

# **Private financing of infrastructure. An application to public transport infrastructure**

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## **1. Introduction**

Over the period 1970-1996, large reductions of government investments were observed in OECD countries. Privatization and public-sector expenditure constraints have given rise to a substantial reduction in public sector investment and to an alteration of the respective importance of the private and the public sector in infrastructure investment. The reduction of the share of gross fixed capital formation cannot be attributed to a "downsizing" of government in industrialized countries: total public expenditure is much the same as it was 30 years ago. Some common factors might explain this evolution of the government expenditure's structure. The shrinking of public investment can be explained by the growing share of social security transfers and public debt strengthened by very high interest rates in public expenditure, which might have crowded out public infrastructure investment. At the same time, privatization of number of public enterprises has taken place and realization of new infrastructure investments.

One trend in the economic literature [e.g. Aschauer (1989a, 1989b) and Munnell (1990)] supports the argument that more public investment is required to favor economic growth. There is evidence that the decline in the US productivity in the 1970s can be explained by lower public investment spending. On the basis of these results, an increase of 1% in the public capital stock raises total factor productivity by 0.39%. However, in more recent econometric studies [Hulten and Schwab (1994), Holtz-Eakin and Schwartz (1995) and Sturm and de Haan (1995)] the previous results are contradicted.

In order to stimulate infrastructure investment, public authorities search to involve the private sector in the creation of new infrastructures. Private investors are in charge of the construction and the operation of the infrastructure. We have to make a distinction between contracting-out the provision of infrastructure services and the private financing of infrastructure projects [Ridley (1997)]. Contracting-out implies the replacement of public suppliers or contractors of a flow of goods or services with private sector contractors of those same flows. In contrast, private financing corresponds to the replacement of a capital asset owned by the public sector by a flow of services provided by assets owned by the private sector. We will focus on private financing which is closer to pure privatization process.

The recourse to the private sector to finance and operate infrastructures is often considered as a way to improve the ex ante screening and monitoring of the project and to increase productive and managerial efficiency. Various additional benefits are expected from the recourse to the private sector to realize new infrastructure [Terry (1996)]. In case of cost overruns, costs fall on the shareholders or lending institutions for privately finance project while in public ownership the public sector has no alternative but to stump up extra costs.

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Moreover, public sector has tended to follow higher technical standard or to be overengineered in the design of the project while the private investor will search for a balance between cost, financial return and risk. Finally, projects managed in the public sector are more often subject to changes in specification, which give scope for contractors to claim extra cost and inflate their profits.

This trend to privatization is strengthened by technological innovations in the collection of user fees. By allowing to devise financing schemes based on the willingness to pay of users, it allows to resort on financing sources for infrastructure investment which are different from budgetary expenditures. A public-private partnership will emerge from those evolutions, the public authorities having to deal with specific characteristics of infrastructure project (non-excludable and non-rival up to a certain level) like network or environmental externalities, the demand uncertainty and administrative costs associated to the project. However, on the other side, if infrastructure privatization is combined with deregulation or liberalization of market entry, the resulting level of competition in the provision of services may increase, and hence, the market risks associated to the project.

Private financing has been used for the development of important infrastructure in Europe. In the UK, the government has introduced the private finance initiative (PFI) in order to promote the construction of new infrastructure. The participation of the private sector in infrastructure projects has led to the creation of a new institutional structure. Indeed, a special purpose company, called "the project company", is set up to realize the infrastructure; the assets of the project reverting to the government at the end of the contract. This project company is liable for the contractual agreement with the private contractors and the lenders. The concession contract defines the contractual obligations of the project company with respect to the government. Debt service is met through cash-flows generated by the project itself. It means that project financing is typically on a "non-recourse" basis, i.e. the lenders will have no financial recourse for repayment of their loans against either the project sponsors or the government. More precisely, recourse is limited to the project company and its assets (real estate, plant and equipment and whatever contractual rights the project company has been able to obtain).

This paper is organized as follows. In the first part, we describe and analyze the institutional structure of infrastructure investment involving the private sector. In the second part, we analyze the development of private financing in the UK. We try to isolate the nature of the incentives of the different players and the efficiency of different institutional structure, i.e. long-term contracting versus vertical integration, for the provision of infrastructure services.

## ***2. The institutional framework of the provision of infrastructure services***

The impacts of private financing of infrastructures have not been really investigated in the economic literature. With the exception of the recent works of Martinand (1993) and Walker-Smith (1995), the consequences of the private sector's participation to infrastructure projects have been essentially analyzed by international institutions [e.g. Augenblick and Scott-Custer (1990)] or by consultants [e.g. Nevitt (1989)]. In this part, we analyze the contractual of project financing and the allocation of risks.

### **2.1 The basic institutional structure of project financing**

The contractual regime used to regulate the relationship between public authorities and private investors is the "concession" (similar to Build Own Operate and Transfer<sup>2</sup>). The concession is a form of privatization without direct sales, i.e. ownership will revert back to the public sector at the end. Moreover, the government will monitor the realization of the

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<sup>2</sup> Different variants have been developed around this notion of BOOT [see Walker and Smith (1995), pp. 190-195]: the Build Own Operate (BOO), the Design Build Finance Operate (DBFO), the Build Lease Transfer (BLT), the Lease Renovate Operate Transfer (LROT), the Build Transfer Operate (BOT), the Design Build Finance Maintain (DBFM).

infrastructure and specify in the contract some public services' obligations. For the government, the main advantages lie in the relief from having to face the costs of construction and in the promise of better project design, construction and operation. Indeed, the concession is a contractual agreement whereby a private entrepreneur leases assets for service provision from a public authority for an extended period (between 30-50 years). This private company, called the project company, is made responsible for financing specified fixed investments during the construction. These new assets revert to the public authorities at expiration of the contract. The concession gives an exclusive right to the concessionary during the construction and operation period. For instance, public authorities can commit themselves not to develop alternative infrastructures introducing competition on the market.

In this institutional framework, the public sector purchases a service not an asset with pre-defined payment levels. The difference in terms of incentives between public and private provision is that in the case of private provision of infrastructure services, the public sector only pays for the service he receives and only if the service meets the contractual specifications. Compared to other forms of private sector participation like contracting-out, the advantage of this institutional structure is to transfer to the same operator the construction and the operation of the infrastructure. If the same entity builds and sells the services but is only remunerated for successful supply of services, there are no incentives to reduce quality even if the consequences do not appear for many years. This contractual structure should also reduce incentives to cost over-run or the choice of an inefficient technology since future revenues of the operator depend on a flow of suitable quality services form the asset. Such beneficial effects will work if revenue streams of the infrastructure project were inherently risky for the suppliers.

The financing of this type of infrastructure project is based on the expected cash-flows and not only on the quality of the debtor. The project financing is typically on a "non-recourse" basis i.e. the lenders will have no financial recourse for repayment of their loans against either the project sponsors or the government. Recourse is limited to the project company and its assets, i.e. real estate, plant and equipment and whatever contractual rights the project company has been able to obtain. Lenders bear the technical, commercial and political risks likely to jeopardize the expected flow of cash-flows. Extensive feasibility and engineering studies are carried out to have cautious cash-flows forecasting throughout the life of the project. However, projects are rarely completely self-supporting such that they cannot be financed without any guarantees and safeguards undertaken by the interested parties, including sponsors and government. Normally, the government will not provide sovereign guarantees or borrow any money on behalf of the sponsors, but support from the host government includes assurance of minimum revenues, sharing of project risks,... Private promoters preserve their borrowing capacity by keeping off-balance sheet the liabilities incurred by the project company.

During the operation period, the project company (or concessionary) charges prices, tolls, fees,... generating cash-flows sufficient to pay the service of the debt and to provide dividends to the shareholders of the project company. Two different approaches are used to define the pricing structure. The first approach rests on the repayment of fixed costs during the operation period, i.e. all charges related to the operation of the infrastructure including the financial charges. The repayment of the variable costs is contingent to the supply of the infrastructure services. This type of pricing is similar to a "cost-plus" contract [in the sense of Laffont and Tirole (1993)]. The alternative approach implies that the government commit itself to buy a pre-defined quantity of products at a given price. Generally this type of contract includes a specific clause compelling the government to compensate the project company if the quantities he buys are lower than the level specified in the contract. This contract is quite similar to "fixed-price" contract.

## 2.2 Regulation and public sector intervention

In infrastructure investment, the government specifies in the concession different public service constraints (pricing structure, safety and environmental regulations,...). The intervention of the government rests on different arguments: the existence of externalities, natural monopoly, public goods and imperfections on the capital market.

The development of infrastructures generates positive externalities on the economy (stimulation of the economic growth, increase in productivity and profitability,...) but it can also impose costs which are not taken into account by the service provider when choosing their actions. As a result, the project's social returns exceed its private returns and the classical efficiency argument for subsidies applies: a subsidy that closes the gap between private and social benefits will prevent the relevant form of infrastructure from being undersupplied.

Moreover, many infrastructure services have natural monopoly characteristics, i.e. least-cost production requires that only one service providers is active on the market. In this case, the government intervention is required as the firm has no incentive to supply consumer at a price equal to the marginal cost of production, since relatively high fixed costs implies that marginal costs are below average cost on the relevant range of output. In addition, when the firm provides a service with imperfect elasticity of demand, the government has to intervene in order to avoid that the firm uses its market power to hold output below its welfare-maximizing level.

Infrastructure services have often public goods characteristics<sup>3</sup>, i.e. non-rivalry and non-exclusion in the consumption of the good. This leads to the well-know free-rider problem which can preclude production by the private sector as no consumer would pay for it. Another justification for government intervention is the need to offset the imperfections on the capital market. These imperfections results from asymmetric information . Even if investors could otherwise capture the social returns, incomplete information that leads to some form of credit rationing can prevent them from doing so. To cover their risks, private investors require higher interest rates which drops out safer projects from the pool of projects of the investor. In such cases, a government interest-rate subsidy or guarantee may effectively relax the credit rationing. However, as we will see later, this type of governmental intervention can weaken the incentive for investors to monitor adequately the project company and to prevent private contractors from deliberately inflating construction costs.

When the government does not provide directly the infrastructure services, subsidies or regulation are alternative intervention mechanisms. If we suppose that the government is benevolent, i.e. acts on behalf of society, the implementation of an optimal regulation or the grant of subsidies can be limited by asymmetric information or incomplete contracting problems. Regulation through price mechanism (RPI-X scheme) or rate-of-return involves three-way trade-off for the government among allocative efficiency (marginal price closest to marginal cost), productive efficiency (cost reduction incentives) and distributional (excess profits of the firm due to its information advantage) [see Laffont and Tirole (1993)].

For the provision of infrastructure service, government intervention can take different forms. Compared to the initial forms of government intervention, we note that financial interventions are quite limited. Moreover, nowadays, the project company will not normally gain any title to the land in the form of either leasehold or ownership rights, but will simply be granted some forms of restrictive licence to use the land specifically for the project during the concession period. The present forms of government intervention are the following :

- ◆ the granting of exclusive rights protecting the project company from the competition of alternative infrastructure (e.g. Eurotunnel);

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<sup>3</sup> Technological evolutions can affect the characteristics of the infrastructure services. In the case of highways, the use of electronic collection toll reduces the transaction costs associated to pricing on highways. Hence, highway services can now viewed as excludable collective good.

- ◆ the insurance of a minimal revenue during the operation phase through "take-or-pay" or "take-and pay" contract;
- ◆ the construction of complementary assets to the infrastructure allowing to improve the access to this infrastructure (e.g. the development of railway and road infrastructure to Eurotunnel);
- ◆ the internalization of the positive externalities generated by the project through land or equipment granting and contribution of actors benefiting from the development of the infrastructure (e.g. participation of property developers, landowners and shopkeepers to the development of the Bristol Light Rail project in recognition of increase in land values along the railway's route);
- ◆ indirect financial aid through, for instance, tax holidays or interest bonus (e.g. subordinated loan provided by the Malaysian government to develop the North-South Highway which could be drawn if the project revenues fell below a projected target level);
- ◆ the transfer of revenues from an existing infrastructure to ensure the financing of a new project during the construction period (e.g. the transfer of the revenue from two existing tunnels crossing the Thames to reduce the debt period during the construction and early operational phase for the development of the new Dartford Bridge).

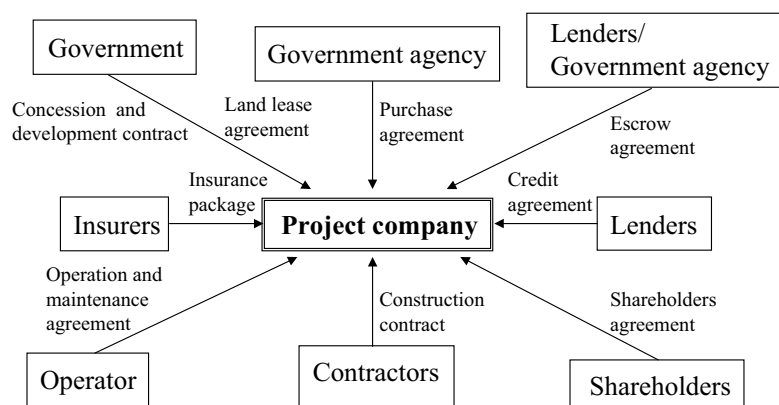
Even if the provision of government guarantees can be justified by the existence of positive externalities or the lower cost of capital incurred by the public sector, the government intervention might have adverse effects. First, it reduces the incentives for banks or private investors to screen projects carefully. Second, guarantees blunt managerial efficiency in particular when the government guarantees against cost overruns. Finally, guarantees create contingent liabilities for the government which do not appear in the budget. The type of government intervention is crucial in order not to distort the incentive of each stakeholder active in the project. For instance, direct subsidies may be better than guarantees since they run through the normal budgetary process and may be limited to an amount just large enough to make the project attractive to private investors. However, political pressures may lead to inefficient subsidies compared to the social benefit of the project.

### 2.3 The contractual structure of project financing

The concession scheme rests on a nexus of contractual relationship between the different players involved in the project. The concession agreement involves different actors:

- ◆ public authorities for which the investment is undertaken;
- ◆ the concessionary or the project company;
- ◆ the financial backers: lenders and shareholders;
- ◆ contractors and operators.

The contractual arrangements are crucial to achieve an optimal sharing of the risks associated to project finance between the different parties. The following picture summarizes the contractual relationships between these actors.



The private financing of infrastructure requires the implementation of a package of contracts. The project agreement (or implementation/concession agreement) is one of the two key contracts, with the credit agreement. This contract entitles the project company to build and operate the project facility and imposes a number of conditions as to design, construction, operation, maintenance, etc... of the project. More precisely, this contract includes the public service obligations imposed by the government and fixes the operation period, the payment for the usage of the facility, the way in which payments should be effected and so on. Moreover, to deal with the tricky problem of windfall profits, a specific clause may be included reserving a right for the government to buy out the private sponsors before the end of the operation period or to adjust certain terms of the project agreement. Indeed, for political reasons, an excessive profitability of the concession may incite the government not to respect his initial contractual obligations in order to obtain a lowering of tariffs or the termination of the contract. In this case, when the government cannot commit to future policies, private investors face the risk of opportunistic behaviour in addition to other types of risks (market risks,...).

The credit agreement includes two elements: the source of financing and the covering of risk of non-repayment of loans. The shareholders agreement includes the subscription of the share capital and clauses concerning the dividend policy,... The shareholders of the project company are normally the private project sponsors (private construction companies, equipment suppliers, lenders) and in some cases the government. The construction contract is normally a fixed price turnkey contract covering all the work. In some cases, sub-contracting is realized. The purchase agreement is defined when a government agency is the only customer of the infrastructure project. This agreement provides the project company with an assurance of a minimum purchase by the government and arranges the pricing structure. If the government pays the fees, the project company faces no market risk and is assured of sufficient funds to service its debt, cover its projected costs and make a profit. The operating and management agreement manages the relationship between the project company and a professional operating firm. This agreement defines the operating costs, the standard norms of service,... along the operating period. The escrow agreement organizes various deposit accounts and the order of benefit sharing. The insurance package includes the various insurance policies for the construction and operating phases, required by the lenders.

Project finance differs in the nature of the contractual arrangement. For instance, the project company can be responsible for the operating phase, like in Eurotunnel, requiring no specific O&M agreement with an operating firm. The nature of these different contracts is crucial to give appropriate incentives to the different partners. The objectives of the project company depend on the interests of its shareholders, e.g. banks vs constructors or/and operators. We can expect that there is congruence between the project company and institutional investors, i.e. parties who are not otherwise involved in the project. The contractors have an interest to limit his equity stake in the project and to inflate construction costs. However, the less equity the contractors takes the less control he has over the terms and conditions of the concession and on the construction contract. As a result, we observe that contractors reduce their share in equity as the project goes forward since they are naturally less concerned with the terms and conditions of the operational phase of the project.

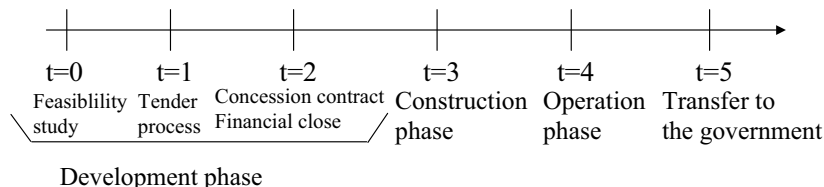
## **2.4 Sequence of events and risks allocation**

### **2.4.1 Timing**

The sequence of events for the infrastructure project is the following. The public authorities undertake the feasibility study leading to the specification of the concession. The banks carries out the financial part of this study and receive a consultant fee. On the basis of the feasibility study, the public authorities organize an auction to allocate the project to a consortium offering the best guarantees, i.e. reputation, financial viability,... Indeed, the

auction is limited to 2 or 3 consortia because only few firms are able to undertake infrastructure project requiring important financial resources, specific know-how and so on. After the implementation of the project and financial agreements, the concessionary undertakes the construction of the infrastructure, either directly or through subcontracting. The concessionary operates the infrastructure and uses cash-flows to repay the loan. The public authorities become the owner of the infrastructure at the end of the contract.

We can describe the time line of the project financing in the following way :



Infrastructure investments are characterized by high level of investment and the specific shape of the rentability of the project i.e. positive receipts expected only at middle term. The investment of the private contractor is relationship-specific i.e. having a low value outside the relationship and being costly for the party which realizes the investment. In such circumstances where the investment is sunk when reaching the operating period, private investors may be reluctant to invest in such project with high risk-benefit ratio. Public authorities also have to perform specific investment for complementary services to ensure the success of the project. These investments are presumed to increase the value of the project. Infrastructure project can be viewed as two distinct projects. The two first phases correspond to a high-risk construction project, the last phase to a relatively low-risk utility project. This dual risk profile means that for equity investors, there is generally a high reward during the early phase (large capital gains) followed by a lower reward in the latter phase (steadily increasing dividend flows). This two-stage profile of infrastructure projects should be reflected in the credit facility.

#### 2.4.2 Allocation of risks

One expected advantage for the public authorities of private involvement in infrastructure project is to achieve a better allocation of risks by transferring some of them to the private sector. The need to transfer risks to private operators has been emphasized to secure efficiency gains and to compensate for the alleged lower borrowing cost faced by public authorities compared to private investors.

In terms of financing, given the high risk associated to the development phase, the financial instrument used at this stage is only equity. In the construction and start-up phase, high risk component is associated with large volume of funds needed for the investment. The financing includes a mix of equity, subordinated debt, senior debt and guarantees. Lastly, the operating phase faces lower risks allowing refinancing with bonds in some cases.

We can distinguish between two principal types of infrastructure:

- ◆ project where fees are charged directly to the public, the public sector involvement being limited to one of monitoring adherence to the contract and renegotiation any changes to the service supplied, e.g. roads, bridges or tunnels with many tolled customers (Type 1);
- ◆ project when there is a direct or fixed purchase of the infrastructure services by the public sector which can either charges the customer (e.g. power, sewage or water treatment plants) or not (e.g. prisons,...) (Type 2).

The extent of the risk transfer differs for each type of project. In type 1's project, there are genuine transfer of risk to the private sector. In general, the public sector provides limited guarantees or indemnities to cushion the private sector against unexpectedly low levels of

demand or other project failure. For type 2's project, the transfer of risks aims to achieve the allocation of risks to the manager best able to manage them.

In the table 1, we describe the most important risks<sup>4</sup> of infrastructure projects and the allocation of risks between the private sector and the public sector. We distinguish the different phases of a typical infrastructure project - development, construction and operation.

We focus on the main risks which can be internalized to some extent either by the private or the public sector. An optimal risk allocation will require that risk should be borne or internalized by the party best able to control the risk or able to bear the risk at lower costs. If the public sector grants complete insurance against cost overruns, for instance, the winning consortium will have no incentive to control costs and on average they will be too high.

Table 1 : Allocation of risks in infrastructure project

Type of risks	Risks transfer to the private sector	No risks transfer to the private sector
<b>Development phase</b>		
<i>Design risk</i>	Full responsibility of the operator for ensuring the underlying asset is fit for purpose	Operator provides a service from a design defined by the public sector which guarantees that the asset will be fit for purpose
<i>Technology or obsolescence risk</i>	Payment depending only on the achievement of performance standard	Payment is fixed
<b>Construction phase</b>		
<i>Construction risk</i>	Operator not paid until construction is realized, must absorb all variations and pay some penalties for delay	Operator transfers significant variations in construction costs to the public sector for this latter is not responsible
<i>Regulatory or legislation risk</i>	Operator responsible for change in law or regulations of general application	Public sector compensates cost variation due to specific or general legislation changes
<b>Operation phase</b>		
<i>Performance risk</i>	Service payment entirely depending on the achievement of performance criteria	Service payment fixed and independent of performance criteria
<i>Operating cost risk</i>	Operator responsible for all variations in operating costs	Significant changes in operating costs passed back to the public sector
<i>Demand or volume risk</i>	Payments are volume related	Service payment independent of volume
<i>Residual value risk</i>	Asset remains with the operator or public sector option to acquire at market value at the end of the contract	Asset reverts to the public sector at the end of the contract at a pre-determined value
<i>Pricing risk</i>	Service payment taking the form of a pre-determined RPI-X	Service payment varying with the underlying cost base

Note that we have not considered political, administrative, environmental or force majeure risks which essentially remains of the responsibility of the public sector and hence of the taxpayers. In some cases, some of those risks can be transferred to consumers rather than to the taxpayers when regulatory rules allow changes in taxation or environmental standards to be passed on to consumers through tariff adjustments. The efficiency and distributional consequence of the choice will depend particularly on the relative effectiveness of the taxation system and the infrastructure tariff system. Transferring those risks like political risks to private investors will increase the cost of private financing since it will ultimately be

<sup>4</sup> The probability of occurrence of a number of risks varies from country to country. For instance, issues like enforcement of regulation, tax regime or uncertainty due to election of a new government which cannot share its predecessor's commitment are important in less stable countries.



reflected in higher tariffs, reduced proceeds from privatization or greater need for public financing in infrastructure. However, even if the public sector bears political risks, those risks cannot be completely eradicated and the final outcome will depend on the credibility of the commitment of the government to establish effective and durable institutional safeguards for private property rights.

The transfer of the demand and volume risks will depend on the access for users to alternative sources for the services provided by the infrastructure. If the demand for the service is relatively elastic, the transfer of the volume risk to the private consortium might increase the price charged for the service when the volume of usage is largely outside the control of the private consortium (e.g. tolled roads versus alternative non-tolled roads). But in this case, since demand may be highly sensitive to the quality of the service, the contractor must be given incentives to perform demand-enhancing activities implying the need to bear commercial risks. When demand is relatively inelastic and unresponsive to the concession-holder actions, there is no need to transfer demand risk and the government has to enforce regulatory mechanism, for instance, the introduction of minimum quality standards.

The nature of the risks associated to the realization of infrastructure investment depends on the type of the project. As stressed before, the advantage of type 2's project are the following : less risky revenue streams and construction and maintenance costs relatively simple to quantify. For instance, electricity projects rest on technologies which are relatively well mastered. In power projects, power purchase agreement or long-term power sales contract with a state-owned utility gives extensive guarantees to the lenders. This possibility to recover fixed charges (including debt service and equity return) and operating costs is not replicable with the same level of guarantees in transport project. This resulting additional market risk is related to the difficulty to assess the willingness of travellers to pay for a new infrastructure given the availability of alternative routes with lower costs (e.g. no toll on existing routes).

But even if the risks are supported by the private sector, the project can give a monopolistic situation to the private provider (e.g. a bridge). In this case, the amount of demand risk faced by the private sector depends on the contractual arrangements for pricing and the duration of the concession. The gains from private financing will depend on an effective price regulation.

The exposure of the private sector to risks can also be assessed according to a distinction between freestanding facilities and those constituting parts of larger integrated networks [Heald (1997)]. For freestanding projects, the transfer of significant risks can be achieved which makes credible the threat of bankruptcy for the concessionary. When the assets of the project are part of a network, the privately financed link may be vital to network efficiency and this will reduce the discipline imposed on the private contractor through bankruptcy threat. The same consideration applies for a freestanding infrastructure delivering primary public services like water. The private contractor can use the infrastructure as an "hostage" to obtain more favorable terms from the government.

The basic difference between the two types of project may induce inefficient behaviour from public authorities [Heald and Geaughan (1997)]. As projects yielding benefits capturable in the form of user charges are favored it might introduce a sub-optimal change in the composition of investment and lead to the realization of project with a low social value.

Lenders are directly concerned by the consequence of interruption or delay in the construction phase which affect the cash-flow streams. The occurrence of construction phase risks jeopardize completion of the project and timely repayment of the debt. The contractual mechanism designed in the construction and operating phases are implemented in order to ensure cash-flow maintenance throughout the project. It may be required to play on maturities and currencies to match with the need of the investors.

The allocation of risks in infrastructure projects is crucial in the bargaining process. The party who ultimately bears a specific risk ought to be the one with a competitive advantage or natural predisposition in risk assessment and control, e.g. the government has to bear legislative risks. In consequence, the state has to pre-commit to bear non-insurance risks or to enforce institutional solutions to imperfect market mechanisms for allocating risks (Credit-export agencies for political risks, for instance). Otherwise, the cost of doing so may be disproportionate in the case where the private sector is less able to control these risks. The risk of excessive intervention of the government in the project may also affect the long term viability of the project. For instance, additional environmental or safety requirements can require additional investment which affect the profitability of the project. This risk of opportunistic behaviour by the government which leads to expropriate the investments undertaken by the project company might reduce ex ante the incentives of private investors to participate to infrastructure project [Laffont-Tirole (1993)].

Finally, the residual value risk is relatively important as he has direct consequence on the incentives of the private operator to maintain the infrastructure in good running. Indeed, the operator's incentives to invest and maintain assets diminish as the date of termination of the concession approaches. This effect is strengthened by the specific flow of revenues associated to long-term infrastructure project.

### ***3. An application to public transport infrastructure : the PFI experience in the UK***

After the privatization of various public utilities in the UK, it remains capital-intensive infrastructure where the final customer is often the public sector, this latter retaining a very close interest in the quality and nature of the service, e.g. the health service, roads, education, custodial services,... The Private Finance Initiative, the so-called PFI, typically corresponds to project financing scheme and introduces a fundamental change in the perception of the state role in infrastructure investment in the UK. The public sector now purchases directly or indirectly services from the private sector responsible for owning, financing and operating the capital asset that is delivering the service, while it was before owner of capital assets and direct provider of service. The government is committed to a long-term agreement at the time of construction which implies that the present value of the financial commitment by the government may be very similar whether the public sector owns the asset or not. Indeed, instead of capital spending having a one-off impact in terms of public expenditure when the investment occurs, there is a stream of future revenues commitment over the lifetime of the service contract entering in public spending into the future. Two main requirements have been introduced for PFI schemes:

- ◆ the project has to demonstrate value for money for the taxpayer;
- ◆ the project has to transfer significant risks to the private sector.

Three potential types of project have been identified. The first category is financially free-standing projects where the private sector undertakes the project on the basis that costs will be recovered entirely through charges for services to the final user (e.g. the tolled Skye bridge). The second category corresponds to project where the services are sold to the public sector, i.e. the cost of the project is met wholly or mainly through charges from the private sector provider to the public sector body which let the contract (e.g. the Fazakerley and Bridgend prisons, the Colfox school, roads schemes,...). Finally, there is joint-venture project where the cost of the project is met partly from public funds reflecting the social benefits of the project and partly from other sources of income, with overall control of the project resting with the private sector (e.g. the Docklands Light Railway extension to Lewisham, the Channel Tunnel Rail Link).

### 3.1 Case studies of PFI

Given the long-run nature of infrastructure projects and the slow development of PFI programme, empirical evidence is emerging slowly and until now, there is no project which is near the termination of the concession contract. However, the development of different projects which are now operational or at the end of the construction phase provides interesting findings.

In this section, we discuss some preliminary findings on the development of private provision of infrastructure services under PFI in transport infrastructure. We will investigate different sectors in order to assess the impact of various infrastructure characteristics (size of the relationship-specific investment, complexity of the service,...) on the design and the type of contractual agreements between the public sector and the private provider. Moreover, as those projects are developed in the same country, we avoid some bias resulting from the comparison of different judicial system or from the introduction of additional risks like exchange risk.

For each case we analyze, we try to provide detailed description of transactions and their associated governance structure (nature of the contract,...). The data we use come from different sources: reports of the National Audit Office [NAO (1997, 1998)] on existing PFI projects, public information from governmental department and studies realized by the Treasury Task Force for private financing.

#### *Case 1: The Skye Bridge project*

This project has been undertaken by the Scottish Office Development Department (SODD) which has arranged the provision of a tolled road bridge to the Isle of Skye using principles of DBFO, i.e. the bridge has been built at the expense of a private sector developer who will operate it and receives tolls to recover the costs incurred. The bridge has been opened to traffic in October 1995.

The sequence of events is the following:

1986	Highland Regional Council feasibility study
10/1989	Advertisement inviting expressions of interest
07/1990	Final invitation to tender to three shortlisted bidders
04/1991	SODD announces the preferred bidder
12/1991	Signing of the development and concession contract with Skye Bridge Limited conditional upon outcome of local public inquiry
06/1992	Public inquiry report published
07/1992	Beginning of the construction
10/1995	{Beginning of the concession period
10/2022	End of the concession

After having undertaken feasibility studies of the Skye bridge in 1986 and 1988, SODD with the agreement of the Highland Regional Council has decided to chose the private finance option. It was expected that the private finance project would provide good value for money because:

- ◆ better scope for innovation in the design of the bridge;
- ◆ better optimization of the costing of the project over its full life by transferring construction and operation to the private sector;
- ◆ better risks allocation by transferring in particular construction risks to the contractual parties best able to manage them or their outcome.

After the assessment of the three preferred bids in competition, SODD has chosen the Miller-Dywidag's bid. Following the signing of the contract in December 1991, a company owned by the winning consortium<sup>5</sup>, Skye Bridge Limited (SBL) became responsible for the development and operation of the bridge. Under the development contract, SBL had to secure the design and construction of the bridge and its approach roads to the SODD's specified technical requirement within a pre-specified period of 3 years from commencement. The SODD makes a fixed contribution of pounds 6 millions (1988 prices) to meet the expected costs of the approach roads. Moreover, as a result of the 1992 public inquiry implying changes in the design of the crossing, SODD compensates SBL by pounds 1,2 million (1988 prices) for the extra costs incurred. In addition, SODD makes an additional transfer of pounds 1,7 million (1988 prices) to compensate for construction delays due to the statutory procedure. SBL has contracted with Miller-Dywidag for the construction of the bridge. SBL is also responsible for the financing of the project secured only on the revenues and assets of the project itself which does not include the bridge itself which remains the property of the Secretary of State throughout the concession. The construction contract is a fixed price contract transferring the risk of cost overruns to Miller-Dywidag. The SODD delegates the monitoring of the construction phase of the project to Highland Regional Council. This latter has sub-contracted monitoring to engineering advisers. Each contracting party is responsible for the financial consequence of any change he proposes in the design of the project.

The financing structure of the project includes debt and equity in a proportion of 98:2. The equity injection by Miller-Dywidag reduces the risks of the lenders that it will not be repaid and provides a guarantee of commitment to the success of the project. The Bank of America acts as a direct lender.

The concession contract assigns to SBL the rights to charge tolls for traffic using crossing. The contract includes a fixed-price mechanism, i.e. the tolls can be increased in function of the RPI, with annual increases after the opening of the bridge. However, if tolls revenue falls below a sum corresponding to some 450000 vehicles crossing a year (i.e. the 1990 traffic level), SBL can increase tolls up to 30% more than the rate of inflation. SODD has negotiated with SBL to charge tolls at no more than 1991 ferry fares in real terms. SBL has obtained in compensation a longer concession period. As the period is defined on the promoter worst case traffic projections, the volume risk is very low. The concession contract includes a semi-variable term for the operation of the bridge. The contract requires SBL to cease collecting tolls as soon as they have achieved the pre-determined "require net present value" or 27 years after opening the bridge, even if by this date the company have not achieved the target toll revenue.

SBL sub-contracts the operation of the bridge to Miller-Dywidag. SBL is responsible for the maintenance of the bridge during the concession period and for remedy in the approach roads during the first years. Moreover, SBL has to provide a maintenance bond of \pounds\ 250000 to cover any dispute over the standard of maintenance. Finally, SBL has to hand the bridge back to the Secretary of State in a fit condition for the design life of 120 years.

In case of default, SODD will gain control on the bridge and take over the responsibility for collecting tolls. SODD can look for a new concessionary for the remainder of the contract, SBL being entitled to receive all sums obtained directly by SODD from collecting tolls and the full consideration received from the new concessionary net of the costs borne by SODD to manage these changes.

The risks transferred to the private sector are the following: surveys and investigations risks, design risk, construction risk, hand back condition risk, bridge maintenance and operation risk. Some risks are shared between the private sector and the public sector: traffic or

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<sup>5</sup> The members of the consortium are: a joint venture between Miller Civil Engineering Ltd and Dyckerhoff & Widmann AG, and Bank of America International Financial Corporation.

volume risk, inflation risk, changes in corporation tax rates risk, force majeure risk and latent and inherent defects risk. Finally, they are risks borne by SODD: specific legislation risk, planning risk, force majeure risk and maintenance of approach roads risk. The transfer of risks to the private sector concerns essentially the design and construction of the bridge and the operation and maintenance of the infrastructure. The demand risk is shared between the private and the public sector while SBL is in monopolistic position since the suppression of the ferry service managed by a public company.

The recourse to the private sector seems to have generated important new transaction costs to the public sector related to development, negotiation and supervision of the contract (advisers's fee representing about 7% of the construction costs ). Moreover, the public sector participation has been higher than expected due to design changes and delays which have give rise to payment of compensation to the private operator. Note also that the recourse to the private sector has increased the financing cost of the project, i.e. the loan stock for the Skye Bridge had a 2 per cent risk margin over comparable gilts

#### *Case 2: Road projects*

The Highways Agency (HA), an executive agency of the Department of Transport, has undertaken four road projects under DBFO contractual scheme:

- ◆ the M1-A1 link road near Leeds
- ◆ the A1(M) widening between Alconburg and Peterborough
- ◆ the A419/A417 between Swinden and Gloucester
- ◆ the A69 between Carlisle and Newcastle-Upon-Tyne.

In such road projects, the asset is provide by the private sector, the provider retains ownership and contracts to supply free entry to traffic for a pre-specified period of 30 years. The provider is remunerated directly from the government, not the user, in the form of a fixed fee per vehicle (shadow tolls), which is monitored at various points on the road. The government pays directly for the use of the service by the public, rather than for the provision of road services.

The sequence of events for this first tranche of DBFO is the following:

12/1993	Announcement that the first DBFO roads contract were to be let within 18 months
08/1994	Advertissement of competition for the first tranche of 4 contracts
01/1995	Following pre-qualification, 4 consortia were invited to tender for each project
10/1995	Invitation for final offer and announcement of the preferred bidder
03/1996	Signing of the contract
04/1996	Beginning of the construction
05/1997	- Beginning of the concession period
03/1999	
05/2027	- End of the concession
03/2029	

The HA's objectives for this first tranche of DBFO are the maximization of value for money by allocating risks appropriately between the public and the private sector, the promotion of innovation, the preservation of the environment and to test the response of the market to private finance road contracts. To reduce the statutory risks, the projects were selected from those which they had taken through public inquiries in the conventional manner. It limits the expected scope for innovation in the design of the project as bidders have to meet specified technical requirements.

From the pre-qualification submissions, HA were able to select four consortia for each project, no consortium being invited to bid for more than two projects. from the short-listed bidders, the HA chooses a preferred bidder for each project. In order to maintain potential competition during the negotiation with the preferred bidder, HA has asked to the other short-listed bidders to keep their bids on the table. For the M1-A1 project, the winning

consortium is Yorkshire Link Limited<sup>6</sup>. The contract implies the provision of a new motorway and the operation and maintenance of the route for 30 years. The date of expected opening is March 1999 and the net present value of expected payments equal to pounds 232 millions. For the A1(M) road project, the winning consortium is Road Management Group<sup>7</sup>. As in the previous contract, the concessionary is responsible for the construction, operation and maintenance of the route for 30 years but is also responsible for the operation and maintenance of the existing A1 until completion. The road will be opened in October 1998 and the net present value of expected payments equal to pounds 154 millions. For A419/A417 road project, including construction of new road but also up-grading of existing one and operation during 30 years, the winning consortium is also Road Management Group. The date of expected opening is March 1998 and the net present value of expected payments equal to pounds 232 millions. Finally, the A69 project road were awarded to Road Link<sup>8</sup>. The project includes specific city's bypass construction and the maintenance and operation of the whole road during 30 years. The date of expected opening is May 1997 and the net present value of expected payments equal to pounds 62 millions.

HA concluded direct agreement with the funders of each consortium. This agreement gives the funder the opportunity to step in the case of supplier default and to replace the supplier with a substitute who fulfils the supplier's original obligations under the contract. The structure of the construction and concession contracts is similar for the four road project. The duration of the concession is 30 years. The length of the contract integrates factors such as the typical life of the road pavement (40 years), the availability of long-term debt (perceived as being a maximum of 25 years), the transfer of delay risk to the private sector,... The payment structure is based on shadow toll scheme, i.e. the concessionary is paid by HA for each vehicle kilometer travelled on the concessionary's road. There are up to four bands of "shadow toll" rates. This mechanism allows bidders to limit their downside exposure in the event of traffic being less than expected, and also limit the HA's financial exposure, since the rate in the top band is zero. Payment are also adjusted to reflect performance of the road in terms of safety and congestion.

HA delegates to an external adviser the monitoring of the construction phase and operation of the new sections of the road until the completion agreement is issued. The operation and maintenance phase of each contract is monitored by a department's representative. The contract includes a mechanism of penalty points in the event of minor breach by the concessionary. behind a certain penalty points threshold, HA can terminate the contract without compensation. One advantage of this system is to disclose earlier information on the progress of the project to the shareholders and the lenders which can react more quickly to restructure the firm. Moreover the concessionary has incentives to minimize such breaches. In case of fundamental breaches of the contract, the operator may be removed from the project without compensation. A specific agreement with the lenders provides some guarantees to the lenders in case of operator's default. the lenders benefit from a step-in-period to appoint another operator, approved by HA, for the remainder of the life of the contract. To prevent default during the construction of the new road, the contractor has to provide a performance guarantee bond. Except in the case of force majeure where only debit is repaid, the concessionary is fully compensated in the event of HA's default. The compensation is calculated to repay the debt borrowed by the company to finance the project and to compensate the equity providers.

At the end of the contract, the roads revert to the public sector. Specific clauses ensure that at the hand-back date, the road satisfies some standards, e.g. a given residual life for each element of the project road.

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<sup>6</sup> The consortium includes Trafalgar House and Belfour Beatty

<sup>7</sup> The consortium includes Ame, Brown & Root, Dragadas and Alfred Mc Alpine

<sup>8</sup> The consortium includes Henry Boat, Christiani & Neilsen, Cogelarimpresit, Morrison, Pell Frischman and ASTM-SINA

The contract includes some adjustment's mechanism to compensate the operator for the effects of reduction in traffic resulting from the introduction of user paid tolls which could be implemented latter on when electronic tolling system would be operational. If HA modifies the design of the project during the life of the contract, he has to modify the tolls in a appropriate way or to transfer a lump-sum payment to the operator. The shadow tolls system implies an accurate traffic measurement which is undertaken by the operator. HA will check the operator's measurement and sets some initial parameters for the accuracy of the traffic counts.

The risks transferred to the private sector are the following: latent and inherent defects risk, design risk, construction risk, delivery and timing risk, hand back condition risk, maintenance and operation risk, general legislative risk. Some risks are shared between the private sector and the public sector: traffic or volume risk, protester action risk, force majeure risk. Finally, they are risks borne by SODD: specific legislation risk, planning risk. As in the previous project, the transfer of risks to the private sector concerns essentially the construction of the road and operation and maintenance of the infrastructure.

Beyond the risk allocation analysis, additional insights can be identified about the contracting costs of these projects. Compared to traditional procurement the tendering process is time consuming for HA and bidding costs higher than expected. Some unexpected delays at the earlier stage of the procurement stage have postponed the beginning of the construction phase. In terms of transaction costs, the great bulk of the costs borne by HA is related to advisers' fees. The consortia's bidding costs for each project were high by comparison with conventional road procurement. This is largely because such contracts differ from conventional construction contract for roads project (financial scheme,...). To assess value for money of DBFO roads contracts, HA prepared public sector comparators for each four projects. Depending on the assumptions on the discount rate, one or two of the four projects have a poorer value for money than the public sector comparator. The project generating the higher value for money are the two projects involving the highest proportion of road construction compared with operation and maintenance costs.

### **3.2 Insights from project financing experience in the UK**

In the preceding section, we analyze in detail two transport project financings, i.e. the Skye bridge project and Roads projects.. We can point out the following elements. First, regardless of the type of projects, the transfer of risks to the private sector mainly concerns the construction, the operation and the maintenance of the physical assets. Moreover, the length of the contract seems to be relatively independent on the lifetime of the infrastructure. Second, the transfer of important risks during the construction phase to the private sector allows to reduce the construction period and to introduce cost reduction innovation in the design of the infrastructure. Third, the transaction costs for the implementation of private finance are relatively high [measured in terms of staff costs, advisers and external consultants fee]. Finally, the transfer of the realization of these infrastructures to the private sector has allowed to have recourse more often to fixed price contract, rather than cost-plus contract used more often in public ownership.

At this stage, we want to complete our analysis by introducing additional information on other PFI cases. These latter cases are the following: the extension of the existing railway of 4,2 km from Island Gardens to Lewisham (Light Railway) and the provision of new trains for the Northern Line of London Underground (Northern Line Trains). In order to emphasize the main results of our case studies analysis, we firstly describe the main project characteristics of the different PFI in Table 2. We distinguish between three dimensions: the size of the investment, the characteristics of the infrastructure services and the potential state contribution to the financing of the project.

Table 2 : *Project characteristics of various PFI*

	<b>Capital cost of the project ( GBP millions)</b>	<b>Characteristics of infrastructure services</b>	<b>Contribution of the state to project financing</b>
<b>Road (4 contracts)</b>	70 in average	<ul style="list-style-type: none"> <li>◆ Indirect payment by the government</li> <li>◆ Simple specification of infrastructure services</li> </ul>	No
<b>Bridge</b>	24	<ul style="list-style-type: none"> <li>◆ User payment</li> <li>◆ Complex specification of design and construction requirements</li> </ul>	Yes
<b>Light Railway</b>	20	<ul style="list-style-type: none"> <li>◆ Direct payment by the government and user payment</li> <li>◆ Complex specification of design and construction requirements</li> </ul>	Yes
<b>Northern Line Trains</b>	400	<ul style="list-style-type: none"> <li>◆ Direct payment by the government</li> <li>◆ Complex specification of design and construction requirements</li> </ul>	No

The sample of contracts concerns projects from various level of investment. The size of the investment is important as all assets of these project are relationship-specific. We observe that direct payment by the users are relatively rare and the project differs on the level of uncertainty and complexity either during the construction phase or the operation phase. Finally, public sector intervention in the financing of the project is not the general situation.

Given the characteristics of the project we have identified, we can analyze the contractual design of PFI projects. The compensation scheme defined in the contract gives informations on the degree of completeness of the project [see Crocker and Reynolds (1993)]. The fixed price with economic price adjustment scheme uses specific labor or materials indices to determine prices according to an agreed-upon compensation formula. The flexibility of such a contract depends on the number of the indexed categories and is constrained by the requirement that the contingencies and the formula must be explicitly prespecified. The fixed price mechanism introduces adjustment which depends on the general evolution of the economy (retail price index, for instance) and not some project specificities. The not-to-exceed price defines a lower or an upper bound on the price variation. This mechanism introduces more flexibility as the price can vary in a larger interval and hence, can be described as less complete than the preceding one. Finally, the fixed-price incentive with escalation clause conditions the payment to the achievement of pre-defined requirements.

The length before opening and the share of the advisers fees in the cost of capital provide information on the ex ante contracting costs<sup>9</sup> for the project. The higher the advisers fees share and the longer the period before opening, the more exhaustive the agreement will be. In this case, we can infer that the contract is more complete. The renegotiation interval gives some gross information on the way the renegotiation process is constrained in the contract. To limit the nature and the scope of renegotiation, parties may restrict either the set of permissible adjustments or the period at which renegotiation can occur. On the other hand, parties may attempt to increase the scope for renegotiation when the specification of the infrastructure services is complex and uncertain.

<sup>9</sup> In terms of transaction costs, we have to note that the private consortium incurs significant bidding costs. If these costs are too high, it will deter private bidder to participate to the invitation to tender. This deterrent effect can be reduced by the implementation of road-test projects to identify the commercial viability before issuing formal invitation to tender. In some cases public authorities commit to reimburse part or the totality of the costs incurred by the unselected private bidding consortium.



As shown in table 3, we observe that the level of transaction costs seems to be relatively independent of the complexity of the project, indicating that the technical characteristics for projects are not the main driver of transaction costs.

Table 3 : *Contractual characteristics of PFI projects*

	<b>Duration</b>	<b>Compensation scheme</b>	<b>Risks transferred to the private sector</b>	<b>Length before opening</b>	<b>Advisers fees relative to the cost of capital</b>	<b>Renegotiation interval</b>
<i>Road (4 contracts)</i>	30 years	Not to exceed price	<ul style="list-style-type: none"> <li>◆ Design, construction</li> <li>◆ Delivery, timing</li> <li>◆ Maintenance, operation</li> <li>◆ Hand back, latent</li> </ul>	51 months	3,9%	3 years
<i>Bridge</i>	Up to 27 years	Not to exceed price	<ul style="list-style-type: none"> <li>◆ Survey, design, construction</li> <li>◆ Delivery, timing</li> <li>◆ Maintenance, operation</li> <li>◆ Hand back, latent</li> </ul>	72 months	7,1%	1 year
<i>Light Railway</i>	24,5 years	Fixed price	<ul style="list-style-type: none"> <li>◆ Design, construction</li> <li>◆ Delivery, timing</li> <li>◆ Maintenance, operation</li> <li>◆ Hand back</li> </ul>	62 months	n.a.	n.a.
<i>Northern Line Trains</i>	20 years	Fixed price incentive with escalation clause	<ul style="list-style-type: none"> <li>◆ Design, construction</li> <li>◆ Delivery, timing</li> <li>◆ Maintenance, operation</li> <li>◆ Hand back, latent</li> </ul>	39 months	n.a.	n.a.

This result is confirmed by a study of the World Bank [Klein and al. (1996)] showing that the level of transaction costs depends on the policy environment and on some learning effects by government officials rather than on the characteristics of the project.

We observe that the risks transferred to the private sector are also independent of the project: design and construction risks, maintenance and operation of the infrastructure are the more important risks borne by the private contractor. This issue is related to the allocation of the residual value risk when assets have an expected useful life beyond the term defined in the contract. As infrastructures developed under PFI contracts are still highly specific assets with no existing competitive markets and are dependent on public sector decisions for contract renewal, a wrong allocation of this risk will affect the investment decisions of the private consortium during the lifetime of the concession and lead to higher price. It might be worthwhile to transfer the risk to the private sector when this asset can be traded on a secondhand market. In this case, the private operator has adequate incentives to maintain the assets, for instance, in order to improve their prospects for extending the original contract.

In each case, the private contractor is immune from demand or volume risk. However, we have to make some distinction between contract where the payment mechanism depends on the volume of usage rather than availability of a service and where the terms of the contract is endogenous. When the payment mechanism is based on volume rather than availability, it can imply an excessive risk transfer to the private sector if the volume of usage is largely outside the control of the private sector. In addition, in such a contractual specification based on traffic volumes might provide bad incentives to private consortia and to the government. Private consortia will be induced to be over-optimistic in predicting traffic growth in order to obtain the market. Such a "winner's curse" may generate pressure for the government to extent the length of the concession in case of trouble, returning the demand risk to the public sector. Note that this strategy of underbidding or lowballing will depend on the lobbying powers of firms since it will affect the terms in which the contract will be renegotiated in the future. On the other hand, the behaviour of the government with respect to the availability of competing services will crucially affect the tender prices. In practice, the payment mechanism for the prisons and school contract as well as the Northern Line Trains project depend on the availability of the service while the road contracts are based on traffic volume subject to some cap limiting downward variations. The light Railway contract combines both

payment mechanisms. Finally, the Skye bridge payment mechanism is also function of the traffic volume but with a variable contract length. The recourse to such an endogenous concession length may be an effective contractual alternative<sup>10</sup> to avoid some inefficiencies in the allocation of risks between the public and the private sector due to a too large exposure to volume risk. This contractual mechanism is similar to the Least Present Value Auctions (LPVA) proposed by Engel, Fischer and Galetovic (1997). The LPVA scheme is designed as follows: the concession is awarded to the consortium asking for the least present value of user fee revenues for a given traffic structure and will end up as soon as the present value of user fee is equal to the concession-holder's bid. This scheme reduces the demand risk borne by the private consortium providing an insurance for the bad state of nature but decrease by the same token the incentive of the consortium to invest in demand-increasing features or in operating cost-reducing activities since it does not provide any additional profits to the consortium but reduces the length of the concession.

#### 4. Conclusion

The design of an optimal contractual scheme for PFI projects has to take into account the close integration between the two phases of the project, i.e. the design-construction and operation of the infrastructure. This preliminary analysis of the recent development of private infrastructure initiative in the UK shows that the gains from the recourse to the private sector are essentially concentrated on the design and construction phase. There is no real transfer of demand or volume risk excepted for the roads contracts. In a study of the private participation in infrastructure projects (in particular, the construction and management of a road tunnel) in Australia, Mills confirmed the result we have derived for the UK: the agreement between the government and the tunnel company eliminates for the company virtually all the revenue or demand risk [Mills (1991)]. Even if the transfer of operating risks to the private consortium might increase the price paid for the infrastructure service, the public sector should try to design a contractual mechanism minimizing the lifetime costs and benefits of the concession. Indeed, the optimal contract will not merely select a total amount of risk to give the best balance between incentives and expected contract cost but has also to distribute optimally the risks between the two phases of the project: the construction and operation phases. The contractual arrangement we have observed may depart from an optimal balance between phases, by placing major risk on the private consortium only during the construction phase. Such a contract may be justified by the characteristics of an infrastructure project:

- ◆ high construction costs versus lower operating and maintenance costs;
- ◆ demand for the infrastructure services hard to estimate and not directly controllable by the private operator.

However, the insurance against demand or revenue risks might distort the incentive of the operator, especially when the different stakeholders are not directly concerned by the performance of each phase of the project. In addition, when there is no substitute for the infrastructure services or when this new infrastructure is part of an integrated network, the private consortium can behave opportunistically in order to obtain a higher monopoly rents. Hence, the efficiency of the concession contract will depend on the ability of the government to implement an effective regulatory mechanism.

The recourse to the private sector for the provision of infrastructures services has modified the nature of the contractual arrangements. Whereas public provisions of infrastructure may be considered as a vertical integration with construction and operation often organized within the public sector, private financing projects are governed by long-term contracts. The private sector participation transforms the role of the public sector from being an owner of capital

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<sup>10</sup> The construction and operation of the Queen Elizabeth II (known as the Dartford Bridge) and the Second Severn Crossing use the same contractual structure. The concession was designed to end up after a specified number of years or as soon as the toll revenue is sufficient to repay principal and interest of the debt.

assets and direct provider of services into a purchaser of service through a long-term agreement.

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