



INDICES AND RESEARCH

Building benchmarks for infrastructure investors

The largest database of infrastructure investment data in the world, advanced asset pricing and index construction tools and indexing solutions for private infrastructure investors.

By 2020, the EDHECinfra Global 1000 Unlisted Infrastructure Index will track most major markets.

EDHEC*infra* indices

Broad market indices

EDHEC <i>infra</i> 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

Each of the index families includes multiple weighing schemes (value, capped, equal weights) and reporting currencies (USD, EUR, JPY, GBP).

Broad market indices geographic breakdown

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**

* Coverage planned by 2019, ** Coverage planned by 2020

Sub-indices thematic breakdown

Global broad market index families				
Unlisted infrastructure equity sub-indices		Private infrastructure debt sub-indices		
Business risk	Broad sectors	Business risk	Broad sectors	Credit
<ul style="list-style-type: none"> Regulated Contracted Merchant 	<ul style="list-style-type: none"> Transport Social infrastructure <ul style="list-style-type: none"> Energy Renewables 	<ul style="list-style-type: none"> Regulated Contracted Merchant 	<ul style="list-style-type: none"> Transport Social infrastructure <ul style="list-style-type: none"> Energy Renewables 	<ul style="list-style-type: none"> Default risk Maturity Instrument currency

Custom benchmarks

Custom benchmarks can be created that give access to the relevant mix of sectors, business models or segments defined in The Infrastructure Company Classification Standard (TICCS). Using the relevant weights and sub-indices allows the creation of benchmarks that match the asset allocation or performance monitoring needs of individual investors.

Indices and benchmarks

Private infrastructure investment indices are needed by asset owners, asset managers and regulators to determine their asset allocation to infrastructure, monitor risk-adjusted performance and calibrate prudential models. EDHEC*infra*'s **eight broad market indices** provide global coverage of unlisted infrastructure equity and private debt markets.

Four global unlisted infrastructure equity indices cover the broad infrastructure sector, the project finance sector and advanced and emerging infrastructure markets, respectively. Four other global indices cover the same segments for senior private debt investments. **A further 28 thematic unlisted equity sub-indices** and **40 thematic private debt sub-index families** are available, allowing detailed analysis of all the major segments of the private infrastructure asset class. **Hundreds of thematic indices** giving access to country or sector specific data, drilling down to business or credit risk sub-segments, can also be created.

Data and analytics

The EDHEC*infra* database and asset pricing technology compute the metrics that investors and regulators need to understand private infrastructure in a multi-asset class context. Each *index and sub-index family data series* includes index values, time-weighted returns, index constituents and weights, and geographic and thematic segmentation (sector, business risk, credit risk, maturity). Within each index family, index data is available using several weighing schemes and reporting currencies.

EDHEC*infra* indices also include numerous key metrics that make unlisted infrastructure comparable with other investments on a risk-adjusted basis. Risk and performance metrics such as Sharpe ratios, value-at-risk, factor risk attributions and duration are all available as *index analytics*.

EDHEC*infra* index and analytics data is available through an online platform at indices.edhecinfra.com or through Bloomberg.

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
Advanced analytics	Peer comparisons	Plot/table historic and forward looking data for several indices or companies
	Custom market reports	Aggregate data for various segments within each family (e.g. energy segment within Europe)
	Custom portfolio creation	Ad hoc indices using the constituents of the relevant families



By 2020, our indices will reach global coverage. By then, proper infrastructure investment solutions and platforms will have started to emerge, giving investors much better access to the characteristics of infrastructure assets. EDHECinfra is looking forward to being part of this exciting future."

Frédéric Blanc-Brude, Director, EDHECinfra.

A better approach

EDHEC*infra* is an independent research organisation delivering unique index data and analytics measuring the risk-adjusted performance of unlisted infrastructure investments.

The lack of risk-adjusted benchmarks

Today, most investors have to use *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 flow: they take **no account of risk**.

Without robust measures of risk-adjusted performance, it is impossible to justify a choice of spread. Without a clear understanding of the **representativity** of reported returns and of their **covariance**, existing 'benchmarks' fail to answer the most important question about the asset class: *What is the risk-adjusted performance of private infrastructure debt or equity?*

EDHEC*infra* exists to answer this question and build the market indices and benchmarks that investors need.

Building the largest database in the world

We collect, clean and analyse private infrastructure investment data and have created **the largest database of infrastructure investment data in the world today**: a global repository of financial knowledge built to be representative of the investable market each year, going back 20 years.

Measuring risk in illiquid investments

EDHEC*infra* has developed a series of models to estimate realised and future volatility, and measure risk and returns at the index constituent level.

We calculate fair value estimates for hundreds of firms using a multi-factor model of expected returns to determine the most appropriate discount rates at different point in time. By mapping

actual transaction prices to a number of risk factors, we can decompose individual transaction prices and estimate time-varying, unbiased and independent factor effects (risk premia). These risk factors are like the DNA of each transaction price. Once we understand what makes each new price, we can use its genetic makeup to estimate the price of any asset since all infrastructure companies' DNA is made of the same elements, only in different quantities.

Measuring credit risk in private debt

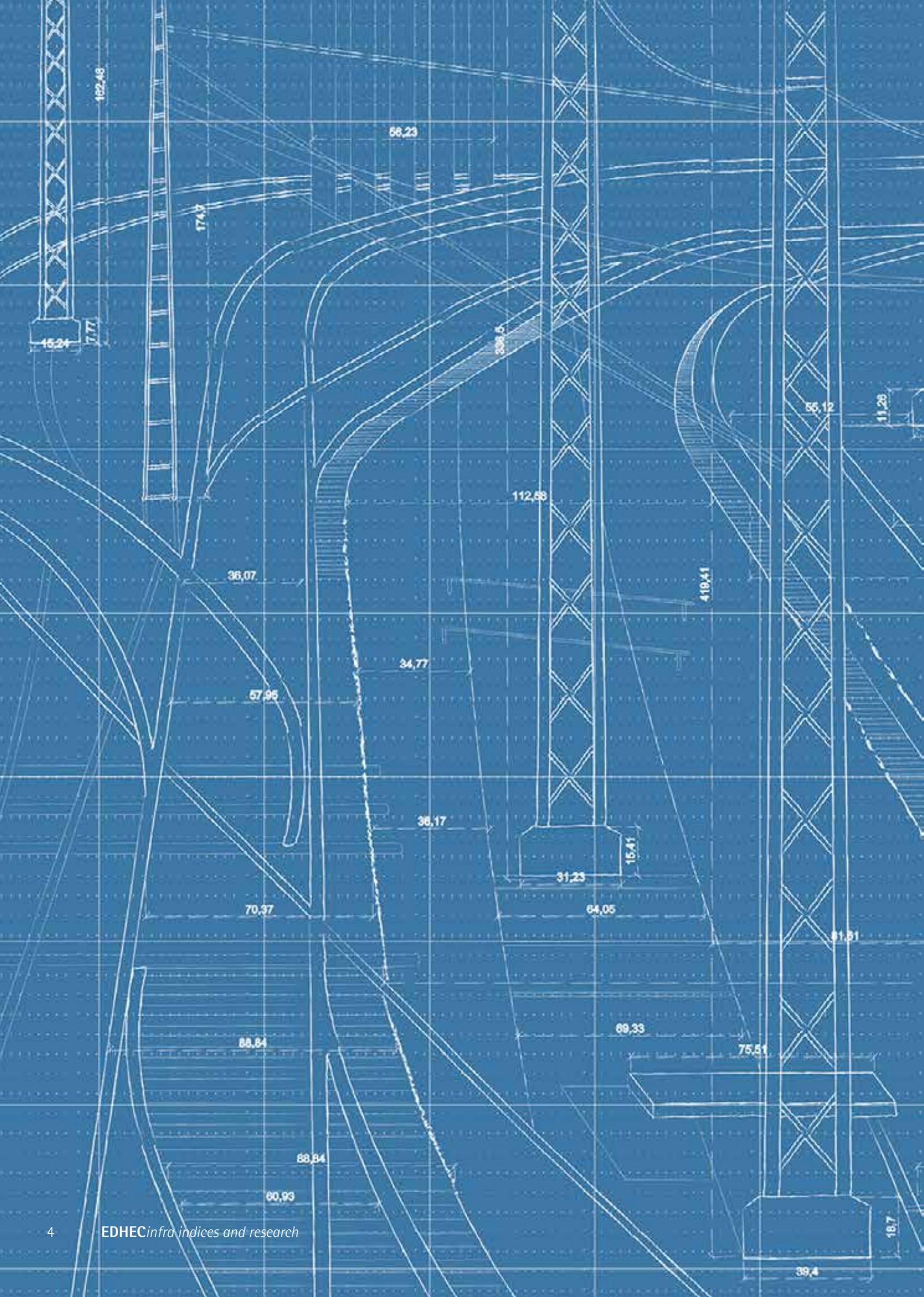
Measuring the risk-adjusted performance of long-term private debt instruments when few defaults are observable requires better credit risk models than the ones relying on historical data alone.

EDHEC*infra* has created and implemented a structural approach to credit risk and post-default debt restructuring in infrastructure debt that allows computing *distance to default* and *expected losses* at each point in the future and as well as the relevant metrics to benchmark highly illiquid infrastructure debt instruments (e.g. value-at-risk, duration, etc).

Building proper indices

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 the categories that are most relevant for investors' investment decisions.

Because each index is built using risk and performance measures derived at the constituent level, return **covariance and diversification benefits** can be estimated, allowing the creation of proper indices and benchmarks.



Data access

EDHEC*infra* is building the largest, most representative database of underlying infrastructure investments in the world. A **representative sample by investable sector, business model, and corporate structure** is built for each national market, while ensuring a 50% market coverage by size. This sampling approach ensures that EDHEC*infra* indices are representative of the universe they track in each year.

*"The EDHEC*infra* Global Index will track 1,000 assets by 2019, going back 20 years."*



Detailed financial data is collected from contributors using a standard template that also aims to improve reporting and transparency. Other sources of data include freedom of information requests, audited accounts as well as sources of physical data about each asset (GIS).

In 2019, the EDHEC*infra* database tracked the performance of 700 firms and included close to 5 million cash flow and balance sheet items, and hundreds of thousands of events, company attributes and financial instruments. The EDHEC*infra* Global Index will track 1,000 assets by 2020, going back more than 20 years. All the data collected by EDHEC*infra* is stored on a secure data server and is protected by the latest encryption.

Supporters of EDHEC*infra*

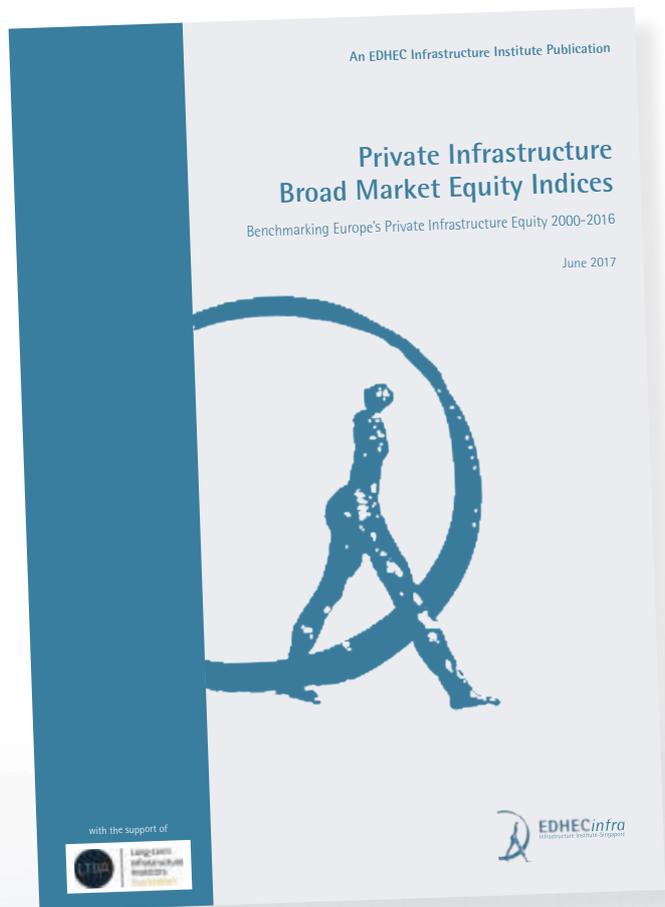
EDHEC*infra* is grateful to its supporters and data contributors including the Monetary Authority of Singapore, Natixis, Meridiam, Campbell Lutyens, the members of the Long-term Infrastructure Investors Association including Allianz Global Investors, Argo Infrastructure, Arjun Infrastructure Partners, Arpinge, British Columbia Investment Management Corporation, CALSTRS, Dalmore Capital, the Development Bank of Japan, the European Bank for Reconstruction and Development, the European Investment Bank, First State Investments, The Government Pension Investment Fund of Japan, InfraRed, InfraVia, John Hancock, Legal & General Investment Managers, Laborers' International Unions of North America, MACIF, Marguerite, Ontario Municipal Employees Retirement System, Palladio Partners, REST Industry Super, Skandia, SunSuper, SWEN, the City of New York Office of the Comptroller, TIIA, tpt Retirement Solutions, members of the Long-Term Investment Club including BNDES, Caisse des Dépôts, CAIXA, China Development Bank, Caisse des Dépôts et Placement du Québec, Cassa Depositi e Prestiti, IDFC, JBIC, Kreditanstalt für Wiederaufbau, Vnesheconombank.

Academic validation

As an independent research organisation EDHEC*infra* provides a standard reference for infrastructure investment performance. Alongside our first of a kind indices we deliver useful applied research in finance for investors in infrastructure.

Both the data collection and asset valuation approaches used by EDHEC*infra* are the object of an extensive process of academic validation, including peer-review by scientific journals. Since 2012, the research staff of EDHEC*infra* have published dozens of papers on the valuation of private illiquid assets, private debt credit risk modelling, index construction using infrastructure investments, the characteristics of listed infrastructure, and the benchmarking of the infrastructure asset class.

Over the past several years, EDHEC*infra* has transformed this scientific research into an applied technology for the sampling, processing, validation and storage of private infrastructure investment data. EDHEC*infra* has developed a series of cash flow forecasting, asset pricing and portfolio models that produce robust indexing results taking into account the actual term structure of interest rates, the evolution of investor preferences as captured by secondary and primary market data over time and the evolution of payout volatility at the individual constituent level.



Industry validation

Following academic validation the work of EDHEC*infra* is also subject to a process of industrial validation involving a prestigious Advisory Board including high-level representatives of asset owners, managers and public sector, policy-making bodies. This important step in the review of our methods and results ensure that we produce indices and analytics that are the most relevant and useful to the financial sector.

Our work has been endorsed by the G20/OECD Task Force on Institutional Investors and Long-term Financing. EDHEC*infra*, with support of the OECD, has developed a standard data collection framework for investment benchmarking that will make data collection more efficient and reporting more transparent. In partnership with the Global Infrastructure Hub we continue to monitor investor preferences for investment in infrastructure with an annual survey of investor perceptions of infrastructure.

Testimonials:

*"The ground-breaking initiatives being produced by EDHEC*infra* represent best practice within the industry. Our support of their benchmark initiatives stems from the ability for their work to provide useful and innovative information for infrastructure and equity investors and lenders. We congratulate their talented and thorough team on creating these benchmarks that will assist the industry for years to come."* – Stan Kolenc – Managing Director, Private Markets Group, OPTrust

*"Benchmarks that reveal how infrastructure performs as an investment are well and truly overdue. Evidence based information on performance is critical to our efforts in scaling up private investment in infrastructure and EDHEC*infra*'s work is an important step towards this goal."*

The Global Infrastructure Hub is pleased to be supporting the development of benchmarks that will help to make infrastructure an asset class that is attractive to a broader investor community."

Marie Lam-Frendo, CEO, Global Infrastructure Hub (G20)

"EDHEC will create usable investment benchmarks for infrastructure investors."

Tharman Shanmugaratnam, Deputy Prime Minister of Singapore

"EDHECinfra's infrastructure performance benchmarks will provide investors with a valuable tool to evaluate their infrastructure investments, and help to support the growth of infrastructure as a mainstream asset class."

Ravi Menon, Managing Director, Monetary Authority of Singapore

EDHECinfra Advisory Board

Asset owners and managers	Academics	Public sector	Research sponsors
AIA , Mark Konyon (Chief Investment Officer) Et Mr Tan Soo Thiam (Regional Director of Investment Management – Fixed Income Group Investment)	Noel Amenc , Professor, EDHEC Business School Et CEO of Scientific Beta	Global Infrastructure Hub , Marie Lam-Frendo (CEO)	Campbell-Lutyens , John Campbell (Chairman)
Abu Dhabi Investment Council , Adriaan Ryder (Chief Investment Strategist)	Robert Bianchi , Professor, Griffith University	OECD , Andre Laboul (Deputy Director, Directorate for Financial and Enterprise Affairs)	Long-Term Infrastructure Investors Association , Thierry Deau (Chairman)
Aviva , Ian Berry (Head of Infrastructure) Et Laurence Monnier, (Head of Strategy and Research)	Antonio Estache , Professor, Université Libre de Bruxelles	Monetary Authority of Singapore , Alan Yeo (Director and Department Head, Financial Markets Development Department)	Meridiam , Julia Prescott (Chief Strategy Officer)
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National Pension Service (Korea) Kim Jee (Head of Infrastructure Investment)			
OPTrust , James Davis (Chief Investment Officer)			
OSuper , Brad Holzberger (Chief Investment Officer)			
Sun Life Financial Asia , Sancho Chan (Chief Investment Officer and Head of ALM)			
Swiss Life , Christoph Manser, (Head of Infrastructure)			



A modern approach to measuring performance in unlisted infrastructure investments

EDHEC*infra* indices and benchmarks aim to provide a **representative, risk-adjusted view of the performance of investments in unlisted infrastructure equity and private debt**. These indices respond to a clear demand on the part of asset owners and managers to have access to better measures of value and risk when defining and comparing infrastructure investment strategies, monitoring performance and setting risk budgets. In the 2019 EDHEC/GIH survey of infrastructure investors, 90% of respondents declared that their current choice of absolute or relative benchmarks were not representative and did not adequately measure risk and performance.

EDHEC*infra* produces *calculated* (as opposed to contributed) indices: our data and technology allows re-pricing hundreds of individual assets through time, using actual transaction prices to recalibrate expected returns (and discount rates). This approach uses market inputs, thus avoiding the smoothing of returns caused by appraisal valuations and providing a genuine **fair value** assessment of performance.

Unlike other private indices, which only report an average performance, EDHEC*infra* indices include the effect of diversification and provide advanced risk metrics such as volatility, value-at-risk and risk factor prices. The index calculation method is summarised below in four key steps.

Further details can be found in a series of in-depth documents available at edhec.infrastructure.institute.

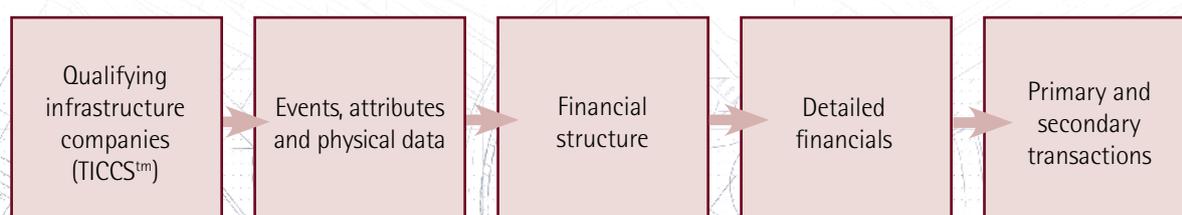
Step 1: A Representative Universe

Universe construction uses systematic rules to identify *principal* markets (IFRS-13) and select individual companies. As of early 2019, the **EDHEC*infra* Universe** includes 25 countries and more than 5,000 firms.



Step 2: A Standardised Database

EDHEC*infra* collects company level data from public and private sources for all firms in the **Sampled Universe** according to the **Global Infrastructure Investment Data Standard**. The hundreds of firms included in the Sampled Universe represent millions of data points.



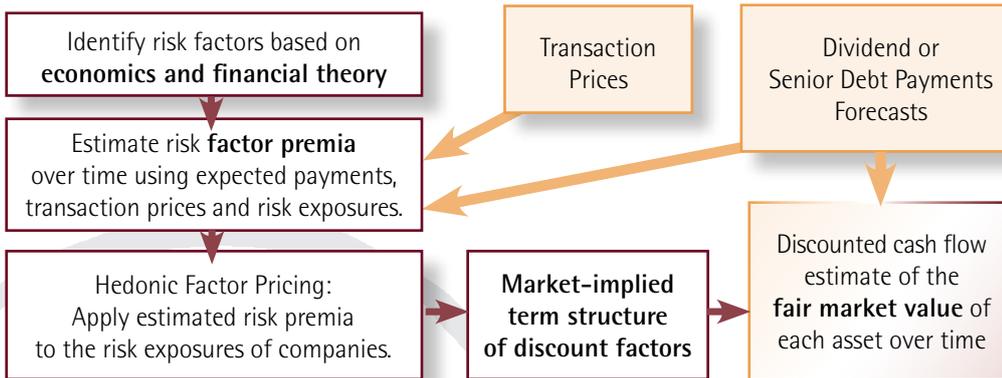
EDHEC*infra* data contributors follow a **Data Contributor Code of Conduct**, which also defines the minimum data required for contributions to be included in the database.

Step 3: Fair Value Asset Pricing

EDHEC*infra* produces **fair value estimates** for equity and senior debt instruments in each infrastructure firm in its Sampled Universe. The IFRS-13 fair value is the average price of a financial asset based on what buyers and sellers in any principal market are willing to pay at the time of evaluation.

In each period, excess returns are implied from the combination of actual transaction prices and dividend or senior debt payment forecasts. These expected returns represent the aggregate market price of risk for a cross-section of equity or debt investments at that point in time. They are then **decomposed into multiple risk factor premia** (e.g. the size or leverage risk premia) using a cross-sectional regression.

Each risk premia in a given period can then be applied to all relevant investments at that time, whether they are traded or not, using each company's 'factor loadings' (e.g. its actual size or leverage) to derive a **market-implied discount rate** for each investment.



Step 4: Risk-Adjusted Performance Indices

Individual constituents returns are computed in both local or major currencies and aggregated using different weighting schemes to compute quarterly index values. EDHEC*infra* indices use three weighting schemes.



We compute the return covariance of each pair of constituents in the Sampled Universe. This allows us to compute index risk metrics such as volatility, drawdown and value-at-risk. Filters are applied to the **Sample Universe** such as geography, sector or business model to create sub-index families.

Geography breakdown

EDHEC <i>infra</i> 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

Sector/business risk breakdown

EDHEC <i>infra</i> broad market index families				
Unlisted infrastructure equity sub-indices		Private infrastructure debt sub-indices		
Business risk	Broad sectors	Business risk	Broad sectors	Credit
<ul style="list-style-type: none"> Regulated Contracted Merchant 	<ul style="list-style-type: none"> Transport Social infrastructure Energy Renewables 	<ul style="list-style-type: none"> Regulated Contracted Merchant 	<ul style="list-style-type: none"> Transport Social infrastructure Energy Renewables 	<ul style="list-style-type: none"> Default risk Maturity Instrument currency

Find out more about EDHEC*infra*

Data for all major indices and analytics can be accessed free of charge.

Try it today.

indices.edhecinfra.com

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About EDHEC Business School

EDHEC Business School, founded in 1906 and among the select few institutions to have garnered international recognition through the triple crown of EQUIS, AACSB and Association of MBAs accreditations, offers management education at undergraduate, graduate, post-graduate and executive levels designed to meet the needs of companies.

Its large range of international graduate programmes draws students from the world over. With its five campuses in Lille, Nice, Paris, London and Singapore, its 6,000 students, and its 134 full-time faculty and researchers, EDHEC has been ranked among the top international business schools for several years.

The Research for Business strategy is a key component of the school's identity. Due to its not-for-profit aim, its financial independence and the time devoted to conducting research, the Research and Development Department contributes, as do other entities within the school, to the group's strategic objectives of growing our resources, aiming to have a visible impact on business, and forging close ties with business wherever they may be located.