

Published 10 December 2012
Last Updated 10 Dec 2012 12:16

Who is afraid of construction risk?

Frédéric Blanc-Brude

In this column, we make two important points about the role of construction risk in the design of efficient portfolios of infrastructure debt. First, the nature and characteristics of construction risk are still badly documented: construction risk in infrastructure project finance can be managed and, using new data, we show that it is lower than under traditional infrastructure procurement. Second, since an efficient portfolio of infrastructure debt must by definition achieve an optimal risk-return trade-off, and because construction risk may be remunerated with higher spreads during the construction period, including construction risk in debt portfolios should help achieve diversification benefits. In other words, it is likely that the efficient portfolio of infrastructure debt, which is also the benchmark for this category of investment, ought to include at least some construction risk, independently of investors' risk preferences.

These two points have important implications for institutional investors considering infrastructure debt as an investment opportunity, as well as for policy makers who now find themselves having to guarantee construction risk in order to attract the same investors to the sector: if construction risk can be used to build efficient infrastructure debt portfolios there is little need to push it out of sight and into new public sector liabilities, except in specific cases. In what follows, we develop each point in turn.

Construction risk is endogenous

Institutional investors might be sold on the 'infrastructure investment narrative' (Blanc-Brude 2012a) but construction risk still makes them nervous. Incidences of large construction cost overruns in infrastructure projects are frequently reported, and it may seem sensible to keep such risks out of their portfolio. But whose risk do they have in mind?

Construction risk in greenfield infrastructure projects can spring from two factors. First, there is uncertainty about the conditions under which the numerous tasks associated with building a large structure can be accomplished: ground conditions, the weather, engineering challenges, unexpected archaeological sites, etc. all make the actual cost of building infrastructure uncertain. This uncertainty is highly idiosyncratic: projects are unique and usually built in different locations at different points in time. We will call these risks 'exogenous' i.e. no one can change their frequency distribution (1, see notes).

The second category of uncertainty found in infrastructure project construction has to do with who is exposed to uncertain costs and what they can do about it. In economics, this is called an agency problem. If the risk of higher construction costs is not borne by the party in charge of building – as is the case in traditional public infrastructure procurement – there is *moral hazard* i.e. little incentives to control costs. Moreover, such procurement methods are also likely to suffer from *adverse selection*: the party selected to build the project may not be the very best one when it comes to controlling costs.

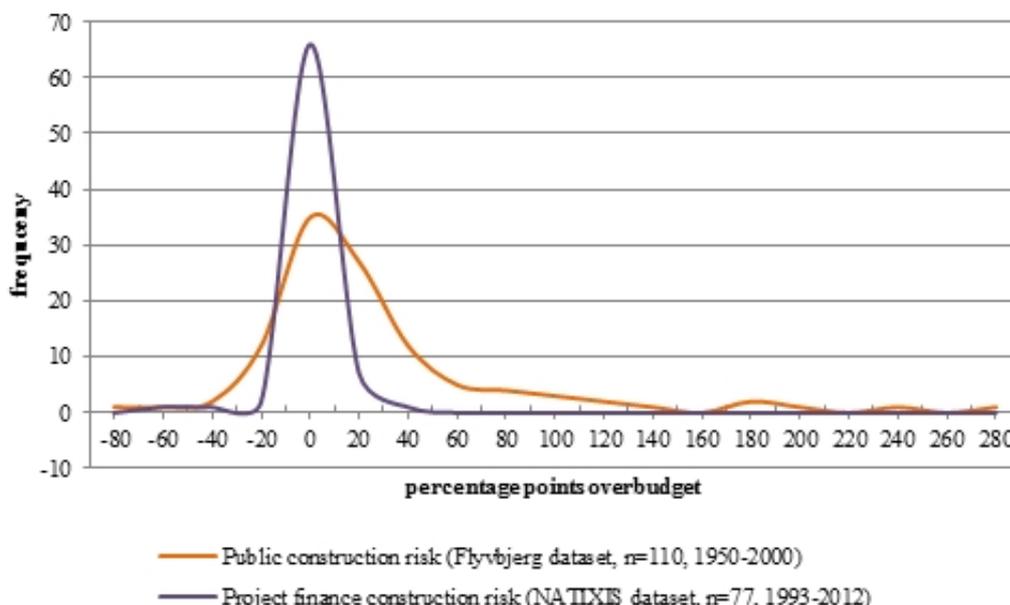
Risk transfer through enforceable contracts deals very well with this situation: if the party building the project is made partly or fully responsible for the variability of costs, two things happens: the builder now has strong incentives to control costs and, if enough risk is transferred, only those builders who *know* that they can control costs well will bid (2). In other words, construction risk transfer leads to projects in which only the best builders manage their own construction risk (3). It follows that a proportion of construction risk found in infrastructure projects is a function of who is exposed to it. We will call this risk 'endogenous' to the choice of procurement contract.

Thus, while exogenous construction risk is almost completely idiosyncratic, endogenous construction risk may be partly systematic if procurement choices encourage adverse selection and moral hazard. This is exactly what existing studies of construction risk show: the cost of building traditional infrastructure procurement is found to be *systematically* 20 per cent over budget as Figure 1 depicts (Flyvbjerg et al. 2002) (4). This 'optimism bias' is a good example of the consequences of moral hazard in procurement: bid prices are low because bidders are not very much exposed to construction risk. Later on, costs go up.

Subsequent papers (Flyvbjerg & Holm 2003; Flyvbjerg et al. 2004) show that cost overruns and delays breed more cost overruns, explaining why things can get so bad in some cases and thus why the observed frequency distribution is so skewed to the right. This double failure at construction risk measurement and management in traditional infrastructure procurement has been widely documented (Mott MacDonald 2002). The *construction risk of the public sector* is high because endogenous risk is not managed through risk transfer.

Once construction risk is contractually transferred to the builder, does it change? Exogenous risk is fixed by definition but under a different incentive scheme we expect endogenous risk to be different. Infrastructure project finance creates such an incentive scheme: construction risk is typically transferred from the project company (InfraCo), which is the borrower of infrastructure debt, to the builder, which commits to a date-certain, fixed price construction contract. Of course, if a project's construction phase goes very wrong the risk may come back to the InfraCo, which is ultimately responsible. But since only the better builders bid for the risk transfer contract, we expect their own risk to be lower than the public sector's and *insurable* through a risk transfer contract.

Figure 1: Observed cost overruns in Flyvbjerg and NATIXIS samples



Using a new dataset of *ex ante* construction prices and *ex post* construction costs in infrastructure project finance *from the point of view of the InfraCo* – the borrower of infrastructure debt – we observe that the risk of construction cost overruns in the project finance sample is almost completely idiosyncratic with a mean value of 3 per cent, much lower than the 27 per cent observed in public infrastructure procurement, and a median value of zero per cent (5). Figure 1 also illustrates the fact that construction risk in project finance is much less extreme than in traditional procurement.

While this finding will not come as a surprise to project practitioners, this fact has not, to our knowledge, been documented until now. Next, we discuss the implications of the

idiosyncratic nature of construction risk in project finance for debt portfolio construction.

Building efficient infrastructure debt portfolios with construction risk

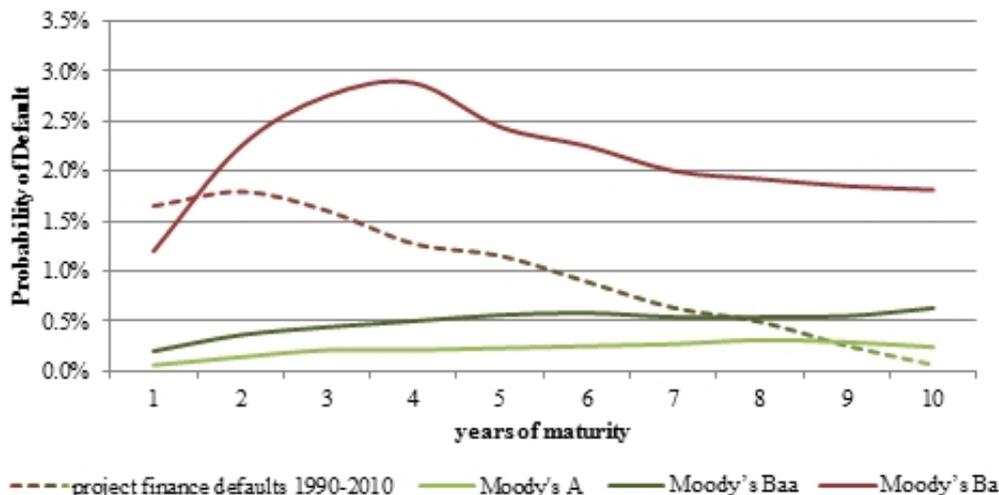
An efficient portfolio optimises the risk/return trade-off for a given level of risk preference: investors may want to have an exposure to infrastructure debt at a given credit risk level, say an 'A' rating. The question is to know what contribution to the efficient portfolio can construction-phase infrastructure debt make?

Two characteristics of credit risk during the construction period are instrumental to answering this question. First, construction risk may be idiosyncratic *between projects* but the period during which a project is being built is typically remunerated with higher all-in spreads. In other words, construction risk can be considered systematic within the project's lifecycle: it is always present at the beginning and always dissipates with time.

In effect the construction period is only the first phase of a project lifecycle that has been shown to systematically drive credit risk in project finance. In a recent study, using a sample of senior loans to more than 3,500 projects and spanning two decades, Moody's shows that project finance creates predictable credit risk transitions as a function of a term loan's date to maturity (Moody's Analytics 2012). Over a period of ten years, the average project finance term loan migrates from Ba (or BB) to A as the project is built, ramps up and become fully operational, as illustrated in Figure 2. This predictable average credit risk transition path suggests the opportunity to diversify debt portfolio across the lifecycle.

This is an important finding since, in a CAPM context, the idiosyncratic nature of construction risk suggests that it should not be rewarded in a diversified portfolio, but its role in the credit risk transition path of project finance loans makes it a potentially potent diversifier, as long as each phase of the project lifecycle attracts a corresponding level of return.

Figure 2: Average credit risk transition of infrastructure project finance debt



Source: Moody's (2012), sample size: 3,533 projects, period: 1990-2010

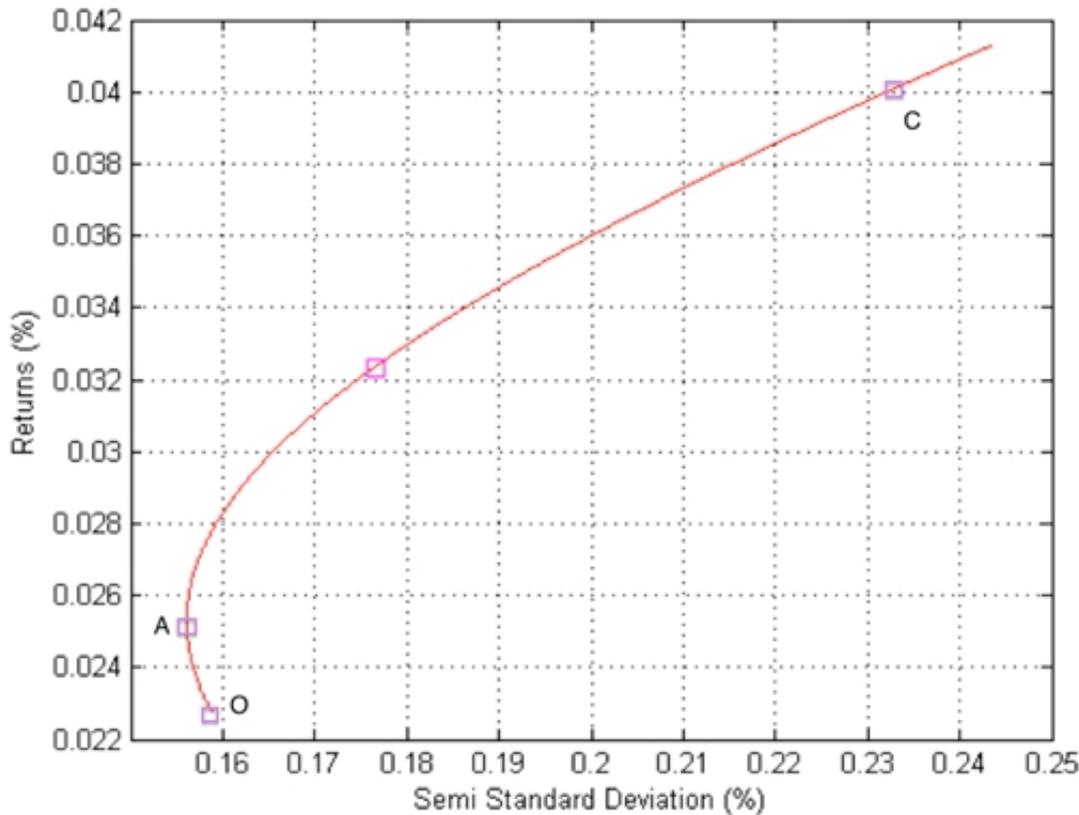
Second, the covariance between default rates, insofar as the default is triggered by construction risk, should be very low. Corporate loan default correlations are considered to be low in general (Saunders & Allen 2002) but systematic factors may increase their correlation (e.g. in the case of corporate debt, a recession would have this effect). This may also be true in project finance, as previous studies have documented, the incidence of defaults increased markedly in 1998, 2002 and 2009 (Moody's Analytics 2012). However, it should be obvious that the correlation between the business cycle and the covariance of infrastructure debt defaults is independent of construction risk. On the contrary, as we argued above, if project finance construction risk is idiosyncratic between projects, defaults triggered by construction risk should be mostly uncorrelated. The bankruptcy of the builder, to the extent that it is involved in the construction phase of several projects at the same time, may be a positive driver of correlations between default rates. Still, we expect default correlations to be low when it comes to the impact of construction risk on credit risk in project finance.

Combining assets with different risk/return profiles and low correlations can create diversification benefits. There is a number of potential combinations of these assets that delivers the optimal trade-off between risk and return: a line representing all such combinations, usually called an efficient frontier, can illustrate the solution to this classic optimisation problem (Figure 3). At one end of the frontier (point O), all funds are invested in the one least-risky asset; at the other end (point C), the most risky asset receives a weight of one hundred per cent. Independently of an investor's risk preferences, the benefits of diversification are visible in the concavity of the frontier: it make no sense to invest only in the low risk asset since a higher level of return can be achieved for the same level of risk by combining different assets. Even the minimum risk point on the frontier (point A) corresponds to an allocation to *some* risky asset.

With infrastructure debt, at a simplistic level, we have two assets: construction period debt with a Ba credit risk and post-construction period debt with an A rating. In effect, the continuous credit transition shown on Figure 2 suggests the opportunity to diversify across each year of the lifecycle of infrastructure term loans. As long as the efficient frontier of infrastructure project finance debt portfolios is a little concave, as illustrated on Figure 3, then even at the lowest risk point, the efficient portfolio will contain some construction-period debt since the point on the frontier that would correspond to investing only in post-construction debt lies below the minimum risk point.

It follows that investors in infrastructure debt should actively seek to invest in construction risk!

Figure 3: Efficient portfolio construction frontier with two fixed income assets rated 'Ba' and 'A' (daily returns, 10 years)



Another important consequence of the predictability of credit transitions in project finance debt is the necessity of a dynamic approach to portfolio construction: whichever combination of term to maturity and the resulting portfolio credit risk has been chosen by an investor, new debt at different maturities needs to be added to the portfolio at regular intervals to maintain its risk profile.

This point also has important implications for public procurement. If governments want institutional investors to finance infrastructure investments, significant capacity in infrastructure debt has to develop since debt represents, on average, 75 per cent of a project's capital programme financing (Blanc-Brude et al. 2010). In turn, if project finance debt portfolios need to be dynamically managed then the predictability of the deal flow becomes important: at the aggregate level, each period requires the origination of new greenfield debt to replace the maturing construction risk found in debt portfolios at the previous period.

This is good news for governments who want to see more investment in greenfield infrastructure and for investors who need a recognisable beta to invest in. Still, a lot more work is needed to benchmark infrastructure debt investments and to coordinate public and private objectives. This and other research questions relating to infrastructure debt instruments are the focus of a new NATIXIS/EDHEC-Risk Institute research Chair.

Finally, where does that leave public sector initiatives to guarantee construction risk? When exogenous construction risk is high and hard to quantify in the case of very large projects (think Messina Strait) or if its contractual management is too difficult (think London Underground) then public sector guarantees will help. But are these really the projects we have in mind when we talk about *betas* or asset classes? Hundreds of schools, hospitals and public buildings as well as dozen of standard transport and energy projects are both what the economy needs and what investors should require in order to have access to the infrastructure investment narrative. If this kind of pipeline can be developed, construction risk will be a welcome diversifier in debt portfolios and financing infrastructure construction risk with institutional money should become standard practice.

The NATIXIS/EDHEC-Risk Institute Chair's first paper "Who is afraid of construction risk?" examines the nature and investment characteristics of infrastructure project finance debt and issues around portfolio construction and benchmarking. It will be published in March 2013 at the EDHEC-Risk Days conference in London.

References:

- Blanc-Brude, F., 2012a. Infrastructure portfolio construction: in search of an asset class. *ijonline.com*.
- Blanc-Brude, F., 2012b. Risk Transfer, Self-Selection and Ex Post Efficiency in Public Procurement: An Example From UK Primary and Secondary School Construction Contracts. *Revue d'Économie Industrielle*, 140(4ème trimestre 2012), pp.1–25.
- Blanc-Brude, F., Jensen, O. & Arnaud, C., 2010. *The project finance benchmarking report, 1995-2009*, Stow-on-the-Wold: Infrastructure Economics.
- Flyvbjerg, B. & Holm, M.S., 2003. How common and how large are cost overruns in transport infrastructure projects? *Transport Reviews*.
- Flyvbjerg, B., Holm, M.S. & Buhl, S.L., 2002. Underestimating Costs in Public Works Projects. *Journal of American Planning Association*, 68(3), pp.279–295.
- Flyvbjerg, B., Holm, M.S. & Buhl, S.L., 2004. What Causes Cost Overrun in Transport Infrastructure Projects? *Transport Reviews*, 24(1), pp.3–18.
- Moody's Analytics, 2012. *Default and Recovery Rates for Project Finance Bank Loans, 1983–2010*, Moody's Investor Service.
- Mott MacDonald, 2002. *Review of Large Public Procurement in the UK*, Croydon: Mott MacDonald.
- Saunders, A. & Allen, L., 2002. *Credit Risk Measurement* Second edition, New York: John Wiley & Sons.

Thank you for printing this article from Infrastructure Journal.

As the leading online publication serving the infrastructure investment market, IJ is read daily by decision-makers within investment banks, international law firms, advisory firms, institutional investors and governments.

If you have been given this article by a subscriber, you can contact us through www.ijonline.com/signup, or call our London office on +44 (0)20 7715 6425 to discuss our subscription options.