RISK TRANSFER, SELF-SELECTION AND *EX POST* EFFICIENCY IN PUBLIC PROCUREMENT

AN EXAMPLE FROM UK PRIMARY AND SECONDARY SCHOOL CONSTRUCTION CONTRACTS

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1. INTRODUCTION

Contracts designed to transfer risk from the public to the private sector with the aim of achieving more cost-efficient procurement of public infrastructure and services have become widely used in Europe and beyond. Since their inception in the UK in the mid-90s, these contracts have also been continuously criticized as too costly because they allegedly allow private sector investors and operators to realize substantial profits.

But realizing cost savings compared to traditional procurement and allowing private profits do not have to be mutually exclusive propositions.

Importantly, the effect of transferring risk on contracting efficiency using the specific contractual instruments embodied for example by the Private Finance Initiative (PFI) in the UK has not been studied consistently in the literature, which tends to focus on describing the optimal contract. In

this paper, we propose to reverse the perspective and provide a theoretical and empirical assessment of the efficiency of actual contracts used to procure public infrastructure using the PFI as an example. Moreover, the PFI model has been adopted in most European countries including France, where it is known as *Contrats de Partenariats*, and in North America where such contracts are known as P3s.

We use data on construction contracts in UK PFI schools to show that risk transfer leads to the self-selection of a few efficient firms at the bidding stage and to the likely *ex post* inefficiency of PFI contracts.

The rest of this paper is organized as follows: section II details our intuition and derives fundamental insights from the economics literature on contracts and regulation ; section III describes our dataset of UK school construction contracts and provides some background information about school procurement under the PFI ; section IV describes and discusses our results and section V concludes and discusses policy implications.

2. INTUITION

The intuition behind this paper is that the use of risk transfer to achieve cost-efficiency in public procurement, and exemplified by the Private Finance Initiative (PFI) in the UK, acts as a revelation mechanisms of firm's type and leads to a separating equilibrium which is characterized by ongoing *ex post* inefficiency. As we argue in the conclusion, high *ex post* inefficiency should be expected to undermine long-term commitment and increase the likelihood of renegotiation on the part of the delegating authority (political risk).

The rest of this section details our intuition and presents a non-formalised analysis of the economics of PFI contracts.

2.1. Setting

Most public procurement is done using cost-*plus* contracts in which the public sector bears the risk of *ex post* cost overruns (Bajari *et al.*, 2006; Bajari & Tadelis, 2001). Such cost overruns are ubiquitous (Flyvbjerg *et*

al., 2003) and have motivated governments to shift towards risk transfer contracts to procure public infrastructure. The UK government, for example, highlights cost control as one of the main reasons for the use of fixed price contracts[1].

However, when it comes to transferring risk, real-world public procurement does not allow for the « second best » suggested in the literature: instead of sharing risk along a cost continuum, as theory suggests (Baron & Besanko, 1987), the public sector proposes a binary choice between *full* risk transfer through a PFI contract or little or no risk transfer through traditional procurement (TP)[2].

By *full* risk transfer, we mean that all cost liabilities inherent to delivering a contractible public service (construction, operation and maintenance costs) are passed on to the firm in exchange for a fixed payment made throughout the life of the contract and agreed *ex ante*, at the time of contract signature. Other categories of costs, such as those incurred because of regulatory changes or « force majeure » events are typically not transferred. With the PFI, the cost of the service provided not being needed (demand risk) is also borne by the public sector, which remains responsible for deciding what and how much public service is needed.

While the firm's cost of capital is typically higher than the public sector's, the assumed ability of the former to improve the cost efficiency of infrastructure project delivery over a period of several decades provides the justification for transferring risk. In other words, the improved cost efficiency of private sector infrastructure delivery must more than offset its higher cost of capital to make the risk-transfer contract valuable to tax payers, or to create « value of money » in British procurement parlance.

To determine whether or not this is the case, the public sector is required to define a counter-factual to private sector bids. This counter-factual is a risk-adjusted, discounted cash flow comparison between the cost of hiring the preferred bidder and that of using traditional procurement methods.

1 (http://www.hm-treasury.gov.uk/ppp_index.htm).

2 One way to interpret this phenomenon is to say that it is too costly to write proper incentive contracts (with risk *sharing*) and that only a more binary form of risk *transfer* (full *vs.* none) can be achieved.

It presupposes that the public sector knows « its own risk » when delivering public infrastructure using traditional methods[3].

Once awarded, each contract leads to the creation of a special purpose vehicle (SPV) or project company, funded with equity capital provided by the firm and other investors and raising commercial debt to finance its capital programme. The SPV then hires contractors to build and operate an infrastructure facility and deliver services according to the output specification agreed at the bidding stage. In exchange, it receives a recurrent, pre-agreed, inflation-linked payment, known as the « unitary charge » for the duration of the contract, typically 25 years or longer.

It should be noted that project financing and its significant use of debt creates incentives for the SPV to manage the risk it takes under the PFI contract effectively. A necessary step towards raising debt finance from banks requires the SPV to have passed construction risk to another party – usually a branch of the SPV's sponsors – under a fixed price, date-certain contract. Thus, some of the major risks transferred from the public to the private sector under PFI contracts are managed or hedged completely by the SPV.

We now analyse these contracts from the point of view of economics; but instead of deriving an optimal contract, we aim to assess the *ex ante* and *ex post* efficiency of observed PFI contracts.

2.2. *Ex ante* efficiency

Let's say that there exists two types of private firms that can deliver infrastructure projects. The first type is efficient and can reduce costs and control risks, the other is not and cannot. The public sector wants to delegate the task of building and operating public infrastructure but does not know which firms to delegate these tasks to. If the public sector writes a contract transferring little or no risk to the firm, as it is the case for most traditional public procurement, the efficient firms have an incentive

3 This « public sector comparator » (PSC) is used to assess long-term risk transfer procurement contracts in the UK (UK Treasury, 2011b), Australia (Infrastructure Australia, 2008), New Zealand (New Zealand Treasury, 2009) or France, where it is called *étude préalable* (MAPPP, 2011).

to mimic the inefficient ones at the bidding stage (adverse selection) and make no effort to reduce and control costs (moral hazard). In this case, whichever firm is hired, the public sector has to cover any future costs and evidence shows that significant cost overruns are indeed the norm in public works (Flyvbjerg & Holm, 2003). In other words, in the absence of an appropriate incentive scheme, private information about firms' type (efficient or not) and actions (risk management or not) leads to high procurement costs for taxpayers.

This situation can be set as a principal-agent problem: a principal (the public sector) delegates a task to an agent (the firm), but the agent has private information about some aspect θ of the task in question (adverse selection), and can decide whether or not to exert effort e that can influence the realisation of the task (moral hazard). Typically, a contract determines a volume of trade or production q by the agent and a remuneration or transfer t, which can be a function of a risk-sharing coefficient, say α. The fundamental intuition behind the principal-agent framework is that the optimal t, α and q under asymmetric information may be distorted from their full-information « first best » because of the agent's strategic use of its private information.

The classic optimal response to an agency situation where the agent has an incentive to misreport his costs is to offer a compensation scheme that minimises *ex post* inefficiency (second-best). To achieve this, the principal must devise a « revelation mechanism » *i.e.* an incentive compatible menu of contracts (Laffont & Martimort, 2002) which induces agents to reveal their private information (about θ or e or both) in exchange for a *rent*. Thus, to solve the delegation problem identified above, the public sector must offer to all firms a menu of contracts by which each firm has a choice to bid for the same low-risk traditional procurement contract or for a new contract to *invest* in the delivery of public infrastructure in exchange for a fixed payment, as long as the demonstration of cost-savings compared with the low-risk option can be made[4].

The point of such contracts is to transfer risks that are endogenous. Exogenous risk, like the impact on costs of the weather or ground conditions, are the same whoever is exposed to them and it is always socially

4 *i.e.* the public sector comparator (PSC) test is conclusive.

desirable for the least risk-averse party to bear them *i.e.* the risk-neutral public sector (Arrow & Lind, 1970). But if risks are a function of who bears them and risk transfer creates incentives to manage risks, then a risk transfer contract can be socially desirable even if the party bearing the risks is not the least risk averse and requires a risk premium *i.e.* a higher cost of capital: with endogenous risks, risk transfer can reduce total future costs.

However, the endogeneity of risk is also what makes risk transfer inefficient: how much risk the firm is effectively taking under the fixed price contract is private information. It follows that, unless competition for the contract is *perfect*, this private information is a source of *rent* or risk-free profit for the firm *i.e.* the project internal rate of return set higher than its weighted average costs of capital for 25 years.

The necessity for the firm to *invest* equity in the project company and to raise the necessary financing plays an important role in a multi-period setting. We know from the literature that investment in relationship-specific assets is likely to be suboptimal without long-term contracts creating binding commitment since each party other expects *ex post* renegotiation and profit expropriation (Hart, 1995). Thus, to induce the firm to make a long-term, relationship-specific investment, the public sector must make a credible commitment not to expropriate the firm's rent, which is embodied in the 25-year, revenue *promise* (the unitary charge), which characterises PFI schemes.

Formally, we know that when a cost sharing rule is pre-agreed and creates a credible commitment mechanism, the principal/agent game becomes a case of « false dynamic » (Laffont & Tirole, 1993), which means that we can usefully approach the *ex post* efficiency of these contracts within a static setting.

2.3. *Ex post* efficiency

The agency literature shows that under the optimal second-best contract the principal must trade off allocative efficiency against the costly

information rent[5] given up to the agent. To keep the information rent to a minimum, output q is typically distorted beyond the efficient level. However, with PFI contracts, the public sector remains the ultimate guarantor of the continuity and quality of public services, which is set before contracting take place. Thus, there is little scope to distort output to reduce inefficiency[6].

Likewise, the degree of risk sharing between principal and agent is distorted to minimise the effect of moral hazard. Typically, the public sector prefers to respond to the hidden action problem with a fixed price contract and to respond to the private information problem with a cost-*plus* contract (Baron & Besanko, 1987). However, under both adverse selection and moral hazard, the literature always concludes that « incentive contracts » (between cost-*plus* and fixed price) should be preferred to pure fixed price or cost-*plus* contracts (Baron & Myerson, 1982; McAfee & McMillan, 1986)[7]. Using Canadian procurement data, Baron and Besanko show that risk transfer tends to increase the average price of the winning bid. These authors estimate the optimal risk sharing coefficient to be around 0.6 (Baron & Besanko, 1987).

With PFI contracts, this ratio is set to unity despite the fact that with adverse selection and moral hazard, full risk transfer through a fixed price contract is never optimal. Instead, greater allocative inefficiency

5 In the procurement literature, the information rent is « costly » from a welfare perspective because of the shadow cost of public funds (the distortion introduced by taxation).

6 Contracted output thus has to be sufficiently contractible and *ex post* observable. For standardized units of certain types of public services such as schools facilities or standard roads, it is not completely unrealistic to consider that a well-run procurement agency could define a « reasonably » complete output specification. In an incomplete contracting world, this is equivalent to the requirement in Hart *et al.* (1997) and Hart (2003) that output specification be easier to specify than input specifications. If output was not contractible, as is the case for very large complex infrastructure projects, contract variations (*ex post* changes to specification of outputs, fee schedules etc.) may be *ex post* equilibrium outcomes (Dewatripont and Legros, 2005) and cost-plus contracts dominates fixed price (risk transfer) contracts in efficiency (Bajari and Tadelis, 2001).

7 The optimal incentive contract is found to be closer to a fixed price contract than a cost-*plus* one. Indeed, cost-*plus* contracts perform poorly in selecting efficient (low-cost) firms and also fail to incentivise firms to reduce risk.

(lower risk sharing) would be required to mitigate the information rent in the presence of costly risk aversion (Baron & Besanko, 1987; Salanié, 1990). In extreme cases, the pooling of the less efficient types may occur, especially for high levels of risk aversion, which can make it difficult to obtain a separating equilibrium (Bontems & Thomas, 2003; Laffont & Rochet, 1997). In this last case, no firm would bid for the risk transfer contract.

PFI contracts are thus *a case of solving the moral hazard problem (creating maximum incentives for cost reduction) at the expense of increasing the adverse selection problem and therefore the selected firm's information rent* (Laffont & Martimort, 2002)[8]. Such contracts can be said to achieve *ex ante* efficiency (solving the task delegation problem under asymmetric information) at the cost of *ex post* inefficiency (the selected firms receives a risk-free rent).

With fixed output and full risk transfer, the public sector can only rely on competition for the risk-transfer contract (between efficient firms) to minimize the efficient firm's information rent *ex ante*.

2.4. Competition and *ex post* inefficiency

In a classic adverse selection model, the ability of the efficient firm to capture a rent can be eliminated by introducing competition for that rent until adverse selection becomes irrelevant (Salanié, 2005). However, numerous authors are skeptical about the ability of the competitive tendering of public works to deliver the best possible price for the public sector. Writing about PFI contracts, Grout (Grout, 1997) and Bennett and Iossa (Bennett & Iossa, 2006) suggest that suppressing the problem of information revelation at the bidding stage may not be without costs.

Closely linked to the question of competition is that of the « distribution of types » of agents that may enter into a contractual relationship with the principal. Laffont and Tirole (1993, chapter7) show that the optimal incentive scheme is not affected by the auctioning of the contract, but that the size of the efficient firm's rent is a function of the distribution of firm types.

8 Laffont and Martimort (2002) show that preventing moral hazard hardens the adverse selection problem and allocative distortions are then always greater than under pure adverse selection.

How many firms can take substantial risks in public infrastructure project? The « shallowness » of the PFI market (Standard & Poor's, 2005) is a point frequently made in the empirical literature: evidence suggests that only a few large international firms can bid for such complex and long-term projects and usually do so as part of a consortium (House of Commons, 2005). Furthermore, and as we described above, PFI contracts require construction firms to invest equity in a project company upfront, creating high entry and opportunity costs that only larger firms may consider.

In the case of awarding PFI contracts, numerous studies have suggested that competition is not perfect[9]. Bids typically cluster « a bit below » the Public Sector Comparator (PSC) *i.e.* the estimate of the *public sector's* total *ex post* cost, accounting for its own risk of cost overruns[10]. This is because the benefits of the risk transfer contract are estimated as a function of how much risk the public sector is insured against under a PFI contract, not how much risk the firm bears. With imperfect competition, it should not be a surprise that bids should simply reflect the *willingness to pay for risk transfer* of the public sector rather than the required risk premium of the firm.

2.5. Contracting solution & separation

Thus, allowing for heterogeneous firm types, the outcome of tendering PFI contracts is likely to be a function of the *ability of firms to minimise their cost of risk bearing* as much as their ability to minimise production costs and control risks. Using long-term risk transfer contracts to purchase public infrastructure for a fixed price over a 25-year period then leads to a *separating equilibrium* in which only the largest firms (the most efficient but also with the lowest costs of risk bearing) self-select to bid for the risk transfer contracts.

9 A number of studies confirm that competition in the UK PFI sector has been limited (NAO 2007) and that collusion in the UK construction sector is widespread (OFT 2008, 2009).

10 Examples abound : Carlisle PFI Hospital Scheme, PFI : GBP173.1m, PSC: GBP174.3m ; Main MOD Building, PFI : GBP746.1m, PSC : GBP746.2m ; Haringey Schools, PFI : GBP97.5m, PSC : GBP99m.

Thus, it should be emphasised that when private information exists, paying an information rent to the efficient firm through the risk transfer contract is the *solution* to the task delegation problem initially identified *i.e.* the social cost of the firm's rent is lower than the extra cost of procurement without risk transfer when no effort was made to minimise costs and control risks.

The complete solution to the task delegation problem found in public infrastructure procurement with asymmetrical information and limited competition is for the public sector to *commit not to expropriate the rent of the efficient firm* by entering into a long-term contract. This can include some form of inflation indexation as well, as is the case with PFI in the UK.

Such *ex post* inefficiency – positive profit rates locked in for 25 years – while it allows the investment to happen in the first place, can also explain why PFI contracts are frequently perceived as expensive a few years after that have been entered into (BBC4 2011).

In conclusion, *ex post* inefficiency in PFI contracts springs from the difficulty to solve the adverse selection problem under full risk transfer schemes in a context where only a limited number of efficient firms exists and competition is thus reduced by risk transfer. The distribution of firm types may be heavily dependent on the industrial structure of the construction sector in a given country. In countries where firm types are very unevenly distributed (skewed), with numerous inefficient firms and only a few efficient ones, full risk transfer leads to the pooling of most firms in the « inefficient » category and the effect of type separation via risk transfer is to reduce competition and to increase *ex post* inefficiency *i.e.* the size of the efficient firm's rent.

Thus, an agency setting helps predict the result of full risk transfer in public-private contracts as a mechanism to improve the cost-efficiency of procurement. This, arguable extreme case is nevertheless well exemplified by the PFI in the UK and a number of similar procurement programmes currently being implemented in Europe, North America and Australia.

Next, we explore this insight using data from the UK primary and secondary school construction sector.

3. PFI SCHOOL DATASET

To validate our intuition, we look at primary and secondary school construction in the UK. Contrary to other types of infrastructure projects, schools constitute more homogenous goods, which should facilitate direct comparisons between PFI and TP. First, there is a clear requirement that all schools in Britain be delivered to consistent, nationally defined standards both for regulatory reasons (health & safety) and to satisfy an imperative of social equity. Furthermore, school buildings are, *ceteris paribus*, more standard types of infrastructure projects than hospital, prisons or certain government buildings, which may demand more case-specific designs[11].

3.1. The UK PFI School Programme

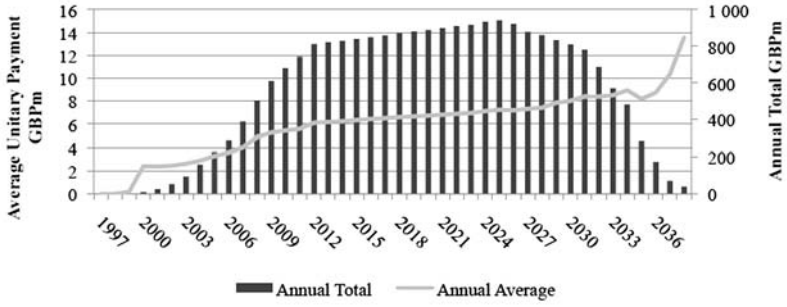
The Private Finance Initiative was introduced in the UK in 1992. In the first years of the policy, PFI was concentrated in the defence, transport and health sectors and there was very little PFI in schools or other sectors that are primarily the responsibility of local governments. However, schools in the UK require substantial capital funding to redress several decades of under-investment in buildings and facilities and in the late 1990s the central Government signaled a strong commitment to improving educational infrastructure through PFI.

Initially, local authorities had weak incentives to engage in PFI: funding for capital investment was allocated by central Government according to a distribution formula unrelated to financing method and no requirement was imposed on local authorities to consider PFI. Funding rules were subsequently changed to treat grants from central Government for PFI projects, known as « PFI credits », separately from other funding streams and to remove these charges from revenue capping limits (McCabe *et al.*, 2001)[12].

11 *e.g.* high security prisons *vs.* juvenile delinquent centres, or the Barts hospital in central London which is also a historic building, or the MI5 headquarter, which is a highly secure building.

12 PFI credits were cancelled by the new conservative government in 2009.

Figure 1. Average and total unitary charge committed to be paid to 135 PFI school SPVs between 1997 and 2038 by the UK Department of Education as of September 2009



Source : UK Treasury, own calculations

These changes led to a surge of interest on the part of local authorities. By 2005/6, PFI commitments in England and Wales amounted to over £2.4bn in more than 500 schools through 86 PFI schemes (Audit Commission 2003). By 2010, total PFI commitments to the school sector alone exceeded £23bn as illustrated by figure 1, which summarises the public outlays of 135 PFI contracts until 2038. This is a perfect illustration of the long-term commitment shown by the British public sector in order to induce firms to invest in the delivery of primary and secondary schools across the UK.

3.2. Known issues with measuring risk in the PSC

The PFI process requires the contracting authority to estimate a public sector comparator or PSC, the cost of a similar scheme under traditional procurement including construction, operating and maintenance costs and the value of risks transferred over the life of the contract and to proceed with the PFI only if the net present value of the stream of unitary payments is less than the PSC. As we discuss above, in our theoretical framework this is equivalent to estimating the outcome of contracting with the « inefficient » firm or the traditional procurement route.

Demonstrating « value for money » in this way is one of the keys for local governments to secure central Government subsidies in the form of PFI credits so local governments have an incentive to make PFI work. As we also discuss above, the endogeneity of risks transferred in PFI contracts

creates a situation of private information about the firm's risks under the contract which may then be very different than that faced by the public sector under traditional procurement. However, the « inefficient » firm or PSC is the only benchmark against which the PFI bids are evaluated.

Nor have local authorities any incentives to use a different benchmark. The UK Audit Commission's 2003 report on PFI in schools states, « Without PFI, the opportunity to obtain new buildings or refurbishment would have been lost » (Audit Commission, 2003). The lack of a genuine financing alternative gives local authorities strong incentives to make sure PFI schemes do pass the VFM, which was confirmed in the interviews conducted by the Audit Commission with Local Education Authorities (LEAs), teachers and other PFI stakeholders: « Some interviewees claimed that the incentive to estimate on the high side for the PSC in order to obtain the Government funding was strong ». The authors find that in all but two of the PFI schemes studied, the cost advantage of the PSC depended on the estimate of the « cost of risk » of TP. They also show that the cost of risk estimate was higher in projects for which the estimated PSC before risk adjustment was lower than the estimated PFI cost (Davies & Ghani, 2006)[13].

In addition to the incentive issues, LEAs may also find it difficult to construct reliable PSCs because they lack information on costs. As there had been no major investment in school buildings from the mid-1970s to the mid-90s and because of the difference in the level of service being required under the PFI schemes, LEAs are obliged to construct a hypothetical traditionally procured project as a point of comparison. This problem is being overcome gradually as more PFI and non-PFI schools come into operation and cost databases are developed.

3.3. School buildings construction contract dataset

Our sample consists of 791 individual building construction contracts with a value of more than one million pounds (GBP) for new primary and

13 Information on the amount of risk transferred was collected for 18 local authorities in a 2006 survey by the Department for Trade & Industry. The median « cost of risk transfer » was equal to 16% of the unitary payment, with a range of 10-18%.

secondary school buildings between 2007 and 2010, 508 of which are traditionally procured schools and 283 of which are part of PFI schools. The data is collected from the Glenigan construction contract database[14].

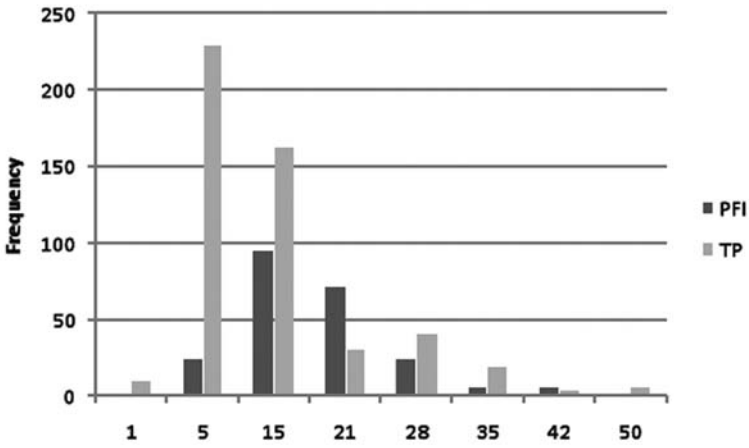
Table 1 describes the distribution of the data by total contract price. As already reported in the empirical literature on PPPs (Blanc-Brude *et al.*, 2007), PPP project includes larger projects than traditional procurement. For example, excluding very large PFI school buildings (above GBP50m), PFI school construction contracts are still larger on average than traditional procurement, even though the second samples have more similar standard error, standard deviation, kurtosis and skew (see Figure 2).

Tableau 1. Descriptive statistics

	Full sample		up to GBP50m sample	
Contract Price	**TP**	**PFI**	**TP**	**PFI**
GBPm				
Mean	10.24	40.06	9.37	15.44
Standard Error	0.66	3.78	0.42	0.53
Median	5.50	16.00	5.50	15.00
Mode	5.00	16.00	5.00	16.00
Standard Deviation	14.95	63.60	9.37	8.17
Sample Variance	223.38	4,044.82	87.85	66.68
Kurtosis	113.26	9.98	2.63	2.31
Skewness	8.29	3.01	1.73	1.09
Range	239.00	399.00	49.00	49.00
Minimum	1.00	1.00	1.00	1.00
Maximum	240.00	400.00	50.00	50.00

14 (www.glenigan.com).

Figure 2. Distribution of PFI and TP contract prices (between GBP1m-50m)



For each contract, we collect the name of the leading firm in charge of delivering the building's construction (main contractor or design and build contractor or prime contractor). As well as the information described in annex about each contract's characteristics including total price, square meterage, number of storey, number of units contract start and end date, duration, etc.

The nature of the price information collected in this database has to be clarified: the Glenigan database (EMAP 2010) collects subcontractor-level data *i.e.* the *ex ante* contract price agreed with the construction firms that will deliver individual school buildings. We know that in the case of TP, these prices are likely to lead to *ex post* variations (NAO 2007) whereas PFI construction prices are fixed *ex ante* as discussed above to insulate the SPV from construction risk.

4. FINDINGS & INTERPRETATION

To test the hypothesis of firm self-selection and type separation:

— We examine the list of firms that achieve the highest market shares in both the PFI and the traditional procurement segments of the school

construction sector and casually observe if top firms in one segment are different than top firms in the other;

— We run a Pearson independence test (Chi-Square) to determine whether the observed and expected distributions of the number of projects between firms are similar for 142 firms.

To test the hypothesis of a skewed distribution of types and that of increased concentration in the PFI segment:

— We casually compare the distribution of firms in the UK construction sector by number of employees and sales volume with that of the firms engaged in PFI projects ;

— We calculate the Herfindahl-Hirschman and C5 indices for the PFI and TP segments.

Finally, we run a regression of unit costs for the subset of the data for which we can derive per-square-meter unit costs and the relevant explanatory variables.

4.1. Firm self-selection

We compare leading firms in the PFI and TP segments of the primary and secondary school construction sectors. We find strong evidence of segmentation: as shown in Table 2, the leading ten firms by market share in the PFI segment are very different from the leading ten firms in the TP segment.

This confirms that when they focus on risk transfer contracts like PFI Schools, construction firms leave the TP segment of the market to other firms, supporting our hypothesis of the separation of firm types when risk transfer contracts are used.

Tableau 2. Type separation in the primary and secondary schools building sector

School building market share of leading 10 construction firms								
	PFI Rank	PFI mkt sh.	Obs.	Avg. price £m	TP Rank	TP mkt sh.	Obs.	Avg. price £m
Carillion	1	24%	79	32	6	4%	13	15
Laing O'Rourke	2	14%	26	55	28	1%	4	13
Balfour Beatty	3	13%	37	35	5	4%	11	17
Kier	4	7%	14	51	1	11%	54	11
Morgan Ashurst	5	7%	11	64	4	6%	33	9
Interserve	6	6%	18	37	12	2%	13	7
Bovis Lend Lease	7	6%	14	42	3	6%	5	60
Bouygues	8	4%	12	32	20	1%	3	24
Miller	9	3%	6	56	11	2%	9	10
Bowmer & Kirkland	10	3%	6	56	18	1%	5	15
Willmott Dixon	n.a.	n.a.			2	11%	53	11

Next, we run a Pearson independence test (Chi-square) of the null hypothesis that the probability of any given firms in the sample to deliver a school building under a TP contract is independent of its probability to deliver a school building under a PFI contract. We reject the null at the 1 % confidence level (DF=141). In other words, in the UK, the distribution of construction firms between PFI and TP contracts is not random. Separation is drive partly by contract size and partly by risk transfer but these two dimensions are also highly co-dependent: only the efficient firm capable of controlling costs can take large risks.

4.2. Type distribution & concentration

The *skewed type distribution hypothesis* implies the existence of numerous inefficient firms and few efficient ones. Furthermore, because the ability to

take and manage risk efficiently is also a function of firm size, we should observe more numerous small firms and a few larger firms. Finally, if fewer firms are able to self-select and choose the risk transfer contract (PFI), we should observe higher concentration in the PFI segment.

To explore this hypothesis, we compare the type of firms that have been involved in PFI contracts in our sample to the average type of construction firm in the UK construction sector by number of employees and by cumulative sales, as shown on Figures 3 and 4. We collect the number of employees and reported sales for firms identified as PFI contractors in our dataset from public sources, including websites and annual reports and compare it with UK construction sector survey data publihsed by the UK Office of National Statistics (ONS). Casual observation suggests that firms involved in PFI projects tend to be bigger than the average UK firm in the construction sector (non-residential and civil engineering), lending credit to the hypothesis that separation of firm types induced by risk transfer in PFI contracts reveals a skewed distribution of types.

Figure 3. Distribution of UK construction firms (non-residential and structural engineering) and PFI construction firms by number of employees

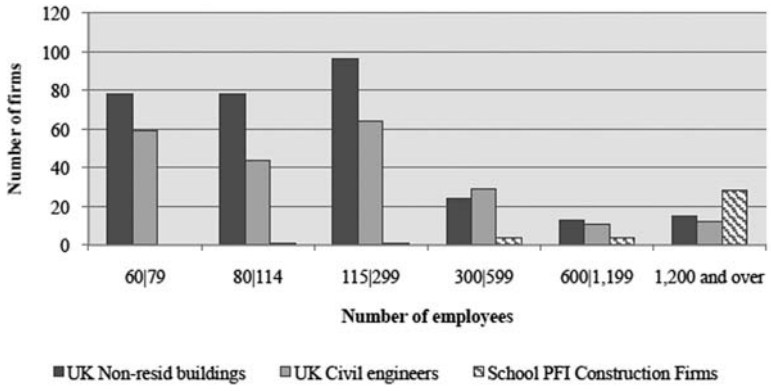
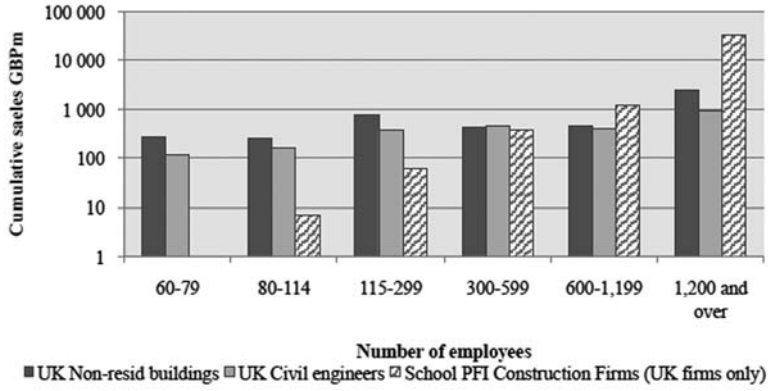


Figure 4. Distribution of UK non-residential and structural engineering construction firms and of PFI construction firms by cumulative sales (£m)



A look at concentration measures further support our hypothesis. Generally speaking, British construction is not a sector dominated by a few large firms, although very serious concerns have been raised about the anti-competitive behaviour of UK construction firms (OFT 2008; OFT 2009). McCouglan (2004) shows that the largest 100 private UK contractors (C100 ratio) together account for about 20 % of all economic activity in their sector, in comparison with a C100 ratio of 30-35% for UK manufacturing. In the same paper, it is shown empirically that since the mid-90s the number of entrants to the civil engineering profession has grown rapidly, coinciding with developments in construction technology and greater emphasis on public safety associated with buildings, as well as quality issues and employment practices. However, concentration varies across specialist trades and where entry is less easy and capital investment is more necessary, concentration is correspondingly higher: constructional engineers is a case in point with a 35 % concentration ratio. Furthermore, effective competition varies over time with the level of spare capacity in the sector (McCouglan, 2004).

Next, Tables 3 and 4 show the concentration measures derived from our sample. All measures indicate a significantly higher level of concentration in the PFI segment of the primary and secondary school construction sectors than in the TP one.

Tableau 3. Concentration measures for primary and secondary schools building contracts

	HHI	C5	C10	Active Firms	Contracts
TP	0.041	37%	52%	130	508
PFI	0.117	65%	87%	28	283

Moreover, over time concentration has been increasing in the PFI construction segment as shown in Table 4, while concentration levels has measured by the HHI index have been relatively stable in the TP segment. This should be seen in the context of the falling number of bidders for PFI contracts: Davies and Ghani (2006) find that the number of pre-qualified bidders for PFI tenders falls over time. Similarly, the number of bidders responding to invitations to negotiate has fallen, with most projects receiving interest from 3-4 bidders in 2001/2 compared to earlier projects, which tended to receive interest from 6-8 parties. This may reflect the tendency of the sector towards larger consortia involving multiple partners or, as the authors suggest, waning interest in PFI schools after the first round of projects and tighter capacity in the construction sector.

Tableau 4. HHI over time for primary and secondary schools building contracts

HHI Index 2007-2010 School Construction		
	PFI	TP
2007	0.095638	0.067823
2008	0.145079	0.038198
2009	0.192599	0.083031
2010*	0.19515	0.08382

* incomplete data

Thus, there is evidence of self-selection and separation induced by the PFI/TP menu of contracts, as well as evidence that PFI risk transfer leads to increased concentration.

Returning to the theoretical argument above, we know that reduced competition for the risk transfer contract should lead to the survival of the agent's information rent to competitive tendering. In the presence of a

skewed distribution of types, PFI risk transfer is thus likely to be *ex post* inefficient, since the mechanism that creates the opportunity for rent seeking (endogenous risk transfer) is also the one that reduces competition for the rent.

4.3. Unit costs regression

Finally, using a sub-sample of our dataset for which we can calculate unit costs, we regress construction unit costs expressed in £/m² using a number of control variables and a PFI dummy variable to measure the impact of risk transfer on construction costs. Our subsample consists of 416 observation, 340are TP schools and 76 PFI ones. We exclude very small (all TP) and very large (all PFI) values from the sample out of concern for their representativeness or when a contract includes *ad hoc* structures, the costs of which is not well captured by a per-square-meter measure *e.g.* a new chapel or a sports hall.

Our results are reported in Table 5. We also report coefficient correlations in Annex 2. We find that for a range of standard school buildings, *ex ante* construction prices in PFI contracts tend to be lower than in TP contracts. Figure 5 plots the logged values of unit costs against contract size (also logged). Unit construction costs in PFI schools follow a form of « efficiency frontier » while a significant proportion of the TP contracts has *ex ante* higher unit costs for a given contract size.

Our results suggest that PFI schools have lower construction costs on average than TP schools. Furthermore, we know that *ex ante* PFI construction prices are fixed and thus less likely to change *ex post* than TP construction prices, which tend to lead to *ex post* variations. Thus, *ex post* construction costs for PFI schools should be even lower on average.

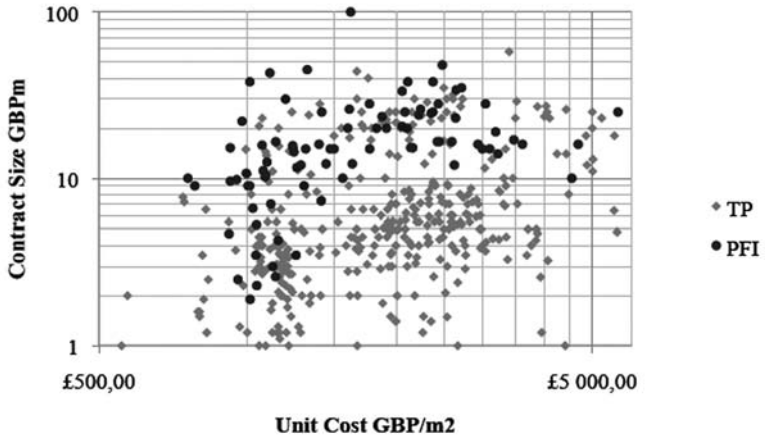
This finding is consistent with the notion that the PFI *vs*. TP menu of contracts leads to the efficient firm self-selecting to enter into the risk-transfer contract and, because under the PFI contract it is the residual claimant of its cost savings, exerting maximum effort to minimize and control costs.

Tableau 5. Ordinary Least Square Regression of *ex ante* construction unit prices in UK primary and secondary schools (£/m²)

	df	SS	MS	F	Significance F
Regression	10	25.5919	2.5592	11.7508	0.00000
Residual	405	88.2044	0.2178		
Total	**415**	**113.7963**			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	7.2136	0.1836	39.2921	0.0000	6.8527	7.5746
Contract Value (log)	0.2967	0.0362	8.1884	0.0000	0.2255	0.3680
PFI	-0.1686	0.0704	-2.3946	0.0171	-0.3070	-0.0302
Y2008	0.0610	0.0687	0.8868	0.3757	-0.0742	0.1961
Y2009	0.1557	0.0683	2.2776	0.0233	0.0213	0.2900
Y2010	0.2445	0.0717	3.4100	0.0007	0.1036	0.3855
Extension dummy	0.2082	0.1688	1.2334	0.2181	-0.1236	0.5400
Demolition dummy	-0.0464	0.0528	-0.8791	0.3799	-0.1501	0.0573
Duration (log)	-0.0693	0.0767	-0.9044	0.3663	-0.2200	0.0814
2 to 3 Storeys	-0.1088	0.0590	-1.8435	0.0660	-0.2248	0.0072
4 to 6 Storeys	-0.3739	0.1109	-3.3722	0.0008	-0.5919	-0.1560

Figure 5. Scatter plot of *ex ante* construction unit prices and contract size



This last intuition fits well with the notion that the efficient firm must receive a risk-free rent to accept to self-select, take maximum risk and exert optimal efforts: in the case of PFI schools in the UK, the selected firms maximize their profit by delivering comparable infrastructure at a cheaper cost. This supports our hypothesis of self-selection of the efficient firms under the risk transfer contract. Moreover, if, as anecdotal evidence suggests (see footnote10), the unitary charge for PFI schools is very similar from the public sector comparator because of limited competition, it may be the case that the difference between the efficient firms' cost under the risk transfer contract and their revenue is substantial. In other words, as we also hypothesized, the efficient firms benefit from a significant *ex post* rent. However, in the absence of comparable estimates of the cost of operations in both PFI and TP schools, the actual profitability of PFI contracts cannot be derived explicitly.

However, the interpretation of the regression result may not seem straightforward in the light of previous research, which highlighted *higher ex ante* unit costs in public-private partnerships (PPP) road projects (Blanc-Brude *et al.*, 2009).

The difference of sign between reported *ex ante* construction prices should not however be a surprise. The UK PFI sector and the European road construction sector represent two distinctive groups of firms with

different approaches to profit maximization under long-term risk transfer contracts:

• Under the PFI, with a very predictable and secure stream, the efficient firms choose to exert efforts to reduce their costs and control risk (because they can) as the most effective profit maximization strategy.

• In road concession contracts, with risky revenues based on real or shadow toll collection, developers and their construction subsidiaries have an interest in recouping their investment earlier if they can, and to increase their cash flow early in the life of the concession by padding construction costs.

In both PFI contracts and European toll roads, we should expect the efficient firms to self-select and, if the distribution of firms is very skewed, for a few efficient firms to capture an *ex post* rent. However, the rent extraction strategy differs between sectors: school developers benefit from their low cost of construction but secure high prices, while highway developers tend to increase construction prices to recoup risk cash flows early.

5. CONCLUSIONS

In this paper, we have proposed a theoretical and an empirical analysis of the *ex ante* and *ex post* efficiency of long-term risk transfer contracts used to procure public infrastructure projects for a fixed price as illustrated by the Private Finance Initiative (PFI) in the UK.

Using existing insights from agency and contract theory, we detailed the intuition that full risk transfer contracts like PFI contracts are likely to be *ex post* inefficient. We concluded that with no other instrument to minimize *ex post* inefficiency than the degree of competition for the contract, the size of the firm's agency rent was likely to be determined by the distribution of firm types *i.e.* the more skewed in favour of efficient types the distribution is, the less competition there is amongst efficient firms and the more likely is the rent of the firm to survive competitive tendering.

For the policy-maker, it follows that the choice to use risk transfer as a revelation mechanism, inducing the self-selection of the efficient firm in order to improve *ex ante* efficiency, should be made in the context of the distribution of firm types, which is country- or region-dependent.

Looking at the UK, in the case of primary and secondary school construction contracts, we find that the probability that firm builds a school under a PFI contract is not independent of the probability that it builds a school under a TP contract. On the contrary, they are inversely related: if proxying firm types by their size (employees, sales) the distribution of construction firms involved in building schools under PFI contracts is different than that of all firms in the sector.

We also find much higher concentration within the PFI segment of the school construction sector, further suggesting that the distribution of types is skewed and advantages efficient firms since they face less competition for risk transfer contracts than for traditional ones.

Finally, we find that *ex ante* school construction unit costs for the firm are lower on average in PFI schools which is congruent with the notion that the efficient firms self-select to bid for the risk transfer contract, following what they exert maximum effort and do indeed minimize their cost. Moreover, since the Public Sector Comparator often suggests that the total *ex post* cost of PFI contracts may be similar to TP contracts, we can formulate the hypothesis that efficient firms, since they have lower costs, have on average higher profit margins *i.e.* as theory suggests, the efficient firm receives a risk-free rent.

5.1. Policy implications

Beyond the obvious need to minimize the social cost of risk transfer in PFI contracts, *ex post* inefficiency when it takes the form of large rents should be a concern insofar as it increase the likelihood of political interference and renegotiation, greater uncertainty and a return of opportunism in the agency relationship.

In an era in which governments wish to see pension funds invest in public infrastructure, the uncertainty created by political risk is all the more damaging.

At the beginning of a period of private sector involvement in public infrastructure delivery, the public sector is willing to see the efficient firm receive a rent because it values the effective delivery of infrastructure assets and services to the economy. For example, when the PFI was launched in 1992, the British infrastructure sector had been starved of capital expenditure for more than a decade. When Labour was elected in 1997 on a promise to deliver public services, the PFI provided the perfect vehicle to attract cost-efficient firms and capital to the sector.

Later, once investments have been made and the attractive risk-adjusted returns become more apparent (and politically difficult to justify), the pressure to renegotiate the rules regulating initial contracts increases. Returning to the PFI, ever since their inception or almost, PFI contracts have regularly been criticized in the UK. The main concern being that investors may be receiving high returns, at the expense of taxpayers.

An important dimension of the contracts used to deliver infrastructure in the UK, France and beyond, is that they do not set the private sector's rent, as opposed to for example, the economic regulation of utilities under the regulatory asset base model, which regularly benchmarks the cost of the efficient firm. As a consequence, if competition was so limited that adverse selection led to granting a large risk-free rent to the firm, or a new technology is introduced that delivers high costs savings, or if the firm is simply very good at generating costs savings or manipulating the SPVs financial structure to maximize its rent, the temptation or the pressure for the public sector to renegotiate or at least cap profits becomes too great to resist.

Thus, even if a principal has to commit to letting the firm earn a risk-free rent under the risk-transfer contract, a new principal may not have to live by the commitment of its predecessor, especially if an external shock (*e.g.* an economic or financial crisis) provides good reasons to renege and renegotiate.

Thus, as long as Labour was in power, its commitment to the PFI remained. Elsewhere in the UK, local government that did not feel bound by the decisions of Labour challenged the validity of the rents embedded in PFI contracts continuously. On a number of instances, the governments of Scotland or Wales cancelled planned projects, terminated existing contracts (Roy, 2011) and even sold assets that were still claimed by banks as security (Ashurst, 2007).

When a new coalition government was elected in the UK in the middle of a financial crisis, which was immediately followed by a crisis of public finances, the commitment of the public sector to the PFI was unlikely to last. At the same time, the main difficulty encountered with continuing entering into PFI contracts was the accessibility of new debt financing, especially long-term bank debt[15]. The increase of PFI borrowing costs induced by the reversal of the credit cycle has led to an increase by 6 to 7 % of the unitary charge paid by the public sector over the lifetime of projects financed since 2009 (NAO, 2010). The realisation that such costs increases may be locked-in for 25 years led HMT to announce a new rule on refinancing gains according to which up to 70 % of the gains achieved from refinancing PFI debt raised after 2008 would have to be returned to the tax payer (UK Treasury, 2008).

The new UK Government embarked on the search for a « new model » for the PFI almost immediately after coming to power. While the PFI had designed to reduce the cost of traditional public procurement, in particular endemic cost overruns and delays in its December 2011 *Call for Evidence*, the UK Treasury chose to characterise the past twenty years of PFI procurement as potentially « too costly, inflexible and opaque » (UK Treasury, 2011a).

15 PFI debt spreads followed the credit cycle and, having reached a through in 2008 at around Libor+80-90bps before fees for a 22.5-year term loan, they increased to Libor+300-350bps in 2009 for a seven-year mini-perm and have only slightly decreased since then. « Mini-perm » debt with tenors of 5 to 7 years (« hard » mini-perms) introducing significant refinancing risk for projects closed after 2009 has become the norm. « Soft » mini-perms allowing for longer tenors but with a margin ratchet or cash sweep encouraging a refinancing are also used and introduce new risks for equity investors in PFI SPVs.

Clearly, the initial commitment of the UK public sector to the long-term contracts entered into to its social infrastructure has eroded and the net benefits are now considered to be insufficient. This *shift from commitment to resentment* is not specific to the UK or PFI contracts. Numerous investments in policy-derived long-term contracts for infrastructure delivery go through the same pattern of events or policy cycle as previous research has shown: « Private initiatives work for a while but after a shock to the sector takes place the public sector returns as regulator, owner or financier; after a while the public sector runs into problems and eventually finds a hybrid solution to ensure the survival of the sector » (Estache & Serebrisky, 2004).

Today, the explicit recognition of the agency dimension of the risk transfer mechanisms described above and of their *ex post* inefficiency would also highlight the need to make the efficient firm's rent *transparent* through cost benchmarking and the regular rebasing of PFI unitary charges as it is already done in the water sector for example. Transparency about returns and costs would help achieve continued investment and cost-efficient delivery of public infrastructure projects while allowing genuine long-term commitment for both sides of these contracts.

In a world in which pension funds are increasingly considering investing for the long term in alternative assets like infrastructure, securing the long term commitment of the public sector thanks to a well understand and universally accepted regulatory regime can only serve both public policy objectives and private sector interests. With transparency about returns, the incentives of the firm can be preserved while insulating investors from political risk.

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ANNEX – DATA COLLECTED

Variable	Description
Generic firm Name	Lead firm/Main contractor/D&B Contractor
Contract price GBP/m²	GBP/m²
Project Name	Text
Address	Text
Contract Value	GBPm
Project Stage	Text
Start Date	Date
End Date	Date
Works Duration	Months
Storey	Number
Floor Area	m²
Number of Units	Number
Development Type	Text

ANNEX 2 – UNIT COST REGRESSION COEFFICIENT CORRELATION

Correlation of Coefficients								
	(Intercept)	**LogValue**	**PPP1**	**D20081**	**D20091**	**D20101**	**D_extention1**	**D_Demol1**
LogValue	0.41							
PPP	0.11	-0.24						
D2008	-0.24	-0.10	0.05					
D2009	-0.30	-0.19	0.03	0.57				
D2010	-0.24	-0.09	-0.08	0.53	0.57			
D_extention	0.04	0.08	-0.33	-0.04	-0.10	0.04		
D_Demol	0.06	0.04	-0.22	-0.16	-0.27	-0.23	0.10	
LogDur	-0.93	-0.63	-0.05	0.07	0.15	0.08	-0.06	-0.08