We just do not know whether infrastructure can bring systematic diversification, hedging or insurance benefits at the portfolio level.

These results do not mean that institutional investment in infrastructure is not a good idea. Existing research relies on limited and biased datasets and we know that statistical estimates of returns are mostly unreliable (Merton 1980). Instead, the inconsistency of research results suggests that infrastructure is an ill-defined investment category lacking useful benchmarks.

Today, we just do not know whether infrastructure can bring systematic diversification, hedging or insurance benefits at the portfolio level. We are faced with a lack of evidence (about performance) compounded by a lack of knowledge (about expected returns and correlations). This is not a small question if pension funds are going to be convinced to invest in infrastructure in search of beta drivers.

Before churning more data, a serious effort is needed on the theoretical side: what should we expect from investment in infrastructure assets? There is a significant body of economic literature on the infrastructure sector, most of which still has to be translated into financial economics. Likewise, thanks to thirty years of project finance practice, we know a lot about how infrastructure project cash flows behave. What is needed today is a concerted effort between academia and the industry to benchmark infrastructure assets as financial assets and work towards the most efficient building blocks that would allow institutional investors to integrate infrastructure in their asset allocation decisions and infrastructure funds in their portfolio construction exercises.

Below, I discuss two issues which should underpin future research efforts from an asset allocation perspective: infrastructure assets as real assets, and infrastructure as a relevant investment category or asset class.

**Infrastructure assets are not real**

Whether one has listed or unlisted assets in mind, project equity or debt, direct investment or shares of specialised funds, infrastructure investment always begins with discreet, real world assets: large, complex endeavours almost always characterised by a high upfront sunk investment into a durable and immobile asset with little or no alternative use and a long economic life and repayment profile. However, the value of privately-financed infrastructure rests on implicit and explicit, direct and indirect contractual relationships.

This is an old problem in economics: two parties can reduce their costs by making a ‘relationship-specific’ investment (with no alternative use) but this creates the possibility of opportunistic behaviour by one or both parties and the solution is to sign a long-term contract before the investment is made. In the infrastructure sector, economies of scale require single,
durable and immobile investments in relationship-specific assets (e.g. it is cheaper for a given city to have a single larger hospital) and investment can only take place if long-term contracts have been entered into.

Infrastructure assets are not real assets (as opposed to commodities or real estate) because they are only worth what contracts creating credible commitment to fund, build, operate and use a discreet piece of infrastructure in exchange for an income stream, say they are. Contractual governance (including financial structure), the balance of payoffs and the likelihood of renegotiation, are some of the main factors driving the value of such investment.

At the primary level, investing in infrastructure means investing in long-term contracts for the provision of specific capital goods and their related usage. Moreover, most infrastructure delivers a 'public service' ultimately underwritten by the public sector. For this reason, infrastructure is only ever conceded, either explicitly or not i.e. the source of enterprise value springs from the existence of a relationship between the public sector and a firm allowing the latter to provide a public service according to an agreed business model.

"Investors should start thinking of infrastructure as investing in long-term contracts, in which different parties agree to take different risks and to receive their related payoffs."

Of course, not all infrastructure is solely a function of public policy, especially if the project's output can be sold in a competitive market in which case there are substitutes to public provision (e.g. merchant power). However, the value of investments in highly specific, durable and immobile assets remains a function of explicit and implicit long-term contracts.

Investors should start thinking of infrastructure as investing in long-term contracts, in which different parties agree to take different risks and to receive their related payoffs.

There is still no investable infrastructure asset class

Speaking of asset classes makes sense if the addition of a new class to an opportunity set improves the available risk-return trade-off. An asset class also has to be investable if its characteristics are to be captured in an investor's portfolio.

Most research on infrastructure investment refers to a list of industrial sub-sectors, from power generation to hospital buildings, as the 'asset class.' Assuming one can agree on a definition of what all listed and unlisted, direct and indirect infrastructure assets consist of, a basket of these assets, weighted by their true value, would be a true representation of the 'infrastructure asset class.'

How large would an infrastructure portfolio have to be to achieve reasonable diversification? With normally distributed returns and equal weights, listed equities can achieve 95% diversification of specific risk with 44 stocks (Brown and Matysiaik 2000). But how are infrastructure asset returns distributed? If returns are skewed and leptokurtic: we know that with direct real estate assets, a portfolio of at least 1,700 properties is needed to reduce risk ten-fold (Young and Lee 2006). In other words, investing in all the PFI projects ever financed would not be enough to achieve the same level of diversification! The problem of non-normal returns is compounded by the indivisibility of assets which prevents equal weighting. If equal-weighting is not an option, larger portfolios of value-weighed properties will be required to obtain the same level of diversification. (Ducoulombier 2007)

Thus, even if the infrastructure 'asset class' exists in theory, in all likelihood it cannot be directly invested as such i.e. infrastructure remains too lumpy and fragmented for investors to contemplate holding a representative basket of investable infrastructure assets. As a consequence, there is still no available passive infrastructure investment strategy for a pension fund through a highly diversified portfolio since actual investments are likely to include exposures to the class and to firm-specific risk. The separation of the beta and alpha decisions is impossible because the estimation of the obtainable beta is a function of a limited set of available investment vehicles.

Since investors committing capital to infrastructure are pursuing a de facto active strategy, negative or positive selection biases are likely. If returns dispersion between top and bottom performers is significant, failing to access top quartile infrastructure funds may result in very poor performance indeed. This is why the best infrastructure funds will continue to charge high fees.

It also follows that despite the gargantuan infrastructure 'financing gap' figures frequently quoted, there may not be enough high quality 'investable infrastructure' for all institutional investors.

Benchmarking infrastructure investment

Today, the lack of accepted benchmark prevents investors from understanding the risk, returns and correlation characteristics of infrastructure investment, and without a consensus on historical returns, little guidance on strategic asset allocation to infrastructure can exist. How should we design good benchmarks?
As current research demonstrates, past data will not be very informative and forward looking models are likely to be more helpful. Analytically, the primacy of contracts in infrastructure investment suggests the need to identify generic risk categories that are relevant to the risk/return profile of contracts on the income side (e.g. availability-based income, demand-based and regulated income) and on the cost side (e.g. the probability distribution of construction cost overruns under private management should be very different than under traditional procurement). Thankfully, with infrastructure project finance, the future is better defined than with most other investment vehicles and modeling the behaviour of infrastructure assets should be possible.

"The need for active management of infrastructure investment should be recognised as well as its long term cost."

If one accepts that infrastructure assets are policy-driven long-term risk transfer contracts, then benchmarking returns by technology-determined sectors such as toll roads or wind power makes little sense. Contracts (and policy) should be the defining characteristics of infrastructure subclasses. It is almost dangerous to claim, as many presentations do, that greenfield toll roads have a 12 to 16 per cent IRR while operational ones offer 8 to 12 per cent (Weber and Alfen 2010). What matters is what concession contracts says, and from this perspective, some Northern European PPP roads look a lot more like PFI schools than like Portuguese PPP roads.

This is also not very different from a total rate of return swap: the public sector receives a given stream of services at a fixed price and the firm (investor) receives a fixed income stream and faces variable costs. Valuing this contract demands taking a view on total delivery costs (including, for example, refinancing risk) and on whether the public sector might renege on its commitment (political risk).

A consensus on a benchmark for investing equity in standardised PFI projects (accommodation, schools, municipal services &c) should be possible, thus allowing the integration of the PFI in strategic allocation exercises. Of course, PFI equity as an investment category does not diversify political risk.

**Conclusion**

Pension funds can invest to hedge their liabilities or to seek performance. At the moment they are asked to invest in something called ‘infrastructure’ and to expect getting both. At the same time, the characteristics of the underlying cash flows seem to be evaporating at the infrastructure fund level.

As discussed above, infrastructure is unlikely to be an investment class for which institutional investors can adopt a passive approach. The need for active management of infrastructure investment should be recognised as well as its long term cost.

It also follows that, with the exception of a few very large players, intermediation remains the solution of choice to achieve substantial levels of institutional investment. This also should be recognised and the cost of using intermediaries compared to the benefits of intermediation.

Attracting pension fund investment to infrastructure is a public policy objective, governments should thus take steps to make sure that the benefits of intermediated infrastructure investment are real. This means working with intermediaries, academics and regulators to create investment products in public infrastructure which offer the liability-hedging or performance-seeking characteristics that pension funds want. Different infrastructure-related investment products could be designed: some for liability hedging, some for performance seeking. For example, instead of agonising about whether or not infrastructure investment can deliver inflation protection, it would be interesting to try and design investment products in infrastructure that do.

Infrastructure investment would then be much more likely to deliver consistent performance and final investors could appreciate whether allocating to infrastructure improves the risk/return profile of their portfolios.

*This article forms part of a new InfraNews series in collaboration with EDHEC-Risk Institute ([www.edhec-risk.com](http://www.edhec-risk.com)), and focuses on issues associated with infrastructure investment and asset management. EDHEC-Risk Institute is an independent research organisation concentrating on risk and investment issues of relevance to the pensions and*
investment industry. It has a team of ninety and offices in France, Singapore, the United-Kingdom, and the United-States. It is currently setting up a new Infrastructure Investment Research Chair. For more information please contact Frederic Blanc-Brude, Research Director, EDHEC Risk Institute–Asia (frederic.blanc-brude@edhec-risk.com).

Next column: “Issues with infrastructure portfolio optimisation”

Notes and references:

1. With unequal tails and a high peak, like the beta-PERT distribution that infrastructure project engineers know well.

   • Ducoulombier, Frédéric. 2007. EDHEC European Real Estate Investment and Risk Management Survey. EDHEC-RISK.