Selecting Reference Indices for the Infrastructure Asset Class

A Survey of investor preferences and the EDHEC*infra* families of infrastructure indices

February 2018

Noël Amenc
Professor of Finance & Associate Dean, EDHEC Business School

Frédéric Blanc-Brude
Director, EDHEC Infrastructure Institute

EDHEC*infra*
building benchmarks
for infrastructure investors

Contents

Noël Amenc is Professor of Finance and Associate Dean for Business Development at EDHEC Business School and CEO of ERI Scientific Beta His concern for bridging the gap between university and industry has led him to pursue a double career in academe and business. Prior to joining EDHEC Business School as founding director of EDHEC-Risk Institute, he was the Director of Research of Misys Asset Management Systems, having previously created and developed a portfolio management software company. He has published numerous articles in finance journals as well as four books on quantitative equity management, portfolio management, performance analysis, and alternative investments. He is a member of the editorial board of the *Journal of Portfolio Management*, associate editor of the *Journal of Alternative Investments*, and member of the advisory board of the *Journal of Index Investing*. He is also a member of the Finance Research Council of the Monetary Authority of Singapore. He was formerly a member of the Consultative Working Group of the European Securities and Markets Authority (ESMA) Financial Innovation Standing Committee and of the Scientific Advisory Council of the AMF (French financial regulatory authority). He holds graduate degrees in economics, finance and management and a PhD in finance.

Frédéric Blanc-Brude is the Director of EDHEC Infrastructure Institute, a dedicated research unit developing a unique body of applied research on infrastructure investment from the perspective of large asset owners. He joined EDHEC-Risk Institute in 2012 after 10 years of private sector experience in the infrastructure finance field, and direct involvement in more than USD6bn of transactions. His research work focuses on asset pricing applied to highly illiquid assets and the stochastic modelling of cash flows in infrastructure projects. He has published papers in economics and finance journals, recently co-authored a book on the valuation of unlisted infrastructure equity and debt investments and is a regular contributor to the press. He is a member of the editorial board of the *Journal of Alternative Investments*. He holds a PhD in Finance (King's College London) and degrees from the London School of Economics, the Sorbonne, and Sciences Po Paris. He is a regular contributor to G20 and WEF working groups on long-term infrastructure investment, has advised the European Insurance and Occupational Pensions Authority (EIOPA) on the prudential treatment of infrastructure investments and also represents EDHEC on the Advisory Board of the Global Infrastructure Facility of the World Bank. EDHEC*infra* was founded in 2016.

Executive Summary

This position paper examines the results of a large survey of infrastructure investors and their preferences for the segmentation of the infrastructure asset class. Using those results, coupled with modern finance theory about what should matter to investors, this paper sets out **a taxonomy of unlisted infrastructure investment indices and benchmarks that can give structure the global unlisted infrastructure asset class**.

This taxonomy will now be used to compute all EDHEC*infra* indices, sub-indices and custom benchmarks.

Key Findings

The survey focuses on five possible types of market segment; geography, sector granularity, the role of business models, the role of corporate structures, and credit risk buckets. The majority of respondents to the survey were asset owners, and over half were focused solely on infrastructure equity investment, while a third seek both infrastructure equity and debt.

When questioned about geographic segmentation of infrastructure, the geographies of standard capital market benchmarks were the least preferred, with less than 10% of responses. Instead, respondents said that economic development and infrastructure investability were considered the most relevant. For debt markets the level of economic development is the most frequently proposed segmentation across all respondents.

With regard to sector segmentation, we asked respondents if broad sector indices would be more useful than specific sector indices. The results show that preferences are split equally between broad and sector specific segmentation. However, large asset owners who wish to be exposed to infrastructure investments across multiple sectors tend to say that only widely defined sector indices make sense.

When asked whether making a distinction between business models (contracted, merchant and regulated) was relevant when categorising infrastructure, 90% of respondents said it was relevant or highly relevant to segment infrastructure investments in this way, in sharp contract with the more limited interest for sector categories.

We also asked whether making a distinction by corporate structure, (i.e. infrastructure projects vs. infrastructure corporates), mattered to investors. Investors' views were split between the two: 37% favour strictly project finance benchmarks, 42% would rather use benchmarks including projects and corporates, and only 20% would prefer an infrastructure corporates-only index.

Finally, we asked infrastructure debt investors whether it is useful to create infrastructure debt indices by maturity and level of credit risk, standard components of fixed income benchmarks, portfolios and products. Respondents were almost unanimous in the need to bucket infrastructure debt by credit risk and maturity.

EDHEC*infra* broad market index families

As a result of these findings, EDHEC*infra* is putting forward a reference set of indices for the infrastructure asset class worldwide: eight broad market indices provide a global view of the asset class (Table 1), while sub-market index families (business risk, sector groups, credit risk) represent specific risk profiles (Table 2).

*Figure 1: EDHEC*infra *Global broad market index families*

EDHEC*infra* Broad Market Index Families	
Unlisted Infrastructure Equity Index Families	**Private Infrastructure Debt Index Families**
Global Unlisted Infrastructure Equity	Global Private Project Finance Debt
Global Project Finance Equity	Global Private Infrastructure Debt
Advanced Markets Unlisted Infrastructure Equity	Advanced Markets Private Infrastructure Debt
Emerging Markets Unlisted Infrastructure Equity	Emerging Markets Private Infrastructure Debt

Source: EDHEC*infra*

*Figure 2: EDHEC*infra *Sub-Index Segments*

Global Broad Market Index Families				
Unlisted Infrastructure Equity Sub-Indices		**Private Infrastructure Debt Sub-Indices**		
Business Risk	**Broad Sectors**	**Business Risk**	**Broad Sectors**	**Credit**
• Regulated • Contracted • Merchant	• Transport • Social Infrastructure • Energy • Renewables	• Regulated • Contracted • Merchant	• Transport • Social Infrastructure • Energy • Renewables	• Default Risk • Maturity • Instrument currency

Source: EDHEC*infra*

Further still, custom benchmarks enable investors to answer specific research questions and understand the evolution and the risks of certain markets, e.g. UK power market or the global airports market.

In the future, these indices can be used to monitor performance, which the majority of survey respondents considered to be the most immediate reason for having benchmarks, as well as defining asset allocations and creating new investment products.

1. Introduction

The need to identify and measure the characteristics of the infrastructure asset class has been acknowledged for several years. The lack of adequate indices and benchmarks has been documented in numerous fora including the recent EDHEC/G20 surveys of major infrastructure investors that involved major asset owners representing USD 7 trillion of AUM (Blanc-Brude et al., 2016, 2017).

The need to collect asset-level data and develop such benchmarks has also been officially acknowledged by the G20 and will be one of the priorities of the 2018 Argentine presidency.

In this position paper, we put forward a taxonomy of unlisted infrastructure investment indices and benchmarks to represent the global infrastructure asset class.

This set of broad market indices and sub-indices reflects the findings of a comprehensive new survey of more than 200 asset owners and managers involved in the infrastructure sector. In this survey, which was conducted in October and November 2017, *investors were asked which segmentations of the infrastructure universe were most relevant to them.*

Our proposed index categories rest on these findings as well as the some of the fundamental tenets of modern finance, including the importance of focusing on persistent and rewarded risk factors when designing asset allocations and financial products.

The result is **eight broad market indices**, four for unlisted infrastructure equity and four for private infrastructure debt, to represent the infrastructure asset class at the global level.

Moreover, investors' preferred segmentation of the infrastructure sector also provides a framework to create a range of sub-indices corresponding to specific mandates or strategies, which we discuss in the paper.

From 2018, this taxonomy will be used to compute EDHEC*infra* indices, sub-indices and custom benchmarks of the risk-adjusted performance of unlisted infrastructure equity and debt investments.

The rest of this paper is structured as follows: Section 2 describes the results of our survey of infrastructure investors' views about the most relevant segmentations of the global infrastructure sector. Section 3 discusses these results and puts forward a list of broad market indices and sub-indices that can usefully represent the unlisted infrastructure asset class in the years to come. Section 4 concludes.

2. Investor Survey: Defining Relevant Infrastructure Index Families

In this section, we describe the results of a survey of infrastructure investors' views of the most relevant segmentations of the global infrastructure sector and, as a direct consequence, of their preferences for different types of infrastructure equity and debt indices.

2.1 Survey Design

This short survey first asked whether respondents were infrastructure debt or equity investors (or both), and focused on five possible types of market segments:

1. geography;
2. sector granularity;
3. the role of business models;
4. the role of corporate structures; and
5. credit risk buckets (Debt investors only).

Finally, we asked investors about the potential uses of infrastructure market indices.

2.2 Respondents

More than 200 responses to this survey were collected between October and November 2017, representing one of the largest surveys of infrastructure investors ever conducted. As in previous EDHEC*infra* investor surveys (Blanc-Brude et al., 2016, 2017), respondents were primarily the members of the *infra500* group of stakeholders, which includes all major asset owners and managers involved in the infrastructure investment sector worldwide. Asset owners who responded represent more than 10% of global AUM in 2017.

Figure 3 shows the breakdown of respondents by type of organisation (left side) and between investors who favour investing in infrastructure equity, debt or both (right side). This data is also summarised in table 1.

More than half of respondents are asset owners and one third are asset managers. Again, more than half are solely focused on infrastructure equity investment, while a third seek both infrastructure equity and debt for their portfolios.

Hence, this sample can be considered to represent a balanced set of views amongst the larger, perhaps more sophisticated investors. The focus on equity is typical of a market in which equity funds and direct investment in infrastructure developed first and remains the most active segment, especially amongst asset managers, who were more likely to identify themselves as equity investors. Meanwhile, infrastructure debt is an area of significant interest since more than half of asset asset owners also declared investing at least in infrastructure debt if not in both types of assets.

Next, we review investors' views on index segmentation.

2.3 Infrastructure Market Index Segmentations

2.3.1 Geographic Segmentation

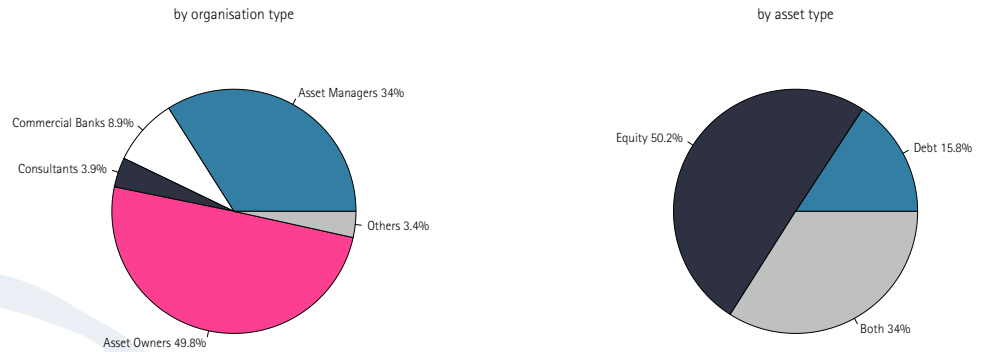
We first asked respondents which geographic segmentation made the most sense and suggested four possible divisions of the global infrastructure market:

1. the five continents (i.e. large landmasses). In other words, this is a division of the infrastructure investment market by based on the

Table 1: Breakdown of survey respondents - by number

	Debt	Equity	Both	Total
Asset Managers	11	40	18	69
Commercial Banks	8	4	6	18
Consultants	0	2	6	8
Asset Owners	13	53	35	101
Others	0	3	4	7
Total	32	102	69	203

Figure 3: Breakdown of respondents by asset and organisation type



United Nations five-continent model, which comprises Africa, the Americas, Asia, Europe, Oceania;

2. broad capital market categories put forward by index providers for stocks or bonds (i.e. the geographic segments used for traditional asset classes);
3. the level of economic development of the relevant markets, for instance OECD markets vs. emerging markets; or
4. the state and size of the investable infrastructure market including number and types of firms, regulation, etc.

In principle, any of these segmentations of the global infrastructure investment market can be a valid one, depending on investors' perspective, including their mandate, liability profile and investment objectives.

Depending on their initial choice, respondents were asked to answer this question explicitly for the equity and the debt markets (or both), since the relevant segmentations do not necessarily have to coincide.

Equity Investors

Table 2 and Figure 4 show the number and proportion of responses for equity investors, including responses for asset owners and asset managers only.

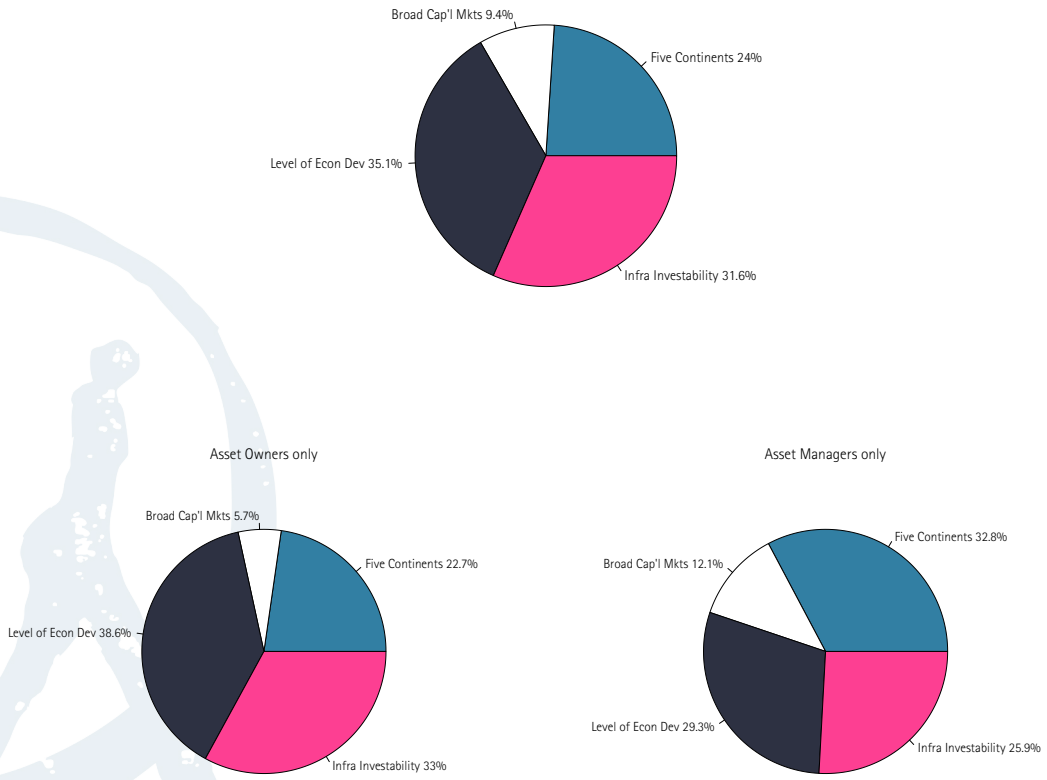
Perhaps surprisingly, the geographies of standard capital market benchmarks are the least preferred with less than 10% of responses. The five continents are considered relevant categories for a quarter of respondents and economic development and infrastructure investability are considered the most relevant segmentations by a roughly equal proportion of respondents (31% and 35% respectively).

However, asset owners' and managers' views differ somewhat when considered independently. One third of asset managers would prefer to use the five continents compared to less than a quarter of asset owners. Managers are also more likely to prefer capital market benchmark geographies (12%) whereas less than 6% of asset owners consider this view to be relevant.

Table 2: Preferred geographic segmentation of infrastructure equity investors - number of responses

	Five Continents	Broad Cap'l Mkts	Level of Econ Dev	Infra Investability	Total
Asset Managers	19	7	17	15	58
Commercial Banks	1	0	5	4	10
Consultants	1	2	2	3	8
Asset Owners	20	5	34	29	88
Others	0	2	2	3	7
Total	41	16	60	54	171

*Figure 4: Preferred geographic segmentation of infrastructure **equity** investors*



For asset owners, the level of economic development (39%) and investability (33%) are by far the most relevant ways to segment infrastructure markets and indices. While these views are less prevalent amongst managers, they still represent the majority.

These differences can be explained by differences of perspective and geographic mandate, as well as varying focuses on sourcing deals, operating assets over time or building portfolios according to existing multi-asset class segments.

Debt Investors

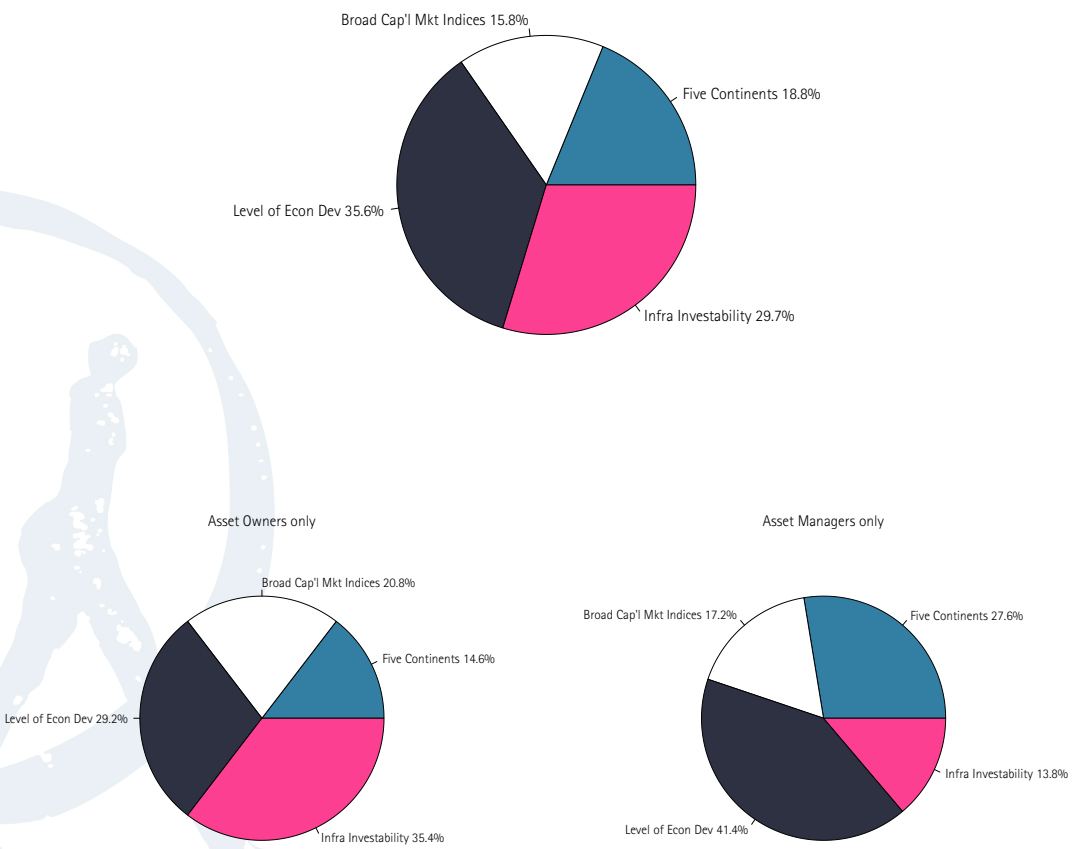
With respect to segmenting infrastructure debt markets, a similar picture emerges overall, and differences of opinion between asset owners and managers about the most relevant geographic categories persist.

The former are still less keen to use the five continents as the most relevant geographic segments (15%) whereas the latter often are more comfortable with this taxonomy (28%). 35% of asset owners consider infrastructure investability to be the most relevant grouping but less than 14% share this view amongst asset managers. Conversely, the level of economic

Table 3: Preferred geographic segmentation of infrastructure debt investors - number of responses

	Five Continents	Broad Cap'l Mkt Indices	Level of Econ Dev	Infra Investability	Total
Asset Managers	8	5	12	4	29
Commercial Banks	4	0	7	3	14
Consultants	0	1	2	3	6
Asset Owners	7	10	14	17	48
Others	0	0	1	3	4
Total	19	16	36	30	101

*Figure 5: Preferred geographic segmentation of infrastructure **debt** investors*



development, while considered informative by a third of asset owners, is favoured by more than 40% of asset managers.

Overall, for debt markets, the level of economic development and the investability of the infrastructure market are the most frequently proposed segments across all respondents.

2.3.2 Sector Granularity

Next, we asked respondents if broad sector indices (e.g. 'energy' including power, gas and renewables) would be more useful than specific sector indices (e.g. 'wind power')?

Table 4 and Figure 6 show the number and proportion of responses.

Preferences are evenly split between broad market and sector-specific indices, both amongst all respondents or for asset owners and managers.

Again, investors in infrastructure may have very different perspectives on the most adequate sector segmentation depending on their investment objectives. Managers with

sector-specific mandates are likely to prefer narrowly-defined benchmarks, while asset owners, especially direct investors, may be exposed to a heterogeneous group of a limited number of investments and may prefer evaluating each asset individually rather than against a 'broad market' to which they may only be partially exposed.

Still, large managers and asset owners aim to be exposed to infrastructure investments across multiple sectors and indeed to diversify sector-specific risks. Hence, half of respondents suggest that widely-defined sector indices make the most sense from their perspective.

Moreover, as we discuss below, a number of investors require infrastructure investment indices to make choices at the strategic asset allocation level, requiring a view to be taken at the asset class level, rather than at the sub-segment level.

Still, the large proportion of respondents who would prefer sector-specific benchmarks, including amongst asset owners, suggests that access to a well-defined and reasonably homogeneous asset class remains limited amongst investors, most of whom have to focus on sub-segments.

2.3.3 Business Models

We also asked respondents whether making a distinction between infrastructure business models ('contracted', 'merchant' or 'regulated') was relevant to them.

While infrastructure investment is still typically approached through the prism of industrial sectors, as the point above illustrates, it can be argued that the financial economics of infrastructure investment, and in particular what can be called 'infrastructure business models' (Blanc-Brude, 2014) can be a more relevant way to group infrastructure investments together.

At least three broad infrastructure business models can be distinguished, thus helping to create more homogeneous risk profile groups: 1/ contracted infrastructure businesses receive revenues that have been pre-agreed with a public or private counterparty, on the basis of which financing can typically be arranged; 2/ merchant infrastructure businesses, on the contrary, collect fees or tolls from end-users and are exposed to commercial risks; and 3/ regulated infrastructure firms, typically see their user fees and capital programmes constrained by a regulatory agency, which is expected to minimise welfare losses associated with 'natural monopolies' while allowing investors to receive a fair rate of return.

Each of these business model archetypes corresponds to a different degree of business risk, hence the potential for leverage is also closely associated with infrastructure business models.

This taxonomy of infrastructure business risk, while familiar to project finance professionals, has nevertheless been introduced to the debate around the infrastructure 'asset class', including its prudential regulation, in recent years only.

Still, both asset owners and managers are fully aware of the relevance of segmenting the infrastructure asset class along business model lines. As shown in Figure 7, 90% of respondents agreed that it was relevant or highly relevant to segment infrastructure investments in this way, especially to differentiate contracted and regulated infrastructure. Only very few respondents (less than 5%) considered this taxonomy not to be relevant.

2.3.4 Corporate Structures

We also asked whether making a distinction between infrastructure 'projects' (i.e. project finance SPVs) and infrastructure 'corporates' (most utilities, ports, airports, etc.) mattered to investors.

This distinction is likely to be as relevant as that between business models. In project finance,

Table 4: Preferred sector segmentation of infrastructure investors - number of responses

	Specific Sector Index	Broad Sector Index	Total
Asset Managers	32	37	69
Commercial Banks	11	7	18
Consultants	7	1	8
Asset Owners	43	58	101
Others	5	2	7
Total	98	105	203

Figure 6: Preferred sector segmentation of infrastructure investors

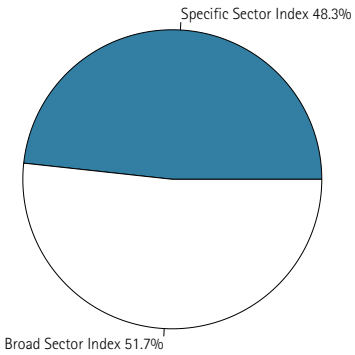
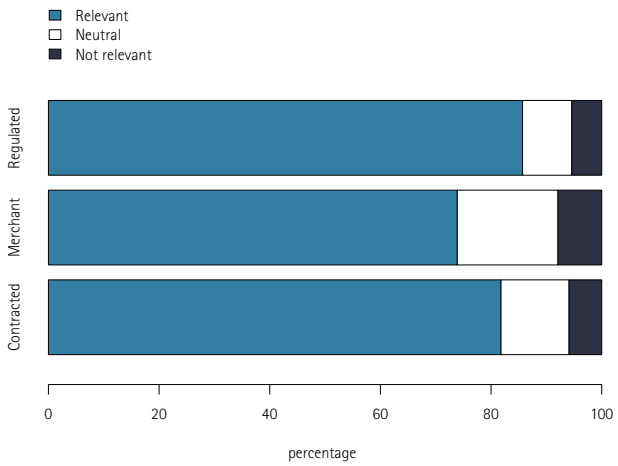


Table 5: Are business model segmentations relevant for infrastructure investors? Number of responses

	Contracted	Merchant	Regulated	Total
Very relevant	99	89	110	298
Relevant	67	61	64	192
Neutral	25	37	18	80
Not Very Relevant	9	12	8	29
Not Relevant at All	3	4	3	10

Figure 7: Relevance of business model segmentations for infrastructure investors



dedicated firms are created for the sole purpose of creating and operating an infrastructure asset. Their financial structure and life cycle revolve around a pre-determined trajectory. These firms have a unique dynamic and also create a unique form of corporate governance, in which creditors have more extensive control rights than in regular corporations (see Blanc-Brude, 2013, for a detailed discussion).

Infrastructure 'corporates', on the contrary, tend to be structured and to behave like large industrial conglomerates. Any decision to initiate new investment projects, change the firm's capital structure, etc. are determined by a board of directors, which may not be very different from that of other large firms.

While infrastructure corporates do have an 'infrastructure business model', often regulated and with monopoly characteristics, they can be expected to respond to different economic and financial forces than project finance SPVs.

We made this argument theoretically and empirically in several publications and found evidence of the systematic difference between the risk-reward profiles of the two types of structures in the context of the first European infrastructure indices published by EDHEC in 2017 (Blanc-Brude et al., 2017a,b).

Here, investors are mostly split between the two views. They either favour project finance specific benchmarks (37%), or would rather use benchmarks with both projects and corporates (42%), thus preferring a more sector-based understanding of what defines and differentiates infrastructure investment. A smaller group of investors (20%) would prefer an 'infrastructure corporates-only' index.

These differences of views echo different interpretations of what it means to invest in infrastructure, as well as different levels of access to individual transactions.

While infrastructure corporates can be found, so to speak, 'in nature', infrastructure project finance SPVs are the result of complex and segmented procurement processes that have typically been the preserve of certain types of organisations, least of which commercial banks but also a number of construction companies.

A number of large asset owners that prefer 'direct' investment in infrastructure typically do not get involved in such transactions but instead follow a process more akin to that of M&A, only within targeted industrial sectors, particularly within transport and energy. As a result, they are more likely to focus on infrastructure corporates.

Conversely, large infrastructure managers typically become involved in both project financed and corporate infrastructure acquisitions. Like asset owners, these managers typically need to deploy large amounts of capital in only a few years and often have broadly defined mandates allowing them to invest in a range of corporate structures, across numerous industrial sectors.

2.3.5 Credit Risk Buckets

Finally, we asked infrastructure debt investors whether it is useful to create infrastructure debt indices by maturity and level of credit risk.

These well-understood risk categories for debt investors are standard components of fixed income benchmarks, portfolios and products, and respondents were almost unanimous that bucketing infrastructure debt indices by levels of credit risk and maturity (duration) would be highly relevant to them as Figure 9 illustrates.

2.4 Infrastructure Market Index Applications

Our last question did not focus on market segmentation, but rather asked respondents what the main purpose of using an infrastructure

Figure 8: Relevance of corporate structure segmentations for infrastructure investors

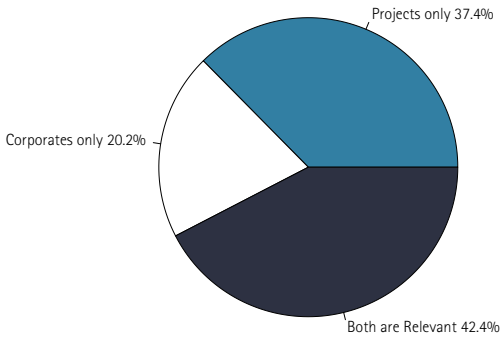


Figure 9: Relevance of credit risk segmentations for infrastructure investors

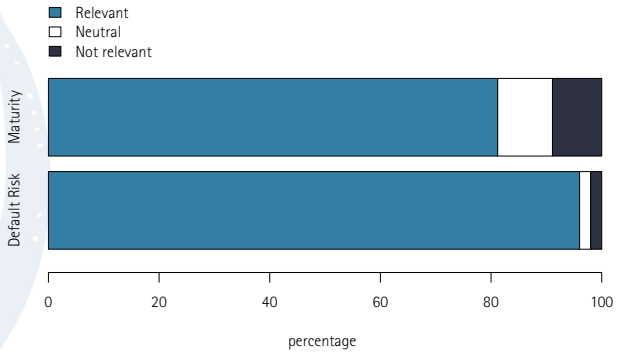
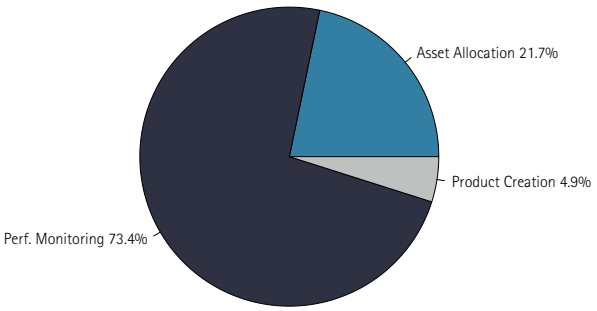


Table 6: Main intended use of infrastructure indices - number of responses

	Asset Allocation	Perf. Monitoring	Product Creation	Total
Asset Managers	12	46	2	60
Commercial Banks	2	12	2	16
Consultants	2	3	2	7
Asset Owners	21	71	3	95
Others	3	3	0	6
Total	40	135	9	184

Figure 10: Main intended use of infrastructure indices



investment benchmark would be for them, and suggested three options:

1. Asset allocation;
2. Performance monitoring; or
3. Product creation.

Table 6 and Figure 10 show the number and proportion of responses.

Performance monitoring, including that of external managers, is the main concern for three quarters of respondents. This result highlights the ongoing demand amongst investors to better understand the risk-adjusted performance of infrastructure assets, echoing the 2016 EDHEC/GIH survey in which 94% of asset owners declared that no adequate benchmark existed and that accurate risk and performance metrics were sorely lacking.

Only one in five respondents considered asset allocation to be the main reason for having benchmarks. This suggests that the number of infrastructure investors who, as of today, need to take a strategic view on infrastructure assets, remains limited.

Infrastructure cannot exist as an asset class that poses a relevant strategic asset allocation question until the pre-existing question of documenting performance is better understood. Hence, numerous allocations to infrastructure, while growing, remain too small today to raise strategic questions.

Finally, the option to use such benchmarks primarily for product creation received less than 5% of responses. This result highlights the state of infancy that the infrastructure investment sector still finds itself in today.

Most investors remain focused on issues of access at the individual deal level, and the opportunity to use a market benchmark to create investable financial products remains a thing of the future. Nevertheless, a small number of respondents are already thinking about this future.

In the next chapter, we discuss these findings and propose a corresponding index segmentation approach.

3. The EDHEC*infra* Broad Market Index Families

In this section, we put forward a taxonomy of infrastructure investment market indices that takes into account the preferences of investors identified in the context of our investor survey.

The point of a taxonomy is to determine the existence of reasonably homogeneous groups that can constitute *useful* categories in the context of the questions at hand. For an investor, the main issue is always *betas* (i.e. systematic risk factors that can create exposure to risk premia). And indeed, the segmentation of the infrastructure investment universe should focus on creating such homogeneous groups.

Perhaps unsurprisingly, the range of views and preferences expressed in the survey follows this logic. The main survey findings can be summarised as follows:

1. **Geography**: for both debt and equity investors, the most relevant segmentation is to focus on the level of economic development and the investability of national markets. Infrastructure investments must indeed be rooted in geography and the political economy of their host market. They are sunk, immobile investments and typically a matter of public policy as well. Hence, providing investors with a clear demarcation between different levels of economic development and types of jurisdiction is more likely to create homogeneous groups in terms of risk profile. While some investors prefer other segmentations for individual reasons, the reference market indices for infrastructure should follow broad economic development lines.

2. **Sectors**: A narrow sector focus is clearly relevant to numerous infrastructure investors, especially asset managers. But broad sector groups are also more relevant to larger investors such as asset owners, who are more likely to invest across a range of sectors/strategies. The idiosyncratic (diversifiable) nature of a sector-specific risk also suggests that broad sectors indices are a better approach to identify infrastructure investment *betas*.

3. **Business risk**: Likewise, distinguishing between systematic dimensions of the business risk of infrastructure projects is deemed relevant by the overwhelming majority of asset owners and managers. This is in line with the notion that what drives systematic differences of risk and reward between infrastructure investments should provide the main categories of reference indices or sub-indices;

4. **Corporate structure**: Investors expressed two views: either a) infrastructure investment is really about project finance and the type of corporate structure it creates, including the structuring of long-term debt that would be seldom found otherwise, or b) infrastructure investment is about gaining exposure to certain sectors whether or not the underlying assets are projects or corporates. The relevance of each view is an empirical question, but both types of indices can be used to denote investments in 'infrastructure';

5. **Credit risk** sub-segments are uncontroversially important for all debt investors, precisely because they can be expected to correspond

to specific risk profiles and their associated premia. Hence, they are also amongst the structuring dimension of market sub-indices.

Taking these results into account, we propose the following *taxonomy of infrastructure market indices, sub-indices and custom benchmarks*, which is suitable for addressing both high-level indexing purposes and very specific benchmarking needs.

3.1 Broad Market Indices

Table 11 presents the names of the eight **Global EDHEC*infra* Broad Market Infrastructure Indices** that are required to provide investors with an asset class-level view of what it means to invest in infrastructure.

Based on the findings discussed above, the most relevant segmentations of the global infrastructure investment sector consist of splitting global unlisted equity or private debt markets between advanced and emerging economies on the one hand, and either all corporate sectors/structures or a project finance-only one on the other.

Thus, **eight broad market unlisted infrastructure equity index families can capture the major systematic dimensions of the infrastructure asset class**. Two universes (debt and equity) are split either between broad areas of economic development or by types of corporate structures that are themselves broad sector filters, since most utilities, port or airports are so-called infrastructure corporates, and most public concessions and public-private partnerships, oil & gas or independent power projects are created through a project financing structure.

Table 12 shows the current and planned geographic coverage of the EDHEC*infra* indices. The 41 countries that are to be included in the global index represent two thirds of the world's GDP. Today, the effective coverage is equivalent to one quarter of global GDP in 2016.

Within each family, these indices can then be computed as a value-weighted, capped value-weighted or equally-weighted index, and using a range of reporting currencies, depending on the perspective taken and the use made of the index data.

Thus, investors only require four unlisted equity and four private debt broad market index families to have a global view of the infrastructure asset class.

3.2 Thematic Sub-Indices

Beyond broad market indices, which aim to represent the infrastructure sector as a whole, our survey findings suggest that a number of sub-indices would also be useful to infrastructure investors, especially for the purpose of performance monitoring.

The following segments can be considered to build sub-indices that can represent specific risk profiles:

1. **Business risk**, as discussed above, is considered a highly relevant segmentation approach and recent empirical research indeed confirms that contracted, merchant and regulated infrastructure investment exhibit quite different risk-return profiles (Blanc-Brude et al., 2016, 2017a, 2018);

2. **Sector groups**: while much sector-level risk can be diversified, groups of sectors are exposed to common factors. Hence, segmenting the broad market by sector groups can be useful to capture different dimensions of infrastructure investing, including the impact of public policy and procurement cycles, which affect certain types of infrastructure differently over time. Hence, four major sector groups: transportation is

*Figure 11: EDHEC*infra *Global broad market index families*

EDHEC*infra* Broad Market Index Families	
Unlisted Infrastructure Equity Index Families	**Private Infrastructure Debt Index Families**
Global Unlisted Infrastructure Equity	Global Private Project Finance Debt
Global Project Finance Equity	Global Private Infrastructure Debt
Advanced Markets Unlisted Infrastructure Equity	Advanced Markets Private Infrastructure Debt
Emerging Markets Unlisted Infrastructure Equity	Emerging Markets Private Infrastructure Debt

Source: EDHEC*infra*

*Figure 12: EDHEC*infra *Broad market indices - geographic coverage*

Global indices	Regional indices	Countries covered
Global broad market infrastructure indices & global project finance indices	Advanced markets infrastructure indices	Australia, Austria, Belgium, Canada*, Chile, Finland, France, Germany, Ireland, Italy, Japan*, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Slovakia, Spain, South Korea*, Sweden, United Kingdom, United States*
	Emerging markets infrastructure indices	Algeria*, Argentina, Brazil, China*, Egypt**, India*, Indonesia*, Kenya**, Malaysia, Pakistan*, Philippines, Russian Federation**, Saudi Arabia**, South Africa**, Thailand, Turkey*, UAE**

Source: EDHEC*infra*, * Coverage planned by 2018, ** Coverage planned by 2019

*Figure 13: EDHEC*infra *Sub-Index Segments*

Global Broad Market Index Families				
Unlisted Infrastructure Equity Sub-Indices		**Private Infrastructure Debt Sub-Indices**		
Business Risk	**Broad Sectors**	**Business Risk**	**Broad Sectors**	**Credit**
• Regulated • Contracted • Merchant	• Transport • Social Infrastructure • Energy • Renewables	• Regulated • Contracted • Merchant	• Transport • Social Infrastructure • Energy • Renewables	• Default Risk • Maturity • Instrument currency

Source: EDHEC*infra*

most exposed to economic conditions, energy to commodity prices, social infrastructure to public credit risk, and renewable energy to regulatory risk;

3. **Credit markets**: infrastructure investments can also represent exposures to a range of credit qualities, interest rate risk and currency risk. These are standard sub-segments of the credit market and will help integrate infrastructure debt investments within broader credit portfolios.

Using these segments, each of the eight broad market index families identified above can be divided into 28 families of unlisted infrastructure equity sub-indices, and 64 families of private infrastructure debt sub-indices.[1] Table 13 gives an overview of these categories.

With 92 EDHEC*infra* sub-indices, investors can track the risk-adjusted performance of almost any specialised manager or dedicated account that is focused on a sub-segment of the infrastructure market.

3.3 Custom Benchmarks

Finally, investors and manager may need to access specific custom benchmarks for monitoring, valuation or due diligence purposes.

1 - Assuming three credit risk buckets, three maturity buckets and three main underlying instrument currencies.

*Figure 14: EDHEC*infra *Index Data and Analytics*

Data Type	Data Point	Description
Index data	Prices	Index values
	Returns	Time weighted index returns
	Weights	List of weights for each firm
	Constituents	List of firm names and identification codes
	Descriptive stats (by nb and size)	By country, sector, business model, maturity, currency, etc.
Index analytics	Risk metrics	Value at risk, duration, credit risk, volatility, maximum drawdown
	Performance metrics	Sharpe ratio, internal rate of return, dividend yield
	Concentration metrics	Effective number of bets, % capitalisation
	Factors	Interest rates (slope, convexity, duration), cash flow beta, market conditions
	Historical constituents and weights	Evolution over time
Constituent data	Firm-level data	Firm specific valuations, risk measures and historical data

Source: EDHEC*infra*

Strictly speaking, these benchmarks are not market indices; they are too narrow to correspond to an asset class or a segment of the infrastructure market. Nevertheless, custom benchmarks could be constructed to answer specific research or strategic questions and, for example, understand the evolution and the risks of the UK power market, or the global airport sector, etc.

The potential segments that can be used to create custom benchmark families are many and include any combination of sub-segments for which enough constituents exist to apply benchmark construction and calculation rules. In the EDHEC*infra* data framework, these sub-segments include:

1. Regions (17) and countries (41);
2. Sector groups (8) and sectors (36);
3. Business models (3);
4. Corporate structures (2).

Thus, if enough constituent data is available, hundreds of custom benchmarks can be envisaged that can be relevant to specific investors or products.

3.4 Index Metrics

The need to measure risk-adjusted performance

Today, numerous infrastructure investors use very *ad hoc* benchmarks for their unlisted infrastructure investments. Some investors use an inflation rate plus a spread; others, a measure of the average returns of an equally *ad hoc* selection of infrastructure projects.

These benchmarks, whether they refer to absolute or relative returns all have the same fundamental flow: they take no account of risk.

Without a robust measure of the riskiness of the expected performance, it is impossible to justify a choice of spread over inflation or the risk-free rate. Without a clear understanding of the **representativity** of reported private project returns and of their **covariance**, that is, how risky each infrastructure investment is relative to others, existing private infrastructure investment 'indices' do not answer the most basic and important question for investors: what is the *risk-adjusted performance* of private infrastructure debt or equity?

As argued above, the taxonomy of indices and sub-indices preferred by investors also points to key aspects of the systematic risk factors that can

be expected to be found in unlisted infrastructure investment.

Highly illiquid private assets like infrastructure do not trade often enough to allow any direct measurement of risk (e.g. return variance) or of the price of risk (excess returns). This is also why designing market indices based on solid hypotheses about the economic and financial mechanisms at play in infrastructure firms matters.

EDHEC*infra* has developed a series of models that can first estimate the conditional (future) volatility of payouts, and then take into account (i) this risk profile dynamic, (ii) any primary and secondary market transactions available in each year, and (iii) the evolution of the term structure of interest rates, in order to calibrate the most relevant measure of expected returns and their variance.

In other words, for a given unlisted equity infrastructure investment with expected dividends $D_{t+\tau}$ from time t to T, there is a *range* of term structures of discount factors $\lambda_{t+\tau}$ at time $t+\tau$ that best matches:

1. the time value of money: the term structure of risk-free rates from t to T;
2. aggregate payout risk: the term structure of the variance of future dividends ($\sigma D_{t+\tau}$);
3. the aggregate price of risk: as implied by the value invested at time t and any other primary or secondary market transactions for assets with the similar payout volatility and similar maturity.

While the mean values of the discount factors $E_t(\lambda_{t+\tau})$ represent expected returns for the average investor, the range of these values, which is primarily driven by the range of observable prices of risk (point 3) captures the return variance of this investment at time t.

Quantitative techniques allow such measures of payout and return volatility to be derived at the asset level as long as the right data is available. These methods and approaches are described in previous EDHEC and peer-reviewed publications (see for example Blanc-Brude et al., 2017b,a; Blanc-Brude and Hasan, 2016; Hasan and Blanc-Brude, 2017; Blanc-Brude et al., 2018).

Once risk and returns are known for individual constituents, proper indices can be built that take into account the covariance of expected returns, and thus include a measure of potential diversification benefits of infrastructure investments.

From here, using taxonomies to design market indices and sub-indices that correspond to risk profiles that are economically and financially meaningful (e.g. geographies, corporate structure, business models, etc.) provides investors with the most useful benchmarking tool since these indices tend to focus on systematic dimensions of risk and performance.

Thus, EDHEC*infra* index and benchmarks give access to a number of index data metrics summarised in Table 14. Importantly, these metrics include estimates of the riskiness of each investment and of the risk-adjusted performance of infrastructure investments, thus allowing direct cross-asset class comparisons.

*EDHEC*infra *Index Analytics*

Beyond index return and risk metrics and the monitoring of performance, the approach taken to model risk at the individual constituent level allows the production of numerous analytics that have relevance for investors wishing to conduct asset allocation exercises including multi-asset class, factor-driven allocations, integrate infrastructure into an ALM framework (e.g. duration hedging), calibrate prudential models, and many other aspects of risk management.

Constituent-level analytics including sector-level valuation ratios or expected default

frequencies can also provide investors with important insights when making new acquisitions. Furthermore, computing the marginal risk contribution of individual assets to pre-existing portfolios becomes possible, allowing portfolio construction strategies that aim to deliver a certain index or custom benchmark.

4. Conclusion

In conclusion, with this position paper we have put forward a set of market indices and sub-indices that are sufficient to map the characteristics of the unlisted infrastructure equity and debt asset classes to the preferences of asset owners and managers.

A shortlist of eight broad market indices covering global infrastructure, global project finance, and emerging and advanced economies infrastructure for both private debt and unlisted equity can respond to investors' indexing demand at the asset allocation level.

Meanwhile, a subset of sub-indices addresses the need to monitor the risk-adjusted performance of particular styles or strategies. Finally, the ability to build numerous custom indices can help answer a long list of other questions about the evolution and the appeal of infrastructure investing.

This taxonomy is useful because it reflects the views expressed by investors in our survey as well as a fundamental position grounded in finance theory, namely that what matters to investors is gaining exposure to systematic, rewarded and persistent risk factors.

Categorising performance information around fundamental economic and financial mechanisms that have also been empirically tested is more likely to lead to indices and benchmarks that are indeed relevant to investors and stay so in the future.

EDHEC*infra* indices for Europe are already available in Bloomberg (EIPEE, EIPED) and all families described above will be made available progressively on indices.edhecinfra.com from 2018 onwards.

References

- Blanc-Brude, F. (2013). Towards efficient benchmarks for infrastructure equity investments. *EDHEC-Risk Institute Publications*, 88.
- Blanc-Brude, F. (2014, June). Benchmarking Long-Term Investment in Infrastructure. *EDHEC-Risk Institute Position Paper*.
- Blanc-Brude, F., G. Chen, and T. Whittaker (2016, June). Towards better products for infrastructure investors? a survey of the perceptions and expectations of institutional investors in infrastructure. *EDHEC Infrastructure Institute Publications*.
- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker (2017a, June). Private infrastructure debt benchmarks - benchmarking private european infrastructure debt 2000-2016. *EDHEC Infrastructure Institute Publications*.
- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker (2017b, June). Private infrastructure equity benchmarks - benchmarking private european infrastructure equity 2000-2016. *EDHEC Infrastructure Institute Publications*.
- Blanc-Brude, F. and M. Hasan (2016). A Structural Credit Risk Model for Illiquid Debt. *Journal of Fixed Income 26*(1).
- Blanc-Brude, F., M. Hasan, Q. Wang, and T. Whittaker (2016, March). Revenue and dividend payout in privately held infrastructure investments. *EDHEC Infrastructure Institute Publications March*.
- Blanc-Brude, F., M. Hasan, and T. Whittaker (2018). Calibrating Credit Dynamics in Private Infrastrcuture Debt. *Journal of Fixed Income Spring*(forthcoming).
- Blanc-Brude, F., J.-L. Yim, and T. Whittaker (2017, November). 2017 investor perceptions and valuation survey. *EDHEC Infrastructure Institute Publications*.
- Hasan, M. and F. Blanc-Brude (2017). You can work it out! valuation and recovery of private debt with a renegotiable default threshold. *Journal of Fixed Income 26*(4).

EDHEC*infra* Publications (2015-2017)

EDHEC Publications

- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Equity Indices: Benchmarking European Private Infrastructure Equity 2000-2016" (June 2017).
- Blanc-Brude, F., A. Chreng, M. Hasan, Q. Wang, and T. Whittaker. "Private Infrastructure Debt Indices: Benchmarking European Private Infrastructure Debt 2000-2016" (June 2017).
- Blanc-Brude, F., G. Chen, and T. Whittaker. "Towards Better Infrastructure Investment Products: A Survey of Investors' Perceptions and Expectations from Investing in Infrastructure" (July 2016).
- Blanc-Brude, F., T. Whittaker, and S. Wilde. "Searching for a Listed Infrastructure Asset Class: Mean-Variance Spanning Tests of 22 Listed Infrastructure Proxies" (June 2016).
- Blanc-Brude, F., T. Whittaker, and M. Hasan. "Cash Flow Dynamics of Private Infrastructure Debt" (March 2016).
- Blanc-Brude, F., T. Whittaker, and M. Hasan. "Revenues and Dividend Payouts in Privately-Held Infrastructure Investments" (March 2016).
- Blanc-Brude, F., and M. Hasan. "The Valuation of Privately-Held Infrastructure Equity Investments" (January 2015).

Peer-Reviewed Publications

- Hasan, M., and F. Blanc-Brude. "You Can Work It Out! Valuation and Recovery of Private Debt with a Renegotiable Default Threshold." *Journal of Fixed Income*, 26(4), 2017, pp. 113-127.
- Blanc-Brude, F., S. Wilde, and T. Witthaker. "Looking for an Infrastructure Asset Class: Definition and Mean-Variance Spanning of Listed Infrastructure Equity Proxies." *Financial Market & Portfolio Management*, 31, 2017, pp. 137-179.
- Blanc-Brude, F., and M. Hasan. "A Structural Model of Credit Risk for Illiquid Debt." *Journal of Fixed Income*, 26(1), 2016, pp. 6-19
- Blanc-Brude, F., M. Hasan, and T. Witthaker. "Benchmarking Infrastructure Project Finance–Objectives, Roadmap and Recent Progress." *Journal of Alternative Investments*, 19(2), 2016, pp. 7-18
- Bianchi, R., M. Drew, E. Roca, and T. Whittaker. "Risk Factors in Australian Bond Returns," *Accounting & Finance*, 2015.
- Blanc-Brude, F. "Long-Term Investment in Infrastructure and the Demand for Benchmarks." *JASSA: The Finsia Journal of Applied Finance*, 3, pp. 57–65, 2014.

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

EDHEC Infrastructure Institute
EDHEC Asia-Pacific
One George Street - #15-02
Singapore 049145
Tel.: +65 6438 0030

edhec.infrastructure.institute