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Which factors explain unlisted infrastructure asset prices?

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Unlisted infrastructure prices have increased considerably over the past decade. Was it a bubble or a normal phenomenon?

In new research from the EDHEC Infrastructure Institute (EDHEC*Infra*)¹ we show that systematic risk factors can largely explain the evolution of average prices but also that valuations have shifted to a higher level. We show that unlisted infrastructure equity prices do not exist in a vacuum but are driven by factors that can be found across asset classes.

Six factors are found to explain the market prices of unlisted infrastructure investments over the past 15 years: size, leverage, profits, term spread, value and growth. To these usual suspects, one can add sector and geographic effects. The result is an unbiased view of the evolution of prices (price-to-sales and price-to-earnings ratios).

We also find that on top of standard risk factors associated with most firms, sector-specific factors explain the level of prices and their recent evolution. For instance, renewable energy projects are found to have much higher price-to-sales ratios than average infrastructure companies, while social infrastructure has lower than average price-to-sales and roads valuations trend up and down with the economic cycle.

Our analysis documents the contribution of these factors to the evolution of average prices over the past 15 years. Their effect is found to have been mostly persistent over this period – ie, individual risk premia have been stable albeit, in some cases, time-varying. These effects are thus likely to continue driving prices in the future.

At the aggregate level, we document a degree of covariance between unlisted infrastructure prices and equivalent measures in public equity markets. At the sector level, patterns emerge with higher correlation with public markets in certain sectors more exposed to the economic cycle (eg, roads) and others experiencing peaks followed by a decrease in prices, as in the power sector.

A second phenomenon documented in this paper is a shift to a generally higher price regime of the unlisted asset class during the 2008–15 period. During those years, the effect of certain risk factors on prices became less powerful, notably leverage, as average prices increase seemingly independently of their risk profile. During that period, the nature of investors active in the unlisted infrastructure market has also shifted: a period of price discovery (which has sometimes been called a bubble) led to lower required returns as the risk preferences of the average buyer of private infrastructure companies evolved. This period appears to end after 2015, when prices stabilise.

Infrastructure businesses are expected to deliver steady and predictable cash flows and to the extent that this is the case they should be expensive. Hence, after 10 years of price increases a price consensus may have been reached.

Unlisted infrastructure prices will, in all likelihood, continue to be driven by common factors in the future, while the evolution of investor preferences will also determine the general level of prices and of the fair value of the unlisted infrastructure asset class. Our results show that despite the evolution of investor preferences, systematic risk factors mostly continued to explain prices over that period, indicating that valuations remained, on average, rational and fair.

Approach: from biased transaction prices to unbiased factor prices

One of the most important requirements of the IFRS 13 framework is to calibrate valuations to observable market prices. Private infrastructure is an illiquid market and assets do not trade often. As a result, observable transac-

1. Mean price-to-sales ratio

Correlation unlisted infra/S&P500: 44.42%



tion prices are limited and are not representative of the investible market. But the prices and returns of unlisted infrastructure equity can be expected to be driven by certain common factors, including some that exist in other asset classes and are well known.

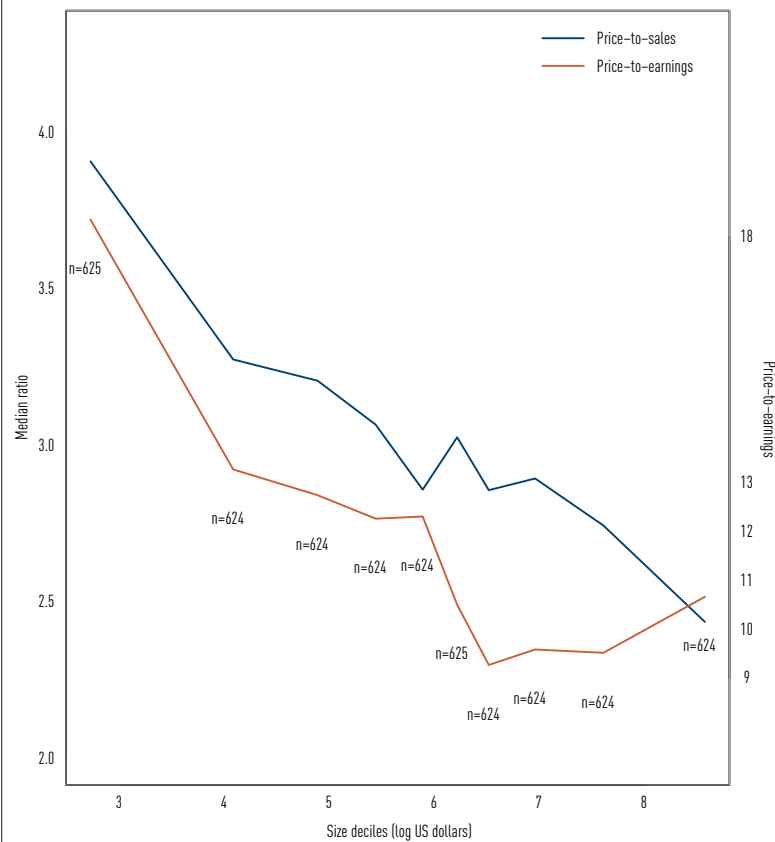
To overcome this issue, we estimate the effect of six factors that impact observable transaction prices and apply these to the more representative EDHEC*Infra* universe of unlisted infrastructure companies. We use statistical filtering techniques (Kalman filter) to capture the changing impact of these factors on prices over time as investor preferences and market conditions change. These factor effects are unbiased and statistically robust.

This allows us to compute thousands of 'shadow prices' for those unlisted infrastructure companies that did not trade over the past 15 years. With this approach, we can document the price dynamics of the unlisted infrastructure market for the underlying population and not just for a biased sample of available transaction data.

We use a price-to-sales (PSR) ratio as a valuation measure, which reflects the willingness of an investor to pay for future risky revenue growth and dividends, adjusted for risk. We find that PSRs are well behaved statistically and present multiple advantages over price-to-book and price-to-earnings ratios, not the least that they always have a positive sign. A higher PSR indicates buyers are willing to pay more per dollar of average historical revenues, suggesting that these revenues are either expected to grow or considered more predictable. PSRs are also the standard metric used in

¹ Which Factors Explain Unlisted Infrastructure Asset Prices? The EDHEC/Long-Term Infrastructure Investor Association Research Chair on Infrastructure Equity Benchmarking, 2016–2019. http://edhec.infrastructure.institute/wp-content/uploads/publications/blanc-brude_and_tran_2019.pdf

2. Size versus price-to-sales and price-to-earnings



international capital markets and may be compared directly with the equivalent ratio for public equity indices.

The six risk factors that explain unlisted infrastructure prices

- **Size:** Previous research shows that small-cap stocks tend to outperform large-cap stocks because they have a higher exposure to systematic risk factors, undergo longer periods of distress in bad times, pose higher credit risk or are less liquid. In the case of infrastructure, larger assets are found to have lower prices – ie, higher returns. Effectively, size is a proxy of liquidity: larger infrastructure projects are more illiquid, complex to develop and the object of information asymmetries between buyers and sellers.
- **Leverage (credit risk):** As for other firms, credit risk has an impact on equity investors in infrastructure, who take the risk of being ‘wiped out’ in the event of default. Infrastructure companies that have higher leverage – proxied by the ratio of total liabilities to total assets – thus have, on average, lower prices.
- **Profits:** Also in line with theory, profitability impacts prices directly and positively. We find that the effect – proxied by the profit margin – is time varying and more important during bad times (the years following the financial crisis).
- **Term spread:** the value of infrastructure investments, with their high upfront capital costs, is determined by their long-term cash flows. They are therefore sensitive to interest (discount) rate changes. The term spread – the difference between long-term and short-term interest rates – is found to have a negative impact on prices, also as theory predicts. In an international context, differences in term spread can also signal differences in country risk, especially when short-term rates are at the zero-lower bound, which is the

case during most of the relevant period of observation.

- **Value:** a value effect exists if companies are ‘cheap’ from one perspective or another. We look at infrastructure companies that report negative book values during their first 10 years as a proxy of the ‘value’ period in their life-cycle. We find that the greenfield stage corresponds to a different level of prices than during the rest of the firm’s life-cycle.
- **Growth:** Infrastructure companies have limited growth opportunities as by nature they are designed to deliver individual investment projects with fixed revenues. Still, merchant infrastructure projects and corporates have opportunities to grow. For these companies, higher expected growth relatively increases prices. We also find that, in line with theory, realised revenue growth tends to have a positive effect on valuations.

Stylised facts: the dynamics of unlisted infrastructure prices

Price-to-sales ratios of infrastructure companies are significantly higher than in public markets, irrespective of market conditions. This reflects the ability of infrastructure companies to transform income into dividends, as highlighted in previous studies, pay-out ratios (dividend pay-outs over revenues) tend to be four to five times higher in mature unlisted infrastructure companies than in listed companies of equivalent size, leverage and profitability.

Price-to-earnings ratios tend to be much more volatile than in public markets. Indeed, pay-outs may be higher as share of revenues but they are also more variable as a result of the significant financial and operational leverage that characterises infrastructure companies. Their large but mostly fixed production costs make any excess revenue a source of pure profit, but since any decline in revenues is not easily matched with a decline in production costs, profits can decline very fast as well.

For the most part, *the factors driving unlisted infrastructure secondary market prices make sense:* size, leverage, value or profitability have the signs predicted by theory and their effects are persistent, albeit variable, across time. This is significant to define an ex ante factor model of returns for the purpose of asset valuation.

Price formation and discovery is slow: the factor effects documented above can take several years to change from one level to another, as transactions and investor preferences are processed by market mechanisms. This is partly the reflection of unlisted infrastructure status as a ‘new’ asset class, so that numerous transactions were necessary over many years for ‘fair’ prices – representing the willingness to pay of numerous buyers and sellers at one point in time – to emerge. Prices do not react immediately to short-term variations in financial conditions: the swings in price-to-earnings are due to the fact that prices stayed on a steady increasing path for most of the period, while earnings swung up and down, especially in the merchant sector. This can be both a function of the slow processing of price information in a high illiquid market, as well as the reflection of the belief by buyers that most of the value of infrastructure companies is embodied in a long-term business model, which can be considered impervious to short-term volatility.

Valuations are not out of line with fair value: because price movements can be explained by systematic factors and the remaining variability of transaction prices appears to be idiosyncratic, prices can be said to have mostly evolved to reflect the preferences of market participants taking major risk factors into account. In other, words, pricing has remained rational and informed. The fact that prices have increased a lot over the past decade cannot simply be attributed to a ‘wall of cash’ effect in a market where many participants were chasing few available opportunities.

The research from which this article was drawn was produced as part of the EDHEC/Long-Term Infrastructure Investors’ Association (LTIIA) Research Chair on Infrastructure Equity Benchmarking.

Reference

Blanc-Brude, F., and C. Tran (January 2019). Which Factors Explain Unlisted Infrastructure Asset Prices? Evidence from 15 years of secondary market transaction data. EDHEC Infrastructure Institute – Singapore Publication.

The pricing of private infrastructure debt

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Which factors explain private infrastructure credit spreads (and discount rates) and how do they evolve over time? Are infrastructure project finance spreads and infrastructure corporate spreads driven by common factors?

In new research supported by Natixis as part of the EDHEC/Natixis research chair on Infrastructure Debt Benchmarking, the EDHEC Infrastructure Institute (EDHEC*infra*) examines the drivers and evolution of credit spreads in private infrastructure debt.

We show that *common risk factors partly explain both infrastructure and corporate debt spreads*. However, the pricing of these factors differs, sometimes considerably, between the two types of private debt instruments.

We also find that *private infrastructure debt has been 'fairly' priced even after the 2008 credit crisis*. That is because spread levels are well explained by the evolution of systematic risk factor premia and, taking these into account, current spreads are only about 20 basis points above their pre-2008 level. In other words, taking into account the level of risk (factor loadings) in the investible universe and the price of risk (risk factor premia) over the past 20 years, we only find a small increase in the average level of credit spreads, whereas absolute spread levels are twice as high today as they were before 2008.

A better approach to estimating market credit spreads

The main difficulty facing econometric research on the pricing of infrastruc-

ture debt is the paucity and biases of observable data. Secondary transactions are very rare and usually not instrument-level sales. Still, large number of primary transactions (at the time of origination) can be observed. Nevertheless, this data is biased: origination follows procurement and industrial trends – eg, it tends to cluster in time and space when and where governments procure new infrastructure using a privately-financed model. Simply observing origination credit spreads over time does not take into account the underlying market for private infrastructure debt to which investors are exposed.

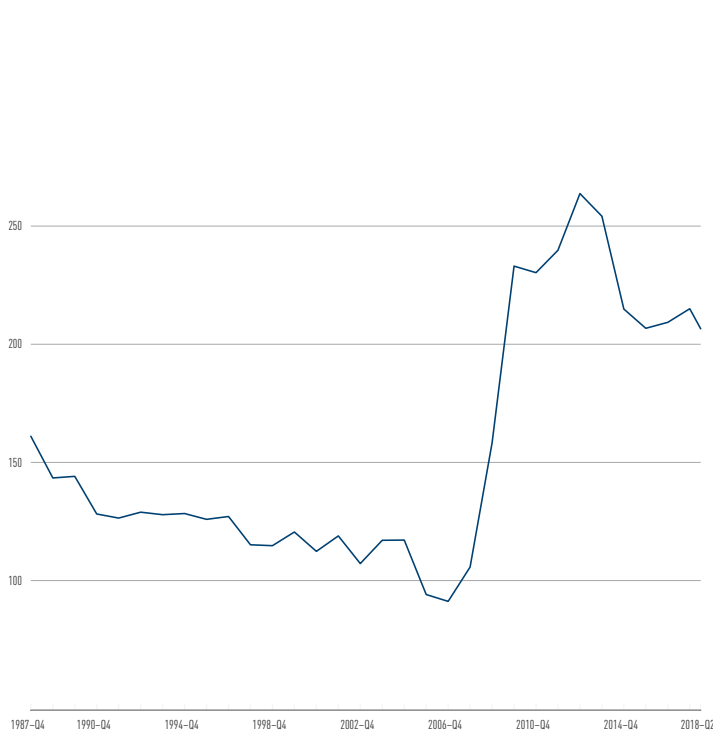
Primary spread data is also auto-correlated – ie, what best explains the spread for a given infrastructure borrower is not its characteristics, but the spread of the previous transaction.

To address these issues and estimate the effect of individual risk factors on spreads we do two things. Firstly we estimate the evolution over time of the risk factor premia and determine their unbiased effects on spreads over time. Secondly we use the EDHEC*infra* universe, a representative sample of existing infrastructure borrowers – as opposed to the biased sample of new borrowers in the primary market – to apply the risk premia estimated in the first step to the 'factor loadings' (the characteristics) of this better sample, thus computing a current market spread for each one, at each point in time.

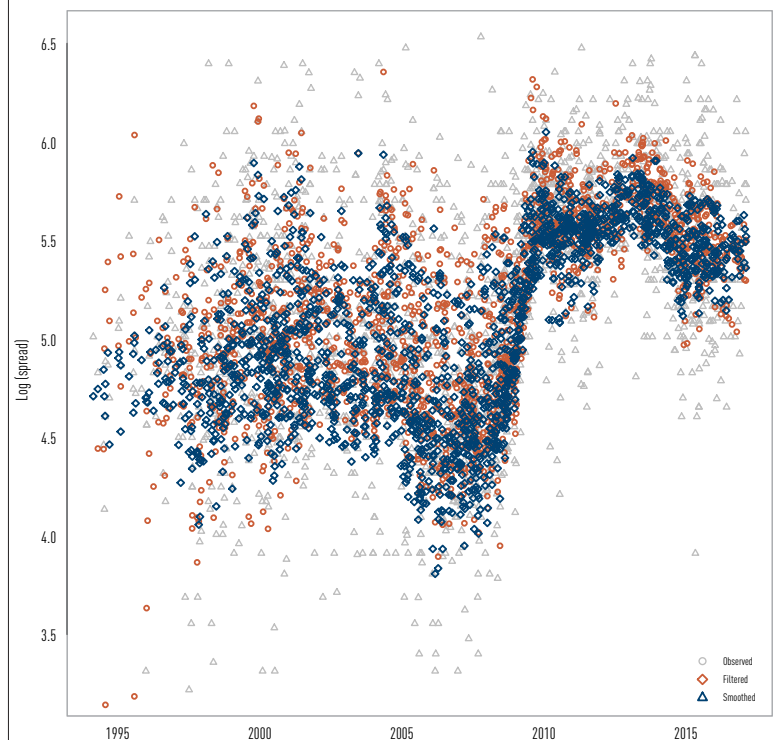
Using a factor model in combination with a representative sample of investible assets can correct the bias and paucity of available data: as long as such factors can be documented in a robust and unbiased manner, they can

1. Input/output spreads over time

Factor implied spreads (market), Q4 1987–Q2 2018



2. Infrastructure debt: observed and predicted spreads



be used to assess the fair value of private debt investments over time, whether they are traded or not.

What factors explain infrastructure credit spreads?

Our results show how the aftermath of the 2008 crisis changed and sometimes removed well-established relationships between certain factors and the cost of corporate and infrastructure debt: the impact of base rates on loan pricing disappeared, structural differences between markets vanished and certain sectors like roads experienced a continued increase in the price of long-term private financing.

Our results are statistically robust and explain the data well. We show that infrastructure and corporate credit spreads are determined by a combination of common factors that can be grouped into four categories:

- **Market trend:** the largest effect driving credit spreads in both infrastructure and corporate debt is a time-varying trend factor which captures the state of the credit market over time. This effect is not explained by loan or borrower characteristics. In the case of infrastructure debt, this effect is roughly constant but exhibits ‘regime shifts’, especially 2008 (up) and 2014 (down). In the case of corporate debt, it is an upward trend also exhibiting jumps in 2008 and 2012. We find a 20bps increase of infrastructure spreads compared to pre-crisis levels, down from 75bps at the height of the credit crisis, indicating a degree of mean-reversion.

- **Credit risk:** only explains part of the level of credit spreads. We find that infrastructure borrowers that are exposed to Merchant Risk are required to pay a time-varying premium from 20–40% above the market average at the time. Size has no effect on average corporate spreads but is a driver of lower risk premium in infrastructure debt. In effect, larger loans can be interpreted as a signal of lower credit risk in infrastructure finance. Industrial groups can be considered a partial proxy for credit risk but are mostly not significant, except for social infrastructure and, among corporate borrowers, infrastructure corporates, which have come to benefit from a substantial discount relative to average market spreads in recent years.

- **Liquidity:** other drivers of spreads are proxies of the cost of liquidity for creditors. Maturity: while it is difficult to capture in static models, maturity is found to be a significant and time-varying driver of spreads for corporate debt, with higher premium charged during period of lower bank liquidity (2008–16), whereas infrastructure debt has a constant maturity premium. While the effect of size is primarily a matter of credit risk, we note that in periods of limited creditor liquidity (2008), even infrastructure debt becomes more expensive as a function of size. However, this effect is not strong enough to create a size premium. Re-financings, which

are not a significant driver of spreads in normal times, are shown to be more expensive in times of credit market stress, especially for infrastructure debt.

- **Cost of funds:** the benchmark against which floating rate debt is priced has been a factor explaining the level of credit spreads. Base rates are inversely related to spread, ie higher rates imply lower spreads, but this effect is shown to have all but vanished since 2008. Since then, the level of credit spreads and that of base interest rates has become completely uncorrelated. Market segments: taking base rates into account, some markets are cheaper than others as a result of the well-known segmentation of credit markets. This is the case when comparing Libor-vs-Euribor-priced loans but also the different geographic areas in which different lenders operate. Again, since 2008, these differences have tended to disappear.

Towards fair value in private infrastructure debt

Our assessment of the impact of certain risk factors in the formation of aggregate credit spreads is relevant for at least three reasons:

- While observable spreads are biased due to the segmentation and low liquidity of the private credit market, unbiased factor prices (premia) can be estimated from observable spreads, and used to determine the factor-implied spreads for any instrument at any time;
- The time-varying nature of individual risk premia implies that re-pricing individual instruments over time can be material and is required if such investments are to be evaluated on a fair value basis;
- A multi-factor model of spreads, ie discount rates, allows more robust valuation taking into account the effect of systematic risk factors. One of the most important requirements of the IFRS 13 framework is to calibrate valuations to observable market prices, thus ensuring that estimated spreads represent current investor preferences at the measurement time. While fair value is not always required for debt instruments, which are booked at their face value unless they become impaired, the requirement to evaluate assets on a like-for-like basis will only grow as the private debt asset class becomes a more significant part of investors’ portfolios.

The research from which this article was drawn was produced as part of the as part of the EDHEC/Natixis Research Chair on Infrastructure Debt Benchmarking.

Reference

Blanc-Brude, F., and J-L. Yim (Forthcoming). The Pricing of Private Infrastructure Debt. EDHEC Infrastructure Institute – Singapore Publication.