets by business model

	Lower	Upper
Intercept	5.8323 ***	3.5589 ***
std error	1.0627	0.9514
IRR	-36.4145 ***	-20.3368 ***
std error	6.3398	4.9627
Merchant	0.7018	0.5084
std error	0.5158	0.5715
Utility	0.2941	0.7929
std error	0.5025	0.5986

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 22: Probability of willingness to invest for EM infrastructure assets for stated IRRs by business model

IRR	Lower all	Upper all	Upper mer	Lower mer
0.1	0.17869	0.10058	0.11571	0.05252
0.15	0.37556	0.40852	0.26564	0.25504
0.2	0.62444	0.81009	0.5	0.67892
0.25	0.82131	0.96343	0.73436	0.92888
0.3	0.92704	0.99389	0.88429	0.98775
0.35	0.97232	0.99901	0.95481	0.998

Table 23: Coefficients from the willingness-to-invest regression for OECD assets by investor type

	Lower	Upper
Intercept	6.4784 ***	5.0954 ***
std error	1.1912	1.2987
IRR	1.1912 ***	1.2987 ***
std error	6.4036	5.3229
Merchant	-0.5497	5.3229 *
std error	0.5057	0.5852
Utility	0.2807	-1.3963
std error	0.5844	0.8426

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 24: Probability of willingness to invest for OECD infrastructure assets for stated IRRs by investor type

IRR	Upper AO	Lower AO	Upper AM	Lower AM
0.05	0.07224	0.12436	0.05981	0.04706
0.1	0.35429	0.44306	0.23944	0.49811
0.15	0.79451	0.81671	0.60908	0.95226
0.2	0.9646	0.96148	0.88521	0.99751
0.25	0.99482	0.9929	0.97447	0.99988
0.3	0.99926	0.99872	0.99473	0.99999

Table 25: Coefficients from the willingness-to-invest regression for emerging-market assets by investor type

	Lower	Upper
Intercept	6.4784 ***	5.0954 ***
std error	1.1912	1.2987
IRR	-37.0192 ***	-22.2286 ***
std error	6.4036	5.3229
Other	-0.5497	-0.9358
std error	0.5057	0.5852
AM	0.2807	-1.3963 *
std error	0.5844	0.8426

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

7. Appendix

Table 26: Probability of willingness to invest for EM infrastructure assets for stated IRRs by investor type

IRR	Upper AO	Lower AO	Upper AM	Lower AM
0.1	0.00225	0.03765	0.08939	0.0641
0.15	0.02321	0.25344	0.2853	0.34228
0.2	0.20036	0.74656	0.61879	0.79815
0.25	0.72543	0.96235	0.86843	0.96779
0.3	0.96535	0.99551	0.96408	0.99564
0.35	0.99661	0.99948	0.99092	0.99942

Table 27: Coefficients from the willingness-to-invest regression for a traditional infrastructure fund by investor type

	Lower	Upper
Intercept	56.1685	6.7439 ***
std error	7310.4215	1.7828
IRR	-438.3035	-51.7479 ***
std error	56234.0112	13.1961
Other	-1.587	-0.7197
std error	1.205	0.7919
AM	0.3001	-0.6444
std error	0.9458	0.8143

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 28: Probability of willingness to invest in a traditional infrastructure fund by investor type

IRR	Upper bound	Lower lower
0.08	0.06887	0
0.13	0.49582	0.69231
0.18	0.92895	1
0.23	0.99428	1
0.28	0.99957	1
0.33	0.99997	1

Table 29: Coefficients from the willingness-to-invest regression for a long-duration infrastructure fund by investor type

	Lower	Upper
Intercept	5.506 ***	3.9562 ***
std error	1.1039	1.0268
IRR	-46.2268 ***	-31.6498 ***
std error	8.5897	7.2211
Other	-1.0457 *	0.1383
std error	0.6026	0.6856
AM	-1.0883 *	-0.045
std error	0.6138	0.6205

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 30: Probability of willingness to invest in a long-duration infrastructure fund by investor type

IRR	Upper AO	Lower AO	Upper AM	Lower AM
0.05	0.0852	0.03937	0.07502	0.10442
0.1	0.3119	0.29248	0.28301	0.54049
0.15	0.6881	0.80659	0.65766	0.92227
0.2	0.9148	0.97678	0.90338	0.99172
0.25	0.98122	0.99765	0.9785	0.99917
0.3	0.99608	0.99977	0.99551	0.99992

7. Appendix

Table 31: Coefficients from the willingness-to-invest regression for a Coinvestment infrastructure-debt fund by investor type

	Lower	Upper
Intercept	18.6593 ***	212.7781
std error	5.4403	53135.2987
IRR	-441.9054 ***	-3868.6934
std error	130.232	962128.7803
Other	1.955	-18.2449
std error	1.6381	6803.2783
AM	1.2264	-17.734
std error	1.5287	6803.2783

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 32: Probability of willingness to invest in a Co-investment infrastructure-debt fund by investor type

IRR	Upper AO	Lower AO	Upper AM	Lower AM
0.03	0	0.00449	0	0.00064
0.04	0	0.27227	0	0.0503
0.05	0	0.96881	0.25	0.81472
0.06	1	0.99961	1	0.99727
0.07	1	1	1	0.99997
0.08	1	1	1	1

Table 33: Coefficients from the willingness-to-invest regression for an Innovative Infrastructure Fund-Dynamic Index Tracking by investor type

	Lower	Upper
Intercept	3.0741 *	5.634 **
std error	1.7163	2.6327
IRR	-24.5924 **	-35.4688 **
std error	11.5209	15.4567
Other	-0.4013	-0.6274
std error	1.2971	1.3567
AM	0.1458	-1.6605
std error	1.1615	1.4035

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

Table 34: Probability of willingness to invest in an Innovative Infrastructure Fund-Dynamic Index Tracking by investor type

IRR	Upper AO	Lower AO	Upper AM	Lower AM
0.05	0.02062	0.13653	0.03794	0.19107
0.1	0.11036	0.35096	0.1885	0.44683
0.15	0.42222	0.64904	0.57778	0.73422
0.2	0.8115	0.86347	0.88964	0.90428
0.25	0.96206	0.95581	0.97938	0.96998
0.3	0.99335	0.98666	0.99644	0.99103

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About Global Infrastructure Hub



About Global Infrastructure Hub

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

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

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

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

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

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

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

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

<http://globalinfrastructurehub.org>



About EDHEC Infrastructure Institute-Singapore



About EDHEC Infrastructure Institute–Singapore

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

Origins

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

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

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

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

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

A Profound Knowledge Gap

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

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

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

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

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

Mission Statement

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

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

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

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

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

What We Do

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

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

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

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

Partners of EDHEC*infra*

Monetary Authority of Singapore

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

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

Sponsored Research Chairs

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

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

Partner Organisations

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

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

EDHEC*infra* is also :

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

EDHEC Infrastructure Institute Publications



EDHEC Infrastructure Institute

Publications

EDHEC Publications

- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Equity Indices: Benchmarking European Private Infrastructure Equity 2000-2016" (June 2017).
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Books

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

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 - #15-02
Singapore 049145
Tel.: +65 6438 0030

edhec.infrastructure.institute