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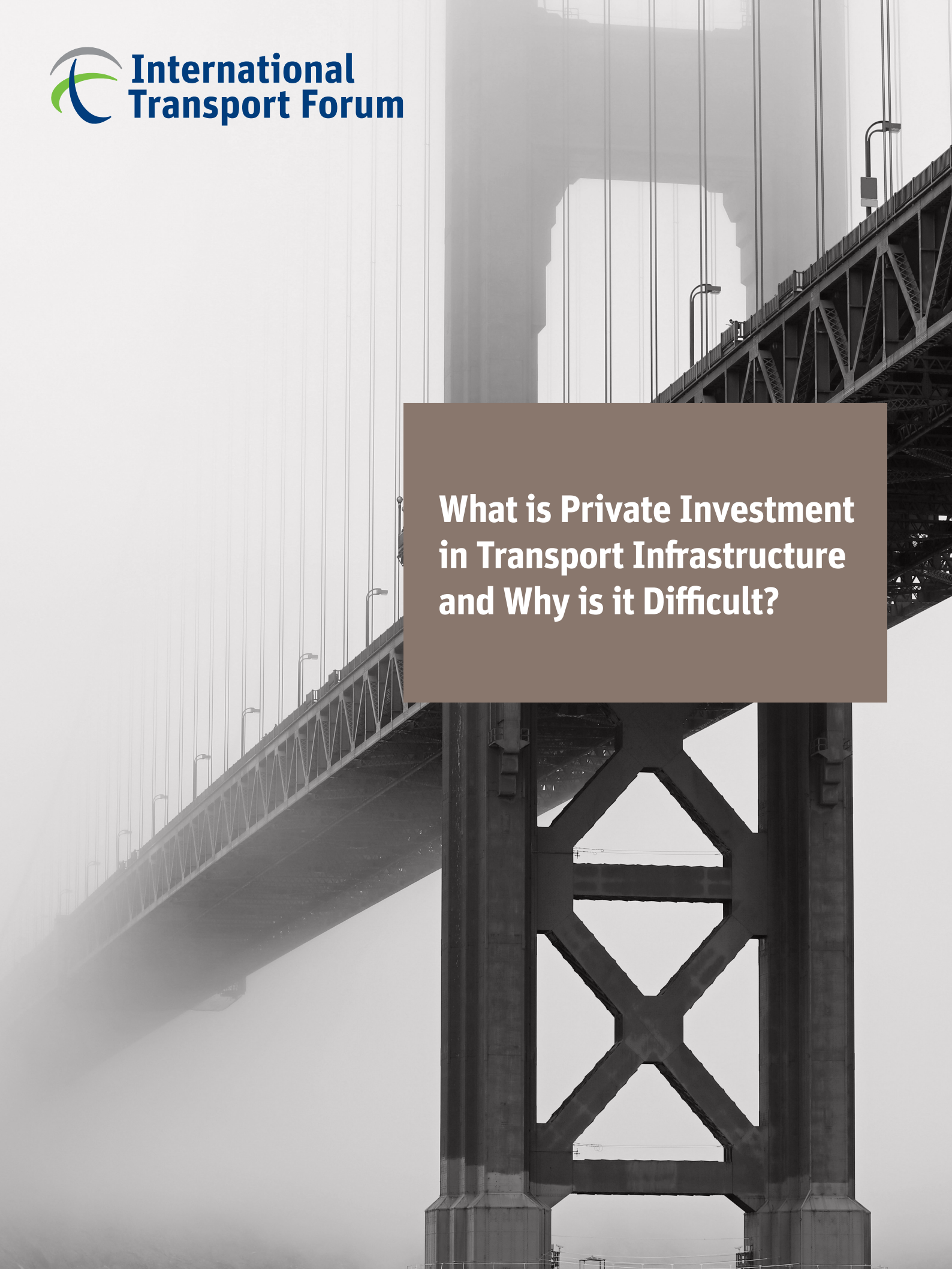

What is Private Investment in Transport Infrastructure and Why is it Difficult?

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Working Group Paper

2019

The International Transport Forum

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Foreword

Transport infrastructure is a major enabler of economic development. In the drive to refurbish or build, governments worldwide have turned to the private capital market for financing. The primary narrative behind this push is the huge stocks of private capital that are available, while public financing capabilities are said to be limited and insufficient.

The almost exclusive vehicle of private investment in transport infrastructure, including social infrastructure, is Public-Private Partnerships (PPPs). In the context of PPPs, two important aspects have received little attention.

First, sufficient attention has not been given to the role of suppliers. The focus of governments and Intergovernmental Organisations has been on resolving the challenges to private investment from the viewpoint of investors: reducing the uncertainty they face and enabling them to price risk more efficiently by establishing infrastructure as an asset class.

However, looking only at investors gives an incomplete view of the total cost of the risk transferred from the public to the private sphere. In PPPs, investors transfer some of the major risks they are not comfortable bearing to design, construction, maintenance, and operations contractors.

Suppliers, too, face uncertainties and are unable to efficiently evaluate price risk. In such cases, the base cost of the initial investment - and of subsequent services - may be much higher than they might have been, and not just the cost of their financing.

Uncertainty arises from the difficulties to accurately estimate the cost of construction, maintenance, operations, and financing. But it also stems from “unknown unknowns” (the so-called Knightian uncertainty). For instance, changes in weather patterns or paradigmatic technological shifts, the timing and impact of which are unclear, will influence what infrastructure is needed and where.

So what can policy makers do to reduce the cost of inefficient risk pricing of suppliers? Where does this put PPPs? How can public decision makers reconcile long-term uncertainty with private investment in infrastructure? Who should bear long-term uncertainty in projects: the public or the private sector?

These were some of the guiding questions for a Working Group of 33 international experts convened by the International Transport Forum (ITF) In September 2016. The group, which assembled renowned practitioners and academics from areas including private infrastructure finance, incentive regulation, civil engineering, project management and transport policy, examined how to address the problem of uncertainty in contracts with a view to mobilise more private investment in transport infrastructure. As uncertainty matters for all contracts, not only those in the context of private investment in transport infrastructure, the Working Group’s findings are relevant for public procurement in general.

The synthesis report of the Working Group was published in June 2018. The report is complemented by a series of 19 topical papers that provide a more in-depth analysis of the issues. A full list of the Working Group’s research questions and outputs is available in Appendix 1.

Acknowledgments

The author is deeply indebted to Alexander Galetovic, the colleagues at the OECD and the ITF, as well as the World Bank and the European Bank for Reconstruction and Development (EBRD) for their comments.

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Executive summary

What we did

Investment in infrastructure can be an important contributor to economic growth. Currently, considerable research effort is directed at how to increase the flow of private investment into infrastructure. The concepts related to this effort are clear to researchers and practitioners who deal with them each in their own specialised area. To policy makers, these distinctions are not necessarily clear.

This paper serves as a primer for policy makers interested in the subject of transport infrastructure and private investment. The paper revisits the nature of infrastructure and the basic underlying challenges of private investment in the transport sector. It reviews how these difficulties can be overcome through specific contractual and regulatory solutions.

What we found

Transport infrastructure, and infrastructure more generally, is synonymous with high capital expenditures, large numbers of users, sunk costs and long lifecycles. These characteristics make infrastructure investment challenging for any investor.

The combination of high capital requirements and large numbers of users creates a considerable difference between average and marginal cost of use. To please voters, governments are inclined to push the cost of use down to marginal cost, paying enough for infrastructure maintenance and management but not enough to recover the initial investment.

Along with high capital expenditure (capex) and a large number of users, the sunk costs imply that the investment has little or no intrinsic value beyond the contract with the government. After all, one cannot dig out a piece of road and sell it on the market. The long lifespan of infrastructure suggests the cost recovery is spread over many years and exposed to future uncertainty. These issues further exacerbate the cost-recovery problem. The risk of implicit or explicit expropriation potentially resulting from these characteristics of infrastructure makes private investment in infrastructure a challenge.

What we recommend

When devising broad policy measures with regard to private investment in infrastructure, policymakers would do well to consider the following distinctions.

Distinguish between infrastructure and the operations that take place on it

Operations that take place on infrastructure are generally subject to less demanding economic characteristics. In different contexts around the world, they can exist in competitive markets or not. Fostering investment in infrastructure and operations where the market is competitive is subject to the same drivers as any other competitive industry – it has no infrastructure-specific element. Most infrastructure investment in the case of transport occurs, however, through contractual arrangements, which offset risks inherent to infrastructure that would otherwise make private investment in infrastructure unlikely or impossible.

To pursue private investment in infrastructure, choose between competition for the contract or the regulated model

The private sector participates in infrastructure in different ways, but not all involve significant private investment. Apart from traditional procurement, there are six forms of private participation in infrastructure. While all represent a contractual attempt to shield investors from expropriation risk and instil efficiency incentives, two require an upfront investment and offer the strongest incentives for efficiency. They are Build-Operate-Transfer (BOT) type contracts and regulated privatisation.

BOT type contracts usually involve discrete pieces of infrastructure, while privatisations generally involve economically-regulated networks - though they can include discrete assets as well, such as ports and airports. These approaches entail different principles of attaining efficiency. In the BOT type contracts, this occurs primarily through the competition for the contract, while in regulated privatisations, when properly performed, the efficiency gains come primarily from incentive regulation.

Differentiate between attracting private investors in existing assets (privatisation) and in new infrastructure PPPs

Though related, the narrative of attracting private investment to a BOT-type contract is different than that of privatising a state-owned asset. The privatisation of an asset *per se* does not have any direct relation to a policy that seeks to extend or improve transport infrastructure. Primarily, attempts to mobilise private investment should target the needs of the particular model of private investment.

Introduction

Infrastructure is an essential component in supporting the competitiveness of an economy and general social welfare. In the case of transport, for example, easier or less costly movement of goods and people through the system directly influences the competitiveness of firms and the welfare of citizens. Infrastructure also has distributional effects in terms of access to essential services such as education or health. The importance of infrastructure through the link between investment in infrastructure or infrastructure stock and GDP growth is well documented. It is especially strong for developing countries, but also plays an important role in developed economies (Straub, 2011), although the corresponding relevance for growth is difficult to establish.

Insufficient investment in infrastructure threatens both the quantity and the substance of infrastructure systems. Numerous technical, technological and other changes are expected in the future. In the telecommunications industry, wireless technologies have reduced reliance on wires. Smart meters in electricity may change electricity production and distribution requirements. Smart and autonomous vehicles in transport could change the capacity expectations of existing transport infrastructure and require an upgrade to smart infrastructure, which will have to be able to interoperate with the new vehicles and users. Ultimately, climate change requires that greater attention be paid to building resilient infrastructure (McKinnon, 2014).

Today, some contend there is great need for private investment in infrastructure. All major international organisations – the OECD, the United Nations Economic Commission for Europe (UNECE), the World Economic Forum (WEF) and the World Bank (WB) – are devoting substantial attention to the question. The G20 seeks to promote private investment in infrastructure and various other initiatives (for example, the European Fund for Strategic Investment (EFSI) in Europe and the potential plans of President Trump in the United States to increase the role of the private sector in transport infrastructure investment) make it clear the topic is high on the political agenda.

The objective of this paper is not to investigate the motives behind the drive for private investment.[1] As the first paper of the Working Group on Private Investment, the objective is to clarify the basic terminology and set the foundations for further work. The intent is to clarify why private investment in infrastructure is a challenge *per se* and what it means in the context of investing in new or upgrading existing infrastructure.

To gain leverage against the complexity of different sectors and contexts, this paper focuses on a single sector – transport. Transport infrastructure is the enabling factor in the movement of goods and people. It reduces the distance between firms and markets, impacting productivity and competition and facilitating trade. Transport infrastructure is also related to environmental and social externalities, providing accessibility to essential services. Recognizing the importance of transport (and ICT) infrastructure, connectivity was one of the recent priority themes of the G20 presidency.[2]

In the context of mobilising private investment in infrastructure, the paper has two objectives, with its sections organized accordingly.

The first objective is to clarify what characteristics of infrastructure make private investment inherently difficult. This involves defining the economic characteristics of infrastructure which lead to diverse market and government failures. It analyses the potential differences of how these characteristics are relevant for transportation infrastructure and operations. Furthermore, the economic characteristics

have spawned different market outcomes in different narratives around the world. In discussing the mobilisation of private investment in transport infrastructure, it is essential to distinguish between the different characteristics. A key distinction is when infrastructure investment (or investments in operations) happens in competitive or non-competitive contexts. The basic conditions of infrastructure investment are also highlighted through analysing these issues.

The second objective is to help identify what the term "private investment" should encompass if the aim is to create new infrastructure or upgrade existing infrastructure. The focus here is not on the financial instruments that facilitate the actual process of investment but on differentiating between the various forms of Private Sector Participation in Infrastructure (PSPI) and identifying where substantial private investment activity is involved.

What is infrastructure?

The term infrastructure generally encompasses a diverse range of assets which provide an economic or social service to the public. Economic infrastructure (transport, telecommunications, electricity, water, sewers, etc.) directly promotes economic activity, while social infrastructure (schools, hospitals, social housing, etc.) affects economic activity indirectly by pursuing social objectives, such as educating a skilled workforce. Most infrastructure exists in the form of networks (roads, railways, electricity distribution, water supply networks, etc.), where any particular section only has a useful function if it is physically linked to other sections, each contributing to the performance of the system as a whole. Other infrastructure exists in the form of nodes or discrete assets (ports, airports, hospitals, etc.), which do not need to be directly physically linked to other similar assets, though conceptually they form a network as well.

Traditionally, infrastructure has been provided and operated primarily by the state. It was originally thought the state was best placed to manage the multiple characteristics of infrastructure which may cause the private markets to fail. This logic has been questioned in recent decades, and private investment in infrastructure has been facilitated through diverse contractual or regulatory solutions. This trend has taken place against the promise of improved efficiency as a result of private management. Improvements take time to manifest, however, and stronger motivations have perhaps been the reduction of public debt (by selling off assets) and the bypassing of (accounting) public-borrowing constraints.

In transport and other sectors, infrastructure (e.g. rail tracks) and the operations that take place on it (e.g. rail freight/passenger operations) are comprised of characteristics that are susceptible to multiple market failures. These include economies of scale, sunk costs, externalities, long-life and market power. The characteristics of infrastructure can, however, also lead to government failures. The main ones are addressed alongside market failures discussed below.

Services provided through infrastructure create externalities. Environmental externalities involve various forms of air pollution, noise, impacts on land use and biodiversity. A consequence of externalities is that the socially optimal cost of production will differ from the private cost. From the private investor's perspective, externalities may involve benefits which they cannot capture (e.g. land value improvements).

Infrastructure services are also subject to distributive effects, for example, in relation to the allocation of fixed costs to different social groups or inclusiveness and access to essential services such as healthcare. Pursuing a social optimum may also involve subsidies.

In both examples, the state as an intermediary has a role which can also expose the investor to additional risk. As Helm (2010) puts it, the theoretically correct solution is to price each and every externality and distributive issue. In reality this is impractical, and infrastructure decisions are based on politics and planning. As this cannot be a fully technocratic process, it is very much open to political and regulatory (i.e. government) failures.

Many kinds of infrastructure have characteristics that can cause government or market failures. Most infrastructure requires large capital expenditures, has a long service life and represents a sunk cost once built. The high cost to build and relatively low cost of maintenance and operations give rise to large economies of scale. (An additional car on the motorway will not make a significant difference in terms of extra cost to the infrastructure manager or to other users, unless the infrastructure is close to capacity and it contributes to congestion.) This is especially true for network infrastructure but is also relevant for other types of infrastructure where the cost of capex dwarfs the cost of operation. The large economies of scale have serious implications for the cost recovery of investments, as explained in Box 1.

Box 1. The crux of cost recovery and public welfare

The cost of infrastructure can be divided into two major parts. The cost of the initial investment involves the cost of constructing the infrastructure. The operating cost involves the wear and tear caused by the users of the infrastructure (the passenger/freight services on the transport infrastructure, for example). Both costs must be recovered. If all costs are spread among all users, each user pays the average cost. If a user pays only the extra cost for the wear and tear they cause to the infrastructure, they pay the marginal cost.

The political preference is to provide the good to as many consumers as possible, but full costs must be recovered. Focusing solely on efficiency by applying Ramsey–Boiteaux prices (i.e. charging users according to the elasticity of their demand) will disenfranchise those unable to pay. This will, however, have distributional or fairness implications. For example, without tax relief, poorer people who are more dependent on a particular service would be paying a disproportionate amount to that paid by those much better off. All users may not be able to afford the infrastructure at full cost-recovery prices, but full cost recovery must be ensured – if not by the user, then by the state's general budget. Indeed, governments have often failed in the latter, resulting in maintenance backlogs and reduced infrastructure quality. Where immediate safety is not at stake (a nuclear plant, for example, would not fall in this category) and the effects are not quickly evident, even maintenance has been a source of savings for governments.[3] The temptation to drive the cost recovery down to marginal cost to please voters has been one of the big failures of the government and is also referred to as time-inconsistent behaviour or short-termism. If the government drives down the price of infrastructure availability below the average cost, the private investor will never recover the investment. Private investment in infrastructure is not possible in such circumstances because it involves a risk of implicit expropriation.

Sunk costs and the long lifespan of infrastructure increase the problem of time inconsistency. In the context of sunk costs, many types of infrastructure have no intrinsic value. These aspects are related to the initial fixed cost of infrastructure delivery. One cannot dig out a piece of road and sell it on the

market. Even when there is something to sell (like the copper cable in telecommunications or rails), the cost of extraction could offset the selling price. For buildings which have a dedicated function (e.g. prisons and hospitals), the problem is similar, but it varies depending on whether the infrastructure can be used in other ways. In that sense, infrastructure is the provision of a service and not a commodity in itself. As infrastructure is costly and long-lived, the recovery of the initial investment must be spread over the many years of its useful life.[4] Sunk costs are not only related to the issue of government time-inconsistency. Technological change also represents a risk that may make assets obsolete before they have been depreciated. Wireless technologies in telecommunications, automated vehicles in transport, smart meters in electricity and other advances will all impact the cost recovery of current investments in long-lived infrastructure. They will also affect the market power of today's infrastructure incumbents.

The combination of characteristics like sunk cost and large capex are related to natural monopoly characteristics and can lead to excessive market power. When the technology of a service or product involves large capex assets and there is massive consumption on the receiving end, there will be economies of scale and potentially scope. These characteristics can make it more economical for a single firm to supply services rather than several competing firms (Joskow, 2008). However, while a monopolistic situation might appear to ensure cost recovery for the investor, it may not last. Technological advances, as discussed above, or negative public opinion may threaten long-term cost recovery.

The issue of sunk cost is less problematic when considering operations only. For example, when there is a market for rolling stock or the nature of some operations is not capital intensive. This explains, in part, why competitive markets have historically emerged in operations more commonly when they have been separated from infrastructure. Economic regulators have pursued similar logic, separating operations from infrastructure to foster the emergence of competitive markets in at least one part of the supply chain.

What makes private investment in infrastructure possible?

To make private investment in infrastructure possible, market failures have to be resolved or the private party must be insulated from them. Primarily, the goal is to reduce the risk of insufficient cost recovery for the private investor. One way is by reducing the investor's perceived risk of implicit or explicit expropriation (the time inconsistency) through contractual commitment by the state. Another is to introduce competition in the market.

The "regulatory contract" and "competition for the contract" are vehicles of contractual commitment by the state. They represent one option to offset market failures when the introduction of competition in the open market is not possible. In incentive-based economic regulation, an independent economic regulator defines the contract's parameters – a rate of return or price cap regulation – which allow the private investor to better predict the return on investment, subject to performance. This is the case of regulated monopoly, where the efficiency gains come from the incentives of the regulator.

In the competition for the contract, the state tenders the exclusive right to operate on a discrete part of the existing infrastructure (e.g. railway passenger franchises) or tenders a BOT contract to deliver new projects. The latter involves the provision of new or refurbished infrastructure, its management and maintenance, but not the operation of services on it. In this case, the future efficiency gains are determined at a single point in time – at the competition for the contract. Similarly, as with the regulatory contract, staying committed to the spirit of the contract signals its credibility as a commitment device.[5] Both approaches are meant to insulate the investors from the uncertainty of time-inconsistent behaviour of the state and allow them to focus solely on the risk vs. return characteristics that arise from the project (e.g. demand/construction/operations risk).

In some cases, it is possible to introduce competition in the market. Economic regulation then represents a transitory solution until the conditions for the competition are established. The market failures described above are barriers to market entry. No investor would be willing to invest in a new company where a particular incumbent, with its economies of scale and scope, dominates the market and possibly exerts political influence.[6] To increase the chance of new entrants (i.e. investment), an economic regulator can try to create a more level playing field. In some contexts, a fully competitive infrastructure market has emerged, while in others, partial solutions have been sought (see Box 2).

In the second case, one of the options is to split the "production process" in two components, where one component, operations, is more conducive to the introduction of competition than the other, infrastructure. The notion of this distinction is not a mechanical conclusion that every infrastructure system should be vertically separated. Instead, and more importantly, that from the perspective of private investment, the nature of infrastructure and that of operations and the role the state plays in each can differ.

Box 2. Competition in railways in the US and Europe

The narrative in which infrastructure systems operate around the world can differ to a great extent. The railway sector is an example.

The railway sector in the United States (US) is dominated by eight large integrated railway companies, which are freight dedicated. Despite the characteristics of railway infrastructure (sunk costs, long recovery, high capex), these companies build their own infrastructure without any government subsidies and provide freight transport services on it. They are not subject to any particular government planning. The Surface Transportation Board (STB) grants the right to build lines following a formal process (subject to some caveats). Having attained permission to build, they have the right to acquire property over the objections of the owner so long as they pay just compensation, either negotiated or court-ordered.

Sometimes companies accept demand risk (i.e. build against a demand forecast). At other times, they will make an investment in the context of a "take or pay" contract tariff, in which the shipper or receiver accepts some or even most of the demand risk.

In terms of use of space, two competing companies could, in principle, build two parallel lines, essentially putting at risk the cost recovery of both. The opposing railroad would be free to issue a complaint to the STB, and a hearing would ensue. In most cases, the applicant would negotiate access rights voluntarily, but this is not always possible.

Since the liberalisation of the US freight rail market in 1981, it has effectively been a competitive

market like any other product or service market where the state is not involved as a planner and has a limited role as a regulator. Accordingly, in terms of infrastructure investment, it would be subject to the same economic drivers as other competitive markets.

In the EU, the historical conditions and context in which the railways operate is entirely different. The EU railway systems have a mixed role, serving passenger and freight transport, and because of different organisation of use/traffic and other reasons beyond the efficiency of management, they achieve much lower productivity ratios than the US (in the US, the average train weight in 2014 was 3 600 tonnes, while in the European Union (EU), the average weight of a train was 1 200 tonnes).[7] In addition, as opposed to the EU, the US does not share a common language and common technical standards for rail. Monopolistic state-owned railways dominated the national markets. In these conditions, a fully competitive railway market similar to the US is not possible. Apart from addressing technical standard harmonisation and other initiatives, the main approach in the EU towards increasing the productivity of the system and, hence, new investment has been access pricing. Through this, competition is introduced only in the layer of operations. In a few cases, the railway companies were also vertically separated into infrastructure management and operations. Furthermore, in the EU, new railway infrastructure construction is subject to government planning and financial support. The discussion whether this process is successful is still open. It is not fully clear whether the vertical separation introduces coordination costs between the infrastructure manager and the operators, which would offset the benefits of competition. One of the important causes why this is not clear is the lack of data sharing from state-owned railway incumbents in the EU, as documented at a recent ITF roundtable (Makovšek et al., 2015).

Source: ITF, STB and International Union of Railways (UIC).

Given the overview above, private investment in infrastructure and operations are not necessarily equally affected by the economic characteristics covered earlier. Looking at how markets have evolved in different transport sectors in the OECD countries in Table 1 below, one finds more examples where competition has manifested in operations only as opposed to cases where operations and infrastructure are integrated.

Table 1. Transport infrastructure and operations organisation

Sector	Infrastructure	Operations		Operations in relation to infrastructure	
Roads	Roads, bridges, signalling/traffic control equipment	Freight/passenger road vehicles		Liberalised and separate from infrastructure management	
Rail	Track, switches, bridges, signalling/traffic control equipment	Freight/passenger railway cars, locomotives, motor-rail cars		Diverse organisation models (integrated liberalised, separate from infrastructure and liberalised, competition for the contract for passenger transport, integrated)	
Air	Airport building, runways, parking lots, signalling/traffic control equipment	Air carriers/planes		Liberalised and separate from infrastructure management	
Port	Pier substructure, break waters, basin, etc.	Port superstructure: terminal operations (ship-to-shore cranes, straddle carriers, warehouse, etc.)	Shipping	Mostly separated (Farrel, 2012), competition for the contract	Shipping is fully liberalised

How infrastructure differs from operations can be examined by comparing the two categories across previously-treated economic dimensions. Table 2 below shows how infrastructure and operations may differ in relative terms when compared against the same economic characteristics. This is not to say, however, that economic characteristics are the sole driver of how the organisation in different transport sectors has evolved. Other factors, like the purpose of the system (as in railways in Box 2) and technological characteristics of different modes or historical reasons, are important as well.

Table 2. Relative differences in economic characteristics for infrastructure and operations

Characteristic	Infrastructure	Operations
Required capex[8]	High	High
Economies of scale (large difference between AC and MC)	Higher	Lower (the cost of equipment per user is smaller)
Sunk cost (does intrinsic value exist?)	Higher (it may be possible to sell the rights of a non-performing asset at a large discount)	Lower (for most transport modes, assets for transport operations can be sold on the market or leased)
Market power	Scale/scope advantage of existing infrastructure manager	Scope/scale advantage of existing operator
Externalities	Yes (emissions/noise during construction, effects on land use, accessibility, etc.)	Yes (emissions/noise during operations, accessibility, etc.)
Long life	Higher	Lower

In conclusion, the economic characteristics of infrastructure present a greater challenge to introducing competition than operations, implying a greater role for the state. Operations are far less exposed to issues of sunk cost and more open to market contestability.[9] When competition in the market is a viable target, the state must strive to create a level playing field. It must remove administrative barriers to investment, prevent discrimination of new entrants by the infrastructure manager, establish necessary standardisation, etc. Achieving this will foster private investment. When competition in the market is not an option, the state must seek to create a protective bubble through contractual commitment to improve the private investor's likelihood of full cost recovery. Although there is no detailed overview available, it is well established that most private investment in transport infrastructure in OECD economies and beyond occurs through contractual commitment vehicles. These are the focus of the next section.

How the private sector invests in infrastructure: A typology

Private investment into infrastructure comes in many forms. The most straightforward are those where private infrastructure delivery and management replace the state altogether. Investments in BOT-type contracts that deliver new infrastructure or refurbish existing infrastructure would be one form. Another is regulated privatisations, where the economic regulator oversees the private infrastructure manager. This includes that of an entire network. Private investment also occurs with mergers, acquisitions or refinancing.[10] In mergers and acquisitions, investors invest money against the prospect of an expected return – i.e. they expect to find either options to reduce costs and increase productive efficiency or improve the revenue flow (e.g. through better managing demand when it can be managed or through secondary real estate developments and other options). On average, one would expect that if there is any improvement to be measured from private investment into infrastructure, examples where the private sector replaces the state would be most telling, as opposed to mergers and acquisitions of already privatised assets.

Not all forms of private participation in infrastructure involve private investment in infrastructure assets. Table 3 below outlines six forms of private participation in infrastructure. They include offering services (such as maintenance), taking over the management (but not the workers), leasing the infrastructure, or getting involved through more elaborate forms such as BOT-type contracts, concessions and divestitures. Operations can be subject to similar modalities of private sector participation (e.g. passenger transport franchises, port terminal operations).

Despite a relatively clear division of the channels of investment, region-specific differences may cause confusion. A "concession" is a specific term in civil law countries. In common law countries, however, projects that refer to discrete pieces of infrastructure are also referred to as concessions, although they could be better described as BOT-type projects.

Table 3. Types of private participation in infrastructure (PSPI)

Type of PSPI	Description
Service contract (outsourcing)	Infrastructure managers source out goods and services from third parties. This ranges from simple traditional procurement to outsourcing a core service like customer billing.
Management contract	The term "management contract" has been applied to cover a range of contracts from technical assistance contracts through to full-blown operation and maintenance agreements, and so it is difficult to generalise about them. Management contracts tend to be task-specific and input- rather than output-focused and may or may not involve the transfer of staff. Operation and maintenance agreements may have more outputs or performance requirements. Examples of the latter are performance-based maintenance contracts, which are present in many infrastructure sectors (roads, rail, etc.) all over the world.
Lease/affermage	Leases and affermage contracts are generally public-private sector arrangements under which the private operator is responsible for operating and maintaining the utility but not for financing the investment.[11] The operator does not receive a fixed fee for his services from the awarding authority but charges an operator fee to consumers.
Government-funded BOT and variants	A BOT project is typically used to develop a discrete asset rather than a whole network. Depending on the variant it can refer to greenfield (new build) or brownfield (rehabilitation) projects. In a BOT project, the project company or the infrastructure manager obtains revenues through annual (availability) payments from the government/utility. The revenues are subject to performance (infrastructure availability) requirements. Although most government-funded schemes will be availability-based, demand risk can also be transferred or shared with the private operator (e.g. shadow tolls). When only operations are considered (e.g. franchises), the construction element is omitted and the private party may lease or purchase rolling stock to provide passenger services against agreed performance standards.
User-funded BOT, variants, operation and management of existing assets (Concession)	A concession can refer to a user-funded-BOT type contract or to the long-term right to use existing utility assets conferred on the concessionaire, including responsibility for infrastructure management/maintenance and some investment. Asset ownership remains with the state and the state is typically responsible for replacement of larger assets. Assets revert to the state at the end of the concession period, including assets purchased/built by the concessionaire. In a concession, the concessionaire typically obtains most of its revenues directly from the consumer, and so it has a direct relationship with the consumer. A concession covers an entire infrastructure system. The concessionaire will pay a concession fee to the authority which will usually be ring-fenced and put toward asset replacement and expansion. A concession is normally an alternative when privatisation is not politically an acceptable option. Demand risk is normally transferred or shared with the private operator.
Divestitures (privatisation)	Full divestiture or privatisation occurs when all or most of the interests of a government in a utility asset or a sector are transferred to the private sector. A divested or privatised utility or public service is distinguishable from a private commercial enterprise in that the government generally retains some indirect form of control or mechanism for regulation over the privatised utility in the form of a license granted to the entity to deliver the service to the public. Typically, a government intending to divest of utility assets will sell shares in the utility or transfer assets into a special purpose company and sell shares in that company, although divestiture can be via a sale of assets.

Source: World Bank, adjusted by ITF.

As is evident from Table 4, they could be classified across multiple dimensions. All but divestitures can be termed PPPs, while, together, the whole range of options represents PSPI. At the risk of oversimplification, four dimensions are expected to have a key impact on the performance outcomes: the presence of ex ante money at risk, bundling of the life-cycle phases of infrastructure, the presence of incentive-based economic regulation and the presence of other commercial risks (such as demand risk). With the exception of bundling, these factors put the investor's cost recovery at risk (e.g. if the investor bears the demand risk and then the expected demand does not materialise). The outcomes will depend on the broader institutional and market conditions in a particular case.

An upfront private investment is normally required in two types of private participation in infrastructure. BOTs and their variants involve an upfront investment in the new asset or its refurbishment while divestments must be purchased.[12] Concessions of existing assets may also involve an upfront financial commitment to rehabilitate or expand part of the network and would also apply, although the distinction with the other two types may be less straightforward. All three cases may be subject to some form of economic regulation. Service (e.g. outsourcing water billing services), management contracts and, typically, leases do not involve any upfront investment. However, the private party's rewards may still be at risk or subject to performance (e.g. leases involving an ex ante rental commitment). When considering operations alone, an upfront commitment (investment) may also occur where the private party cannot lease the equipment or rolling stock and is required to buy it.

Expanding on the issue of market power discussed in the first section of the paper, incentive/price regulation is required where competition is insufficient.[13] The regulation may be derived through contract only, where the performance targets are set through a formula. Alternatively, the contract may also define the discretionary powers of a specialised institution – the economic regulator.[14] In the latter case, international practice shows a range of nuances in the discretionary power of the regulator to monitor and adjust the incentives in regular periods through price reviews. Depending on the regulator's discretionary powers and capacity, the nominal description of a price cap or rate-of-return regulation can mean relatively little in terms of expected performance incentives. In cases where competition between different infrastructure service providers is possible, price regulation may be less heavy-handed or even unnecessary.[15]

Regardless of the model of private investment, with few exceptions the state is involved in planning, whether transport infrastructure is built or upgraded. In most transport infrastructure, the state itself creates the opportunity for investment. Major improvements are a part of a broader planning process. The state organises a national draft or sectoral transport plan, which is then checked against the interests of various stakeholder groups. Ideally, such a plan is aligned with the national development plan, supported by technical analysis (a national transport model) and aligned with the budgeting process. Having a clear plan of priorities is a necessary tool to address the oft-reiterated importance of a project pipeline (OECD, 2014) by investors and the construction industry.

Table 4. PSPI and characteristics

Characteristics	Forms of PSPI					
	Service contract (outsourcing)	Management contract	Lease/ affermage	Government-funded BOT and variants	User-funded BOT, variants, existing assets (concessions)	Divestitures (privatisation)
What PPPs encompass						
Scope (discrete piece of network)	Discrete existing assets and network	Normally discrete existing assets	Discrete existing assets (e.g. port terminal) and networks (e.g. water)	Discrete new assets or refurbishment	Existing networks and normally existing node infrastructure (e.g. ports and airports)	Existing network and node infrastructure (e.g. ports and airports)
Contract duration	1-3 years	2-5 years	10-20 years	25-30 years	25-30 years	Perpetual/ subject to license
Commercial/ demand risk for the private party	None	None	Yes	Both options (yes or no)	Both options (yes or no)	Both options (yes or no)
Money at risk ex ante*	No	No	No	Yes	Both options (yes or no)	Yes
Provider of service	Private	Private	Private	Private	Private	Private
Tariff setting	Public	Public	Subject to contract performance parameters/ discretion of regulator	Mostly fixed, part variable related to production parameters	Subject to contract performance parameters/ discretion of regulator	Subject to contract performance parameters/ discretion of regulator
Price regulation	No	No	Yes, in monopoly situations	No	No/Yes in monopoly situations	Yes, in monopoly situations (incentive regulation)
Private investment during contract	No	No	No	Small investments/renewals are done by the private party (major expansions/refurbishments in the regulated case are approved by the public sector/regulator and financed by the private party)		
Legal ownership of assets	Public	Public	Public	Public/private	Public/private	Private
Competition	Ongoing	One time only; contracts usually not renewed	One time only; contracts usually not renewed	Initial contract only; subsequent contracts usually negotiated	Initial contract only; subsequent contracts usually negotiated	Initial contract only; periodic renegotiation through price reviews

*Does the private partner have to pay for the contract upfront (e.g. by financing and building the infrastructure)? In operations where the private party must buy equipment because there is no market for leasing it, this would also qualify as ex ante money at risk.

Source: Thillairajan et al. (2013), ADB (2008), World Bank Group (2018) adjusted by author.

Concluding remarks

Policy makers tend to deal with infrastructure and private investment in broad abstract meaning. In terms of policy advice and analysis regarding private infrastructure investment, three basic distinctions are necessary.

Infrastructure must be conceptually distinguished from the operations that take place on it. The economic characteristics that make private investment in infrastructure challenging can be less pronounced in operations that take place on that infrastructure. This is true in particular with regard to the aspect of sunk cost. For example, for assets used in transport operations, markets on which they can be sold often exist.

When governments seek to mobilise private investment in infrastructure, they need to consider that there are different ways for the private sector to participation in infrastructure projects. Many of these do not involve private investment.

In non-competitive markets, only two models of private infrastructure investment are commonly practiced, and both also require government intervention. Either, the state creates an opportunity for investment (for instance by opening a PPP tender), or permits investment through a regulated model. These two differ in terms of the requirements that must be met.

In both cases, the state must credibly present and maintain the right of the private sector to recover the cost of its investment. Issues related to the financial viability of project proposals, institutional stability, corruption and others rank high on the private investor list of concerns (ICA, 2014; Felzer, 2004). These are particularly relevant for developing countries, whereas the immediate drivers for private investment in infrastructure in developed countries are less well understood.[16]

Notes

1 The fiscal implications of private investment have been covered by economists elsewhere (Funke et al., 2013).

2 See: http://www.g20.org/English/Dynamic/201512/t20151225_1715.html

3 In the United States, for example, the American Civil Engineers Society (ASCE) issues a report periodically (http://www.infrastructurereportcard.org/) estimating the backlog in American transport infrastructure. The 2013 report estimates a required investment of USD 3.6 trillion, although this number includes expansions and improvements as well, not only renewals.

4 For transport infrastructure, this is over 50 years in many cases (ITF, 2013). For the purpose of economic and financial evaluations, the recommended useful life for roads is 25 years and for railways 30 (Florio et al., 2008), though recommendations from country to country may differ.

5 Contract renegotiations are perceived as a substantial problem, especially in countries with weaker institutional structures. By reducing the credibility of contractual commitments, the expected efficiency gains from competition are also adversely affected due to the strategic behaviour of one or both parties to the contract (Makovšek et al., 2014).

6 It is well established in the literature (Salinger, 1984; Rose, 1987; Hendricks, 1977) that in large infrastructure companies, unions organise more easily and can have a considerable influence on the company's policy and its owner.

7 The United States number comes from STB statistics (https://www.stb.dot.gov/) and the European Union number was inferred indirectly by UIC from tonne and train kilometres (email, dated 28 January 2016).

8 Across sectors there will clearly be individual cases of investments in certain projects that are far bigger than in smaller projects that deliver new infrastructure in the same sector (e.g. in rail rolling stock or airplanes as opposed to a rail section or a small new airport).

9 It should also be noted, however, that different infrastructure systems arose from different historical circumstances. Railways in the United States, for example, exist as vertically integrated private companies and compete with each other over vast geographies. Even if a similar model were pursued in the European Union, it would not be feasible due to multiple interoperability issues and essentially a different purpose of the railway systems in the US and the EU (the US companies are freight-dedicated businesses, while in the EU, the traffic on the railway infrastructure is mixed and companies normally pursue a range of public goals).

10 Commercial databases such as DEALOGIC and Thomson Reuters tend to include a wide variety of private investment forms. The list of projects in these may also include examples of private bank loans to corporatised state-owned companies. We do not consider such transactions private investment. As the state-owned company is subject to an explicit or implicit government guarantee and more favourable lending terms, its investing is closer to state borrowing than private investment in infrastructure.

11 In the case of an affermage, the operator also charges the customers a surcharge for investment that is transferred to the authority. The operator tends to bear greater operating risk and tends to employ the staff directly. What's more, the operator is assured of its fee (assuming that the receipts are sufficient to cover it), and it is the authority that takes the risk on the rest of the receipts collected from customers covering its investment commitments. In the case of a lease, the rental payment to the authority tends to be fixed irrespective of the level of tariff collection that is achieved, and so the operator takes a risk on bill collection and on receipts covering its operating costs.

12 It is not uncommon that the funds are not provided upfront for the whole amount but in proportion to the selected debt/equity ratio for the deal on a pro-rata basis.

13 Given the difficulty of market problems, regulation may involve ex ante or ex post intervention. In a market where competition is developing well but a company still has significant market power, ex post (or responsive) regulation may be sufficient where the regulator observes the market and introduces corrections to prices or fines only after competition-inhibitive behaviour. When a company is dominating the market or competition will never be possible, ex ante (or proactive) price regulation is necessary where the regulator determines (or approves) the prices and their changes. There are two forms of price regulation, ranging from rate-of-return regulation to price-cap regulation. The debate about whether the incentives arising from the two approaches may be different with regard to operational efficiency and the incentives to invest is beyond the scope of this paper.

14 In this case, the contract may take the form of a license. The distinction between a contract and a license has legal implications which are beyond the scope of this paper.

15 In transport, the rail freight sector has been deregulated. Telecommunications, for example, have been liberalised in some regions due to sufficient competition, although ex post price controls may still be present. That means the regulatory body only intervenes ex post if it detects the operator is behaving with significant market power and it could hurt competition in the market.

16 One aspect (investment de-risking) is discussed in a related paper by Makovšek (2018).

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Appendix 1. Research questions and outputs of the Working Group on Private Investment in Infrastructure

Introduction: Getting the basics right

What are the economic characteristics of infrastructure? What is infrastructure and what are operations? What are the models of private participation in infrastructure and through which significant private investment actually takes place?	Makovšek, D. (2019), "What is Private Investment in Transport Infrastructure and Why is it Difficult?", Working Group Paper, International Transport Forum, Paris.
Can private investment improve productive efficiency? Improve project selection? Close the infrastructure funding gap? Have other positive effects when it is private?	Makovšek, D. (forthcoming), "The Role of Private Investment in Transport Infrastructure", Working Group Paper, International Transport Forum, Paris.
What have the private investment trends in transport infrastructure been over the last 20 years? How much of that was foreign private investment?	Mistura, F. (forthcoming), "Quantifying Private and Foreign Investment in Transport Infrastructure", Working Group Paper, International Transport Forum, Paris.

Defining the challenge: How uncertainty in contracts matters

How does uncertainty affect risk pricing? Beyond investors, do suppliers in PPPs also have issues with risk pricing? How does its transfer to the private sector affect competition? What does uncertainty mean for the public vs. private cost of financing?	Makovšek, D. and Moszoro, M. (2018), "Risk pricing inefficiency in public–private partnerships", *Transport Reviews*, *38*(3), 298-321.
Is uncertainty also an issue in long-term services/operations contracts?	Beck et al. (forthcoming), "Uncertainty in Long-term Service Contracts: Franchising Rail Transport Operations", Working Group Paper, International Transport Forum, Paris.
What is the competition for large transport infrastructure projects in the EU Market? Is there a difference between traditional procurement and PPPs?	Roumboutsos, A. (forthcoming),"Competition for Infrastructure Projects: Traditional Procurement and PPPs in Europe", Working Group Paper, International Transport Forum, Paris.

Addressing uncertainty for suppliers: the construction phase as example

Adversarial vs. collaborative procurement – is collaborative contracting the future?	Eriksson et al. (forthcoming), "Collaborative Infrastructure Procurement in Sweden and the Netherlands", Working Group Paper, International Transport Forum, Paris.
What lessons in dealing with risk and uncertainty were learnt in Danish mega projects from Storebaelt to Femernbaelt?	Vincentsen, L. and K. S. Andersson (2018), "Risk Allocation in Mega-Projects in Denmark", Working Group Paper, International Transport Forum, Paris.
What can governments do in the short run to reduce inefficient pricing of risk by construction contractors?	Kennedy et al. (2018), "Risk Pricing in Infrastructure Delivery: Making Procurement Less Costly", Working Group Paper, International Transport Forum, Paris.

Addressing uncertainty in long-term contracts in the absence of continuous pressure for efficiency

What is the public sector organisational counterfactual on which private investment should seek to improve?	Holm, K.V. and T.H. Nielsen (2018), "The Danish State Guarantee Model for Infrastructure Investment", Working Group Paper, International Transport Forum, Paris.

Partial fixes to the Private-Public Partnership approach

How would an organisational structure consisting of PPPs come close to a network-wide management approach? What benefits would it yield?	Vasallo, J. (forthcoming), "Public-Private Partnerships in Transport: Unbundling Prices from User Charges", Working Group Paper, International Transport Forum, Paris.
Should the public or the private side bear the cost of long-term uncertainty? How could we design a PPP contract to avoid hold-up due to incomplete contracts?	Engel et al., (forthcoming), "Dealing with the Obsolescence of Transport Infrastructure in Public-Private Partnerships", Working Group Paper, International Transport Forum, Paris.

Long-term strategic approach

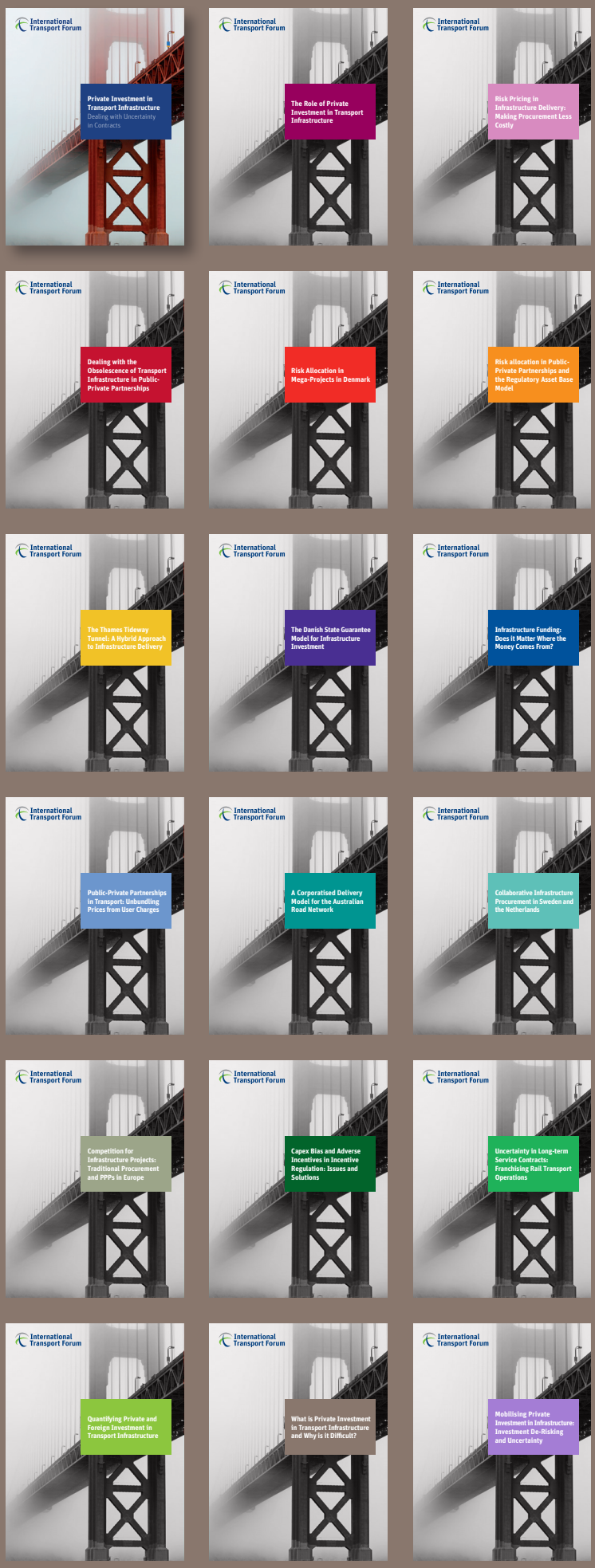
How do the PPP and regulated utility model (RAB) compare in terms of efficiency incentives?	Makovšek, D. and D. Veryard (2016), "The Regulatory Asset Base and Project Finance Models", International Transport Forum Discussion Papers, No. 2016/01, Paris.
What basic considerations underlie the choice between a PPP and RAB approach?	Hasselgren, B. (forthcoming), "Risk allocation in Public-Private Partnerships and the Regulatory Asset Base Model", Working Group Paper, International Transport Forum, Paris.
Which are the preconditions a country would need to take to establish a RAB model on a motorway network? Is user-charging a must?	Alchin, S. (forthcoming), "A Corporatised Delivery Model for the Australian Road Network", Working Group Paper, International Transport Forum, Paris.
From the investors' point of view, does a RAB need to be fully reliant on user-charging?	Francis, R. and Elliot, D. (forthcoming), "Infrastructure Funding: Does it Matter Where the Money Comes From?", Working Group Paper, International Transport Forum, Paris.
Incentive regulation can also yield perverse incentives. Can the capex bias be managed?	Smith et al. (forthcoming), "Capex Bias and Adverse Incentives in Incentive Regulation: Issues and Solutions", Working Group Paper, International Transport Forum, Paris.
Does it make sense to pursue hybrid solutions between PPP and RAB?	Zhivov, N. (2018), "The Thames Tideway Tunnel: A Hybrid Approach to Infrastructure Delivery", Working Group Paper, International Transport Forum, Paris.

Uncertainty and private investment mobilisation in transport infrastructure

What lessons can we draw from recent attempts to mobilise private investment in infrastructure in the aftermath of the global financial crisis?	Makovšek, D. (2018), "Mobilising Private Investment in Infrastructure: Investment De-Risking and Uncertainty", Working Group Paper, International Transport Forum, Paris.
Synthesis	ITF (2018), *Private Investment in Transport Infrastructure: Dealing with Uncertainty in Contracts*, Research Report, International Transport Forum, Paris

What is Private Investment in Transport Infrastructure and Why is it Difficult?

This paper provides a primer for all interested in better understanding the issues around private investment in transport infrastructure. It revisits the economic characteristics of infrastructure and the underlying basic challenges to private investment in the transport sector. The paper is part of a series of 19 papers and a synthesis report produced by the International Transport Forum's Working Group on Private Investment in Transport Infrastructure.



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