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Infrastructure portfolio construction: in search of an asset class

Defining the role of infrastructure investments in a liability-driven investment context is not straightforward and is still little understood. The current investment narrative about a pre-existing infrastructure asset class tends to divert investors from what they are really after with such investments: improving performance and hedging liabilities. Infrastructure portfolio construction should be approached with these objectives in mind rather than assuming the existence of an infrastructure beta that has so far remained elusive. In effect, an infrastructure asset class that responds to investors' needs remains to be built.

Infrastructure: an attractive asset class narrative

In a world characterised by bounded rationality, investors are receptive to narratives or "the passive acceptance of the formulation given" (Kahneman 2002). Indeed, the gradual formulation of a coherent narrative about the characteristics of infrastructure investment as a previously unrecognised asset class has caught the attention of investors and academics.

In this context, the characteristics of investable infrastructure are typically explained by the nature of tangible infrastructure assets: immobile and demanding high sunk capital costs and long repayment periods, they tend to create monopolies thanks to barriers to entry and increasing returns to scale. Thus, infrastructure assets are expected to have pricing power and the concomitant low elasticity of demand for 'essential' services to create an inflation hedge and low return covariance with other investments, as well as attractive risk-adjusted returns. At its most formulaic, the infrastructure asset class narrative can be summarised thus:

- "Investors are attracted to (infrastructure's) low volatility, yield-oriented returns, inflation-hedging and diversification potential." (JPMAM & Weisdorf 2007)
- "For pension funds in particular, the long duration, steady cash flow and inherent inflation hedge of mature infrastructure investments hold considerable appeal." (RREEF et al. 2008)
- "An investment opportunity targeting a net annual return of 8% from long-dated, inflation-protected, quasi-government cash flows." (GCP 2010)
- "An inflation-linked bond with rising coupons." (Lazard 2011)

This investment narrative is very attractive indeed for institutional investors, most of which are required to meet a combination of performance-seeking and liability-hedging objectives. In modern finance theory, separation theorems state that the management of risk and of performance is best done via separate portfolios: for a pension fund, performance is obtained through exposure to optimal risk factors in order to minimize the burden of contributions. Hedging liabilities against unexpected shocks is the role of a separate, dedicated portfolio (Amenc et al. 2010). Thus, the infrastructure asset class narrative points to both performance-seeking and liability-hedging objectives. Indeed, illiquid assets such as infrastructure are found to play a growing role in pension funds' alternative investment decisions (Sender 2010) as part of a performance-seeking portfolio (PSP). Likewise, infrastructure may contribute to a liability-hedging portfolio (LHP) if it can offer exposure to predictable, a-cyclical and inflation-linked cash flows.

However, this dual role may also be a source of confusion: because infrastructure investments might contribute to both dimensions, one may wonder if they belong to the PSP or the LHP. In fact, accessing the multiple investment characteristics generally associated with infrastructure has not so far proven as straightforward as the infrastructure asset class narrative might suggest, and pension funds have, for example, become reportedly dissatisfied with existing private equity-like infrastructure funds (Burgess & Davies 2011). In this context, whether final investors wish to invest directly in infrastructure or continue to

use intermediaries, the question of infrastructure portfolio construction is central to their strategic allocation achieving the desired objectives.

Infrastructure and the PSP

In the literature, the performance-seeking portfolio (PSP) is the one that achieves that highest Sharpe ratio (Amenc et al. 2010). In this respect, a number of academic studies have explored the performance-seeking characteristics of listed and unlisted infrastructure equity.

Existing research on listed infrastructure finds a tendency to deliver excess returns but also higher market risk in the case of Australia (Peng & Newell 2007) or lower market risk but higher total risk looking at a global sample (Rothballer & Kaserer 2011). Crucially, listed infrastructure is a heterogeneous sector dominated by utilities offering diversification potential but not necessarily low volatility (Newell & Peng 2009; Bird et al. 2011; Rothballer & Kaserer 2011) as well as other listed infrastructure entities exhibiting higher market risk driven by leverage (Bird et al. 2011; Newell et al. 2011)

Thus, as an addition to the PSP, listed infrastructure may fit the infrastructure asset class narrative insofar as it can improve portfolio diversification but this is mainly a feature of listed utilities and one may wonder whether investing in listed utilities represent anything new for pension funds. Furthermore, the finding that listed infrastructure exhibit high levels of idiosyncratic risk combined with non-normal returns (Rothballer & Kaserer 2011) has implications for portfolio construction since building well diversified positions with such stocks may demand a larger number of investments that with other stocks (Ducoulombier 2007).

Still, there are a number of issues with the listed benchmarks used to proxy 'infrastructure' in existing studies. Authors use ad hoc datasets suffering from historical and country biases or industry-provided infrastructure indices which suffers from two fundamental drawbacks: first, market-cap weighting leads to poor diversification and even concentration in a few very large stocks. Existing research has shown that market-cap weighted indices are so inefficient that they are dominated by equal-weight indices, which are themselves suboptimal (Amenc et al. 2010). Second, the weight of privatised utilities leads, for historical and political reasons, to a geographic concentration in the US, UK and Australia and in a sector where regulation is a driver of returns this 'Common Law tilt' may not be very informative of the characteristics of infrastructure assets in countries that have adopted the Napoleonic code, or in China and India.

Turning to unlisted infrastructure equity investments, a single study (Rothballer & Kaserer 2011) examines the return characteristics of several hundred underlying investments and finds that infrastructure investments made by closed-ended, unlisted infrastructure private equity (PE) funds are five times larger than other PE deals but do not have longer durations. The authors also test the variability of cash flows around the average s-shaped cash flow structure of deals in their database and find that infrastructure PE fund cash flows are not less volatile than other PE fund cash flows. However, they also observe less zero (bankruptcy) or below unity (loss) multiples in infrastructure funds compared with other PE funds, while average and median IRRs are higher for infrastructure funds. Overall, the Sharpe ratio of infrastructure PE tends to be higher than that of other PE deals. Still, the investment characteristics of several hundred individual infrastructure PE deals may not be indicative of the expected performance of infrastructure PE funds from the point of view of LPs.

Only a few papers examine net-of-fees returns to infrastructure fund LPs. Using Australian data almost exclusively, these studies find that unlisted infrastructure funds can have an attractive Sharpe ratio (Peng & Newell 2007; Bird et al. 2011; De Francesco et al. 2011). As for listed infrastructure, these authors suggest that leverage is the main source of return in unlisted infrastructure. However, the use of Australian equity funds to illustrate the characteristics of infrastructure funds is problematic. Bird et al and others report that Australian infrastructure data is biased because its covers a period during which assets were acquired at significant discounts from distressed local governments (e.g. the Victorian government in the early 90s) and a benign regulatory environment allowed tariff increases consistently above real GDP growth. Australian unlisted infrastructure funds can also be open-ended (Bird et al. 2011) which is exceptional in other jurisdictions and may thus have a different return profile than the global population of close-ended infrastructure PE funds.

The diversification benefits of unlisted infrastructure PE funds are harder to document than for listed infrastructure. Bitsch et al (2010) document significant correlation between unlisted infrastructure funds and private equity, as well as stronger correlation between infrastructure and public equities than between the rest of private equity investments and public equities. Peng et al (2007) find that the correlation of

unlisted funds with the stock market is very low but that correlation with property has tended to increase during their sample period (1995-2006). However, Bird et al (2011) fail to find any correlation with public equities in their sample of Australian unlisted funds.

In summary, while existing research shows that it is possible to improve the PSP's Sharpe ratio with both listed and unlisted infrastructure equity, it is not straightforward which strongly suggests that the inclusion of infrastructure investments in the PSP is a skill-based, active investment process rather than the simple addition of a previously unidentified asset class with a clearly identified beta.

Infrastructure and the LHP

Formally speaking, the liability-hedging portfolio (LHP) is the portfolio that achieves that highest correlation with the liability process. Here, we focus on inflation hedging which has attracted the most research interest and because the ability to hedge away inflation through infrastructure investment is a core claim of the infrastructure asset class narrative that has been made repeatedly in numerous industry publications (RREEF et al. 2007; RREEF et al. 2008; Colonial First State Asset Management 2010a; Colonial First State Asset Management 2010b; AMP 2010; Lazard 2011).

The argument supporting the claim that infrastructure can hedge inflation are summarised by Rödel et al (2011).

- Infrastructure is a real asset, the replacement costs of which increase in an inflationary environment, thus preserving investment value (RREEF et al. 2007);
- Infrastructure assets create monopolies with pricing power and low elasticity of demand (RREEF et al. 2007);
- The economic regulation of natural monopolies grants them an explicit inflation pass-through with tariff setting formulas following the RPI-X model (Euromoney & Rickards 2008), as is also the case for toll setting formulas in most toll roads (Colonial First State Asset Management 2009);
- The high share of capital costs in infrastructure businesses minimizes their exposure to input price inflation (Martin 2010).

However, the literature testing for the inflation protection potential of infrastructure fails to arrive at such unconditional conclusions. Two industry studies by J.P. Morgan show that the EBITDA of regulated utilities in the US is positively correlated with inflation and that the income cash flows of EU and US regulated utilities grow above the inflation rate (JPMAM et al. 2008; JPMAM et al. 2009). A similar study examines the ability of a listed infrastructure index to outpace inflation over a given period and concludes that it is highly likely for a 10-year investment period (Russell Investments & Ross 2009). However, these studies do not test the statistical significance of their conclusions.

The rest of existing papers are more circumspect. While Martin (2010) suggests that infrastructure investment can be an inflation hedge, he also concludes that sensitivity of utility returns to expected and unexpected inflation is statistically insignificant. Bird et al (2011) measure sensitivity to inflation expectations by comparing infrastructure returns with returns to US and Australian inflation linked bonds, using the Barclays US TIPS index and the UBS Australia Inflation Linked bond index. They also test infrastructure inflation hedging abilities directly by using the CPI and obtain similar results: the US and Australian utility sectors exhibit inflation hedging potential, however, pure infrastructure (non-utility) stocks show no evidence of inflation hedging.

Rödel and Rothballer (2012) conduct the most robust study so far of the potential for additional inflation protection through listed infrastructure. They estimate the impact of expected and realized inflation on 1-, 2- and 5-year rolling nominal returns for domestic and international series but find no evidence of statistically significant improved inflation protection from infrastructure stocks compared with the stock market. Likewise, Sawant (2010) and Peng et al (2007) fails to find any significant correlation between inflation and the returns of listed infrastructure indices.

Also looking at the effect of expected and unexpected inflation, Boudoukh et al. (1993) show that US utilities nominal returns between 1953 and 1990 tend to covary positively with expected inflation, but quite the reverse for unexpected inflation. A follow-up sector study using data from 1928 to 2008 arrives at similar conclusions (Antwerpen 2010).

Unlisted infrastructure does not fare much better as an inflation hedge in recent studies. Peng et al (2007) do not find evidence of inflation protection in Australian unlisted infrastructure. Likewise, looking at underlying investments in infrastructure PE funds, Bitsch et al (2010) test whether returns are inflation-

linked but cannot find any statistically significant evidence of inflation protection. In the context of shorter, exit-focused PE deals where the impact of two layers of leverage is likely to dominate other effects driving returns, this finding is unsurprising.

Thus, the inflation hedging properties of infrastructure investment are difficult to demonstrate but the lack of conclusive research results when it comes to inflation hedging may be partly a matter of the definition of the relevant investment universe. Indeed, there is plenty of anecdotal evidence of infrastructure contracts offering an inflation hedge. It follows that delivering the liability-hedging dimension of the infrastructure investment narrative through active, skill-based management should be possible at least for some investors.

Is infrastructure an asset class?

While existing empirical research thus struggles to fully replicate the infrastructure asset class narrative, it suggests that infrastructure may improve the Sharpe ratio of the PSP and thus belongs there rather than in the LHP. In the event that more than one efficient performance-seeking portfolio exists, the PSP that has the best liability-hedging properties should be selected (Amenc et al. 2010).

This is problematic since, in a liability-driven investment context, infrastructure's contribution to the LHP is probably what pension funds are most interested in. However, this research is still in its infancy and data limitations are a particular concern. Still, three remarks can be made:

The infrastructure investment space is badly defined: the infrastructure asset class narrative is about financial economics (long-term contracts for investing in relationship specific assets) not real assets. The focus should be on regulatory regimes, especially contracts, and financial structure, not physical characteristics: "investing in mature toll roads" is a meaningless proposition until tariff setting mechanisms and financial arrangements have been considered. Conversely, an Australian coal terminal with a take-or-pay throughput contract and 90% leverage, may have a very similar equity return profile than a PFI school in Scotland. Likewise, classifying infrastructure investments by regulatory regimes should clarify the role of infrastructure assets in the LHP. For example, PFI contracts mostly have built-in inflation pass-through clauses, as such they can constitute an explicit UK inflation hedge, different from an RPI-X regulatory regime.

To deliver the narrative investors must include infrastructure debt: the infrastructure investment narrative is a 'revenue story' i.e. infrastructure businesses are expected to capture stable, a-cyclical, inflation-linked income streams, a significant proportion of which is channelled towards debt service. Capturing the characteristics of these cash flows should be improved by investing simultaneously in equity and debt. However, this is not a reason for calling infrastructure debt a new asset class. As fixed income investment, infrastructure debt can be added to existing fixed income allocations. But the net effect of infrastructure debt, especially on the LHP side deserves to be better understood.

In effect, there is currently no infrastructure asset class that would deliver on the infrastructure investment narrative. Asset classes should have an inherent non-skill-based return, which distinguishes them from investment strategies (Idzorek & Armstrong 2009). While infrastructure investment may deliver the investment narrative that institutional investors seek, it remains very much a skill-based, active strategy that is valid both within the listed and unlisted equity spaces. As far as current research can tell, the contribution of listed securities is difficult to measure and may be lost to market volatility and that of unlisted solutions may be too dependent on current PE-like structuring solutions and their distortionary impact on the characteristics of the underlying.

In conclusion, we still need to develop large-scale investment solutions using infrastructure projects as underlying that also respond explicitly and effectively to the performance seeking and liability hedging objectives of institutional investors. Only then will there be an infrastructure asset class worthy of the narrative.

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