

ORIGINAL ARTICLE

Infrastructure policy: Basic design options

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ABSTRACT

The paper lays out basic design options for infrastructure policy. It first sketches mechanisms to assess demand. Then it sets out a hierarchy of issues starting with choice of market structure followed by conduct regulation. Ownership options are largely a function of market structure choices. The implications for finance—the topic of much day-to-day discussion in infrastructure policy-making—follow from these various prior choices. The discussion naturally circumscribes the role for the so-called public-private partnerships, their uses and pitfalls.

Keywords: *infrastructure; regulation; ownership*

1. Introduction

For decades, policymakers all over the world have announced goals for infrastructure services. Investment goals and access goals are popular ways of framing policy. This paper sets out the basics of choosing goals and putting in place the machinery to achieve them.

The argument proceeds in six basic blocks. First, mechanisms for setting infrastructure goals or demand are discussed. Second, market structure options are explored followed by price regulation issues. Third, this yields the basic arguments about ownership choices as a by-product. Financing options then derive from these fundamental building blocks. Finally, the expansion of access to infrastructure for poor people may require special subsidies; their design follows again the basic choices about market structure and pricing.

As a by-product, the paper provides a framework for assessing the numerous proposals for “innovative” partnerships and financing techniques. In particular, the so-called public–private partnerships (PPPs) for infrastructure ventures have become popular.

The discourse around PPPs emphasizes ownership form and financing approaches. This paper argues that such an emphasis risks cloaking the real issues. Instead of ownership and finance, the prime issues are the choice of market structure for an infrastructure sector, which determines the way prices are set, and the level at which prices are set. Financial and ownership considerations derive from the primary choice about price formation processes, be they market-based or regulated.

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2. Demand

“When high roads, bridges, canals, etc. are in this manner made [i.e. based on user fees] and supported by the commerce which is carried on them by means of them, they can be made only where that commerce requires them, and consequently where it is proper to make them. ... A magnificent high road cannot be made... merely because it happens to lead to the country villa of the intendant of the province, or to that of some great lord to whom the intendant finds it convenient to make his court.”
Adam Smith (1776)

In many countries, infrastructure services are deficient. At the same time, it is not unheard of that a new road serves the estate of powerful people or that water or power systems reach them first. Roads to nowhere and prestige projects recur all too often. The demand and supply of infrastructure services may thus both be deficient. Dealing with the issue brings out the central role of prices—as determinants of demand and as incentives to supply.

Demand or “need” is often determined with reference to some “norm”. Policymakers may come to believe that development requires a certain percentage of GDP to be invested in infrastructure. Such a norm may be derived from cross-country studies on past levels of investment. Or one may set stretch goals for service quality, such as continuous service 24 hours a day. Whether in any given situation it actually makes sense to spend a fixed amount of GDP or set a single service goal is generally not clear.

Consider, for example, a norm that says a country should invest 7% of GDP in infrastructure annually. The basic idea behind such a norm is some notion that economic performance, typically growth, requires a fixed proportional input of infrastructure. Yet, growth theory has shed the illusion that fixed proportions of factor inputs are required to produce a desired rate of growth (Easterly, 2001). The big thing in growth is not investment. Choosing the right things and producing them at lower cost matters most. Systems that stimulate genuine innovation of both products and ways of producing them are at a premium.

Applied to infrastructure, this means first of all establishing the level and type of demand that is welfare improving. For this, one should ideally rely on a mechanism that provides a test whether the benefits of a project or service exceed its costs. In most infrastructure sectors, cost-covering prices provide a sound basic test whether a project is worth undertaking. Relying fully on user fees to fund infrastructure services makes sense for almost all sectors, with the exception mostly of roads where the cost of tolling may be prohibitive.

Relying on prices to reveal demand implies that policymakers instruct potential providers to proceed on the assumption that they will not receive any fiscal transfers or subsidies and that regulation will allow them to set prices at cost-covering levels in the aggregate. Providers, whether publicly or privately owned, will estimate demand and calibrate it against costs just as any investors in a normal market would do. The infrastructure providers will then invest and provide the service. They can only make money if customers are actually willing to pay the required price. Thus, it is assured that investments are welfare improving. Financing happens as in any other market and is again fundamentally the same for private or public enterprises.

Proceeding in this way also means that policymakers themselves need not take a view on “need” or demand. They can delegate this to the service provider. Furthermore, fiscal transfers are not required. All this assumes that policymakers are capable of committing credibly to the announced policy of cost-covering prices.

Where pricing is technically or politically not feasible, or where externalities such as health benefits of sanitation are not reflected in prices, social cost-benefit analysis provides the best way to assess the merits of an investment. When cost-benefit analysis is used, governments can then provide fiscal transfers that mimic the role of prices in a normal market. For example, for toll roads, governments may pay “shadow tolls” to service providers based on the number of vehicles using a particular service.

All this is trivial, were it not for the fact that many projects and aggregate investment levels are chosen without explicit mechanisms to ensure as best as possible that welfare is enhanced and productivity raised. All too often, neither cost-covering prices are charged nor cost-benefit analysis performed.

Politically, cost-covering fees can be contentious. Water services, for example, are provided at prices that cover on average only some 30% of costs throughout the developing world (Komives *et al.*, 2005). Raising water tariffs tends to give rise to acrimonious debate. Yet, a service is worth the cost when the customers’ valuation of benefits exceeds cost. That means people would be willing to pay if they did not have the choice of subsidized provision. Prices below cost stimulate excessive demand and, to the extent that this excessive demand is met, reduce overall income and thus complicate poverty reduction as well as excessively damaging the environment.

If one wants to provide very poor people with access to certain infrastructure services, there is an argument for subsidizing that access in some fashion. Yet, this is not an argument to drop cost-covering prices as a test for the value-of-service provision.

Special pricing issues arise in infrastructure sectors, which are typically network-based. Average costs may then be higher than marginal costs. Pure economic efficiency considerations require a service to be priced at marginal cost. This would be too little to cover costs and supply the service. Hence, the standard argument is for governments to subsidize the difference between average and marginal cost. Yet, marginal cost pricing does not tell us whether a project is really worth doing, as laid out in the above quote from Adam Smith. For example, the marginal cost of using a bridge may be zero, and there may be some demand at that price, but it does not mean that the bridge was worth building in the first place. Moreover, by introducing the possibility of fiscal transfers, non-economic considerations more easily intrude on the choice of infrastructure services (Laffont and Tirole, 1993).

Systems of full cost-covering fees thus remain the policy of choice on economic grounds. Where possible, price discrimination can help solve the particular efficiency issue that arises due to declining average costs. For example, in some natural gas systems, price discrimination is allowed, traditionally in Germany for wholesale customers. As resale of gas is hard, it is possible to charge different prices to different customers. Marginal customers with low valuations just above system marginal cost can then still be served even though such prices are below average cost. Higher charges to customers with higher valuations make up for the shortfall in revenue. Price

discrimination may also help provide cheap service for poor customers while recovering costs from richer ones.

3. Market structure

3.1 A tale of two sectors

For the most clear-cut demonstration of the role of prices and price formation processes, consider access to water in Sub-Saharan Africa compared to access to phone services. Just about everywhere in Sub-Saharan Africa access to mobile phones is greater than access to modern water systems (GSMA, 2014; Hope and Rouse, 2013). Yet, official policy statements have been full of promises to enhance access to water for decades. Policies have not advocated access to cellphones in similar ways. Hence, official policy stance does not seem to be the key factor.

Maybe administrative capability is more important. Both water and phones need some level of regulation. Yet, the regulation of modern phone systems is conceptually more challenging than the regulation of water systems. In all systems, regulation needs to set prices that cover costs. Costs need to be calculated along with an allowed rate of return. So it is for water systems that typically have monopoly providers in any given area. In addition, in phone systems there are competitive and non-competitive segments that require regulation, which deals with the segments and their interfaces. There are multiple players posing challenges to regulate interconnection. Yet, it seems that African countries, including tough environments such as the Democratic Republic of Congo, are able to provide a regulatory environment that enables the penetration of mobile phones, whereas they have trouble to do the same for water. “Capacity” to regulate does not seem to be the deciding factor either.

So, what can explain the divergent patterns of access? A striking difference between the two sectors is the level of prices relative to cost. In water, prices are typically barely capable of covering operating costs and tend to be at about 30% of total cost. In mobile telephony, prices tend to exceed cost. Unsurprisingly, system operators whether public or private, who charge and collect prices that exceed costs, have an incentive to expand systems and can do so. Providers who receive less than full cost have neither incentive nor financial ability to expand access.

The irony is that low water prices are often defended with arguments that water is needed for life, that it is a human right. Cellphones are neither necessary for life nor considered essential rights. Rather, they used to be considered relative luxury goods. Yet, people have more access to the luxury goods than to the basic necessity of water. The trick is allowing people to pay for what a service actually costs. There may then still be people who cannot afford it, but access will expand and the problem of connecting further people will be made more tractable.

The story of water and phones throws up an additional important factor. Traditional landline telephony did not expand fast. State-owned monopoly phone companies had limited interest in expanding service. Prices were higher relative to cost than for water, but not always sufficient to cover the full cost of system expansion, including the cost of capital. Incumbent managers and employees of such companies had no particular personal interest in expanding systems. They could have a relatively easy life by administering a fairly static system, while asking for bribes on the

side from customers, who were begging for connections and service. The unofficial payments could exploit the gap between official prices and monopoly prices—for the private benefit of officials in such companies. There was little incentive, however, to maximize the value of the firm in state-owned firms.

The advent of mobile telephony changed this. Private companies had an incentive to maximize the value of their firms and thus expand systems. Competition kept a check on prices. Of course, the sector also benefitted from technical progress that tended to reduce prices such that price levels did not typically become political flashpoints. With enough cash flow in the system, all complex regulatory problems were solved. In the water sector, no amount of clever financial engineering or special ownership forms such as concessions or leases could get around the basic fact that without adequate cash flow, investment cannot happen. When prices cover all costs, finance becomes easy and ownership discussions can be focused on efficiency concerns rather than on shifting risks to taxpayers.

At some level this is trivial. Yet, again and again, the debates primarily focus on ownership and financial engineering when the core issue is lack of cash flow and the resulting lack of deal flow, as investors call it. Many PPPs just try to paper over the problem by seeking to shift some risks or costs to the public sector and thus the taxpayer, for example via guarantees of various types. Instead, the prime question for policymakers is how price setting happens and what level of prices this yields. The ideal way is to have prices set in competitive markets that have pricing freedom. Prices are then set at or above cost-covering levels. Competition keeps a check on excessive profit. Administrative price regulation is not needed and politicization of pricing can thus be reduced.

3.2 Market structure options

The following basic market structure options exist:

- Head-to-head competition or “competition in the market”
- “Competition for the market”
- Free entry into an unregulated natural monopoly business
- Regulated natural monopoly, with or without legal protection against entry
- **Head-to-head competition or “competition in the market”**: As in normal competitive markets, customers have a choice of who to buy from, and firms are free to set prices. To obtain profit, firms need to offer at a price that is better than that of their competitors for a given quality. That places a check on pricing power. An exit mechanism for failing firms exists—sale, liquidation or some form of restructuring. Scope for head-to-head competition exists in the following infrastructure sectors or sub-sectors.

Telecommunication providers are the most prominent example. In natural gas, there can be effective competition from competing fuels, for example fuel oil. In transport, there can be various forms of head-to-head competition. Transport ventures, such as bus or truck companies, may compete. Where multiple ports or airports in relatively close vicinity are economic, some level of head-to-head competition is possible. Freight rail companies may face effective competition from

road transport over significant distances. Where water is provided by small vendors selling bottles or other containers of water, for example in cities such as Lagos, head-to-head competition is the norm.

- **“Competition for the market”**: Head-to-head competition may not be feasible due to natural monopoly features. The duplication of network infrastructure tends to be inefficient. A single fully built-out network can often undercut any competitor. History has a number of examples where initially firms were free to compete head on, but later the market structure converged to monopoly provision. For example, in Canadian cities, water utilities originally competed by laying competing pipeline networks to supply firms and households. Eventually, only one water utility for a given area remained and others left the market. In other cases, a monopoly provider started and was not challenged either because competitors could not undercut it or because entry was forbidden by law.

Even when there is a natural monopoly, it may be possible to auction off the right to provide a monopoly service for a certain period. When it is possible to re-auction such a monopoly franchise relatively frequently based on the lowest price, prices can be set via auctions mimicking price competition in the market. Firms that lose at auction exit the particular market. Repeated auctions have been used to award bus franchises or waste management contracts. The assets of such companies, for example buses or garbage trucks, can be deployed elsewhere if a company loses a franchise. Auctions can then be held at intervals of, say, one to three years, which may effectively render price regulation unnecessary.

When assets are specific to a service area, repeated auctions are not a sufficient mechanism to select providers and set prices continuously. It is, of course, possible to award any franchise for a natural monopoly by auction and to use the auction to set the initial price. However, repeated auctions of the same franchise tend to be impractical and no auction format has been found that can solve the price-setting problem repeatedly so as to render price regulation unnecessary. For example, when auctioning off water franchises and the incumbent water provider loses, it would be excessively costly to remove the pipeline of the incumbent and have the winner lay new ones—contrary to the case of basic bus and garbage companies. If the assets have to stay, then the following issue arises. If one holds an auction to determine the price of a service, the bidder needs to know the price of the assets. The assets in the ground have, however, no significant market value outside the franchise area. The value of the assets is thus a function of the price that the provider can charge. However, that is yet to be determined at auction. So, somehow the asset price needs to be fixed before the auction. This is *de facto* equivalent to regulating prices directly. Hence, infrastructure subsectors with natural monopoly characteristics, where repeated auctions can set prices efficiently without regulation, are rare.

Existing evidence on the performance of different systems of infrastructure service provision suggests that real competition is worth its costs. This applies to systems with head-to-head competition as well as to systems that rely on repeated auctions for price-setting.¹

1. Relevant empirical assessments are found in the following publications: Andres *et al.* (2008), Gassner *et al.* (2008), Kessides (2004), Li and Xu (2004), Newbery (1999), Pollitt and Smith (2002), Zhang *et al.* (2008), and Winston (1993).

- **Free entry into an unregulated natural monopoly business:** Firms enter freely. In each service area, a single firm survives with the power to set monopoly prices. The threat of entry forces firms to provide a service that customers are willing to pay for, even though it may approximate the monopoly price level. Price structures will be shaped by the incumbent monopoly provider to reduce the threat of entry. Typically, policy studies ignore such systems as they seem to allow unwarranted monopoly power. Yet, such systems exist in surprisingly many places. They have been documented in 32 countries for electricity and in 49 for water. Many more cases are likely to exist, because traditionally they have not been considered in studies of infrastructure. Cambodia provides a telling example. Over 600 electricity providers in cities and villages were unregulated monopolists. Where they exist, such small service providers provide service to a significant number of households, often more than 50% (Kariuki and Schwartz, 2005).

Such systems can be socially desirable when large regulated firms do not function well. Consider the case of electricity. Typically, when a large utility does not provide good service, many firms and households use standby generators to assure power supply. Yet, normally regulations forbid citizens to string a wire from their generator to their neighbor. Thus, entry into the “wires business” is forbidden. When it is not, people can purchase larger generators and connect a whole township or village at lower cost than relying on standby generation for each party.² The resulting mini-power firms may charge monopoly prices, but people may prefer that to low-quality service from the major utilities. Similarly, small pipeline systems or water vending systems “by the bucket” may spring up when the utility does not benefit from some form of “exclusivity” or legal protection against entry.

When unregulated free entry is allowed into power or water systems, access can expand significantly. This is most clear-cut in areas where official utilities simply do not venture. The most dramatic example may be Somaliland, the northern part of Somalia that enjoys a modicum of peace. Here, for example, private electricity companies provide the service, sometimes even laying competing color-coded lines to households (Nenova and Harford, 2004). Cambodia also provides ample examples of private small water systems that use small plastic pipes to supply villages or townships. Where willingness to pay is adequate, small water treatment plants can also be part of such systems. In water, these small systems can actually deliver service at unit costs that are not significantly above the unit costs of large modern systems. Existing studies suggest costs that are about 1.5 times that of modern, well-run utilities (Kariuki and Schwartz, 2005). In power, unit costs can easily be double or more, say 20 to 40 cents per kWh, but still well below the opportunity cost of having no access or erratic service. Those costs can often reach 100 cents per kWh or more.

- **Regulated natural monopoly:** Under this option, firms provide monopoly service under prices set by a regulatory body. Prices are reset by regulators periodically, typically every two to five years, to take into account shifting demand and cost developments. The monopoly may be combined with a legal prohibition of entry or not. In the latter case, pricing decisions will depend on potential entrants’ options.

In regulated monopolies, firms lose pricing freedom. At least, the level of prices is set by the regulatory body. The regulator may also determine the full price structures. Alternatively, it may

2. Such options can make sense even within cities. For example, in Lagos, for years there have been proposals by entrepreneurs to connect townships within the city to mid-sized generators, so as to save everyone the cost of standby generation—only to be thwarted by the legal monopoly of the national power company.

leave some flexibility to firms under some form of price cap system, where the regulator may set a weighted average price ceiling for a basket of prices. The regulated firm may then vary the structure of prices so as to maximize profit subject to the overall constraint.

Price regulation is open to a variety of pressures on the price setting process that may not arise in competitive markets. Regulators may be under political pressure to lower prices *ex post*. This is a version of the “obsolescent bargain”, leading to some level of *de facto* expropriation of firms. Firms in turn may anticipate such risks and under-invest to begin with. Thus, the core issue of the regulated approach to pricing is the establishment of a credible regulatory commitment.

Finally, there is the question whether one should provide legal protection (exclusivity) against entry for a natural monopoly business. This may be desirable when policymakers require the monopoly provider to cross-subsidize customers in a way that encourages inefficient entry. New entrants may then target customers that pay for the subsidy, offering a cheaper service, thus undermining the cross-subsidy system. In the face of threats from entry, it could also be that incumbent providers even with pricing freedom will not be able to charge a sustainable set of prices that keep entrants out and still deliver the amount of service that would be socially optimal (Train, 1991). If the regulatory system is competent and independent of extraneous pressures, there may then be a reason for legal entry barriers.

The option of free entry even within the franchise area of a utility may help provide services with quality parameters that are more attractive to poorer customers than the standard offering of the main utility. Connections may be cheaper. Service package may provide more basic but cheaper service. Payments terms may be handled more flexibly. The main utility could, in principle, always undercut new entrants if it had sufficient flexibility with regards to pricing, service standards and labor costs. Yet, incentives to do so may be lacking, hence the value of allowing entry (Kariuki and Schwartz, 2005).

Sometimes policy makers worry that introducing markets may be more difficult than dealing with a monopoly provider. Typically, this is not the case. The free entry option set out above is precisely the default setting when governments have weak capability. It is also historically the normal initial approach to much of infrastructure provision. Some level of competition exists in some of the most challenging country environments, as in the electricity sector in Somaliland (Nenova and Harford, 2004).

Mobile telephony provides a vivid example that even relatively complex forms of competition can function under difficult circumstances, for example in the Democratic Republic of Congo. Mobile telephony shows that many low-income countries are capable of dealing with the regulatory issues that arise in this market, such as interconnection agreements among telecommunications providers.

Finally, competition for the market is not harder than regulating monopoly firms. It just forces governments to be more transparent and structured when running an auction to reveal the initial price for a service.

Complex forms of head-to-head competition, for example between electricity generators, only make sense in markets large enough to sustain a decent number of competitors. That rules out most low-income countries. In others, such as India, it has proven feasible to organize power trading.

4. Price regulation

4.1 A tale of nationalization and privatization

Historically, most infrastructure systems started with some form of unregulated private ownership—a bit like the free entry system we still find in a number of developing countries. Many roads in England were originally privately funded and constructed. The first railroads in Japan and Thailand were concessions or “BOT (Build–Operate–Transfer)” schemes. The brothers Perrier set up the first piped water system in France in pre-revolutionary Paris. The fate of the Perrier pipeline system—nationalized following the French revolution—also highlights a key issue with infrastructure systems that are essentially natural monopolies.

Throughout history, privatizations and nationalizations have succeeded each other in many countries. The basic story of why this happens goes like this: For some reason governments are unhappy with private providers. They may, for example, seek ways to reduce tariffs, be it to help politically important retail customers, to control inflation or to support industry via cheap infrastructure. For example, Prussian railways were nationalized to improve the competitiveness of Upper-Silesian coal with English coal.

Prices then easily drop below the full cost of service including investment and the cost of capital. This forces state-owned firms to slow down expansion and compromise on service quality. To some degree, governments are able to support firms with subsidies. Yet, when fiscal constraints bite, subsidies are cut. Service deteriorates further. Unhappiness with service provision leads to calls for reform.

Privatization is held up as a solution. Private investors claim that their superior efficiency will solve the problem. Fiscally constrained governments eventually seek to combine a solution to the quality of infrastructure with raising funds for the fiscal authorities. Infrastructure firms are privatized. The sales price reflects private expectations of future prices and the risk of governments renegeing on regulatory commitments. Initially, great enthusiasm reigns among private firms seeking to make outsized returns.

Then consolidation and a more somber mood set in. Some governments struggle to stick to their pricing commitments. In other cases, precisely because governments do what they said they would, investors *ex post* reap sizeable returns because the risks priced into the sales price did not materialize. A case in point is Argentina’s telephone system, which was privatized in 1989 when risks were very high, exemplified by inflation still in the order of 1,000% at the time of privatization. Some pressure to expropriate private firms *ex post* emerges. Calls for excess profit taxes or price reductions are widespread—as in England and Wales after the successful privatization of water and electricity. At the same time, private firms find that the utilities business is just that: a business with limited upside but significant downside, because regulators limit profits and pressures exist to reduce prices further or enhance access and quality without commensurate compensation.

When the level of prices becomes insufficient to expand systems and to provide quality service, calls for reform arise. The value of private firms falls. Eventually governments may decide to buy up private firms at fairly cheap prices and try to solve the problem through nationalization. Yet,

because prices are low, state firms cannot perform either without subsidy.³ Thus, the cycle starts again.

Some countries, depending on the sector, have seen several cycles of privatization and nationalization, some only one, and a few none. The key to end the cycle is the ability to commit to adequate prices that allow infrastructure firms to perform, whether they are privately or state owned.

4.2 Establishing regulatory commitment

Typically governments announce some form of regulatory regime for infrastructure service providers, be they private- or state-owned firms.⁴ Firms then invest. Regulators rule on the actual revenue that firms can make. Regulators may *de facto* renege on the pre-announced pricing rule, if they are under pressure to lower consumer prices or reduce profits deemed too large. Private firms know that agents of the sovereign may do so. This is a form of political risk. Firms underinvest when political risk is of significance. State-owned firms equally shy away from money-losing operations. Even in countries with strong legal systems and long regulatory traditions pressures to renege on *ex ante* rules can be strong. For example in the United States, in the few cases where utility regulators are actually elected by consumer-citizens, pressures to curb prices have tended to undermine service provision.

To render a price regulation regime sustainable, one needs to consider various mechanisms to curb *ex post* opportunism on the part of regulatory authorities. The mechanisms comprise: i) the nature of the pricing rules themselves, ii) the legal framework under which rules are made and administered, and iii) the organizational arrangements for administering the rules.

4.3 Pricing rules and commitment

Consider first the pricing rules. The greatest danger of *ex post* expropriation exists when some form of UK-style price cap is used. The idea behind price cap or incentive regulation is to provide firms with an incentive to perform efficiently. Thus, a price would be set. If firms could provide quality service at lower cost than anticipated, they could keep the resulting profit. *Ex post* profits may seem “too high” when the firm is more efficient than expected. Also, prices are independent of how much capacity is utilized. When demand is low, regulators may feel pressure to reduce revenues because the price charged is not just based on the cost of capacity actually used but also on that of unutilized spare capacity (Newbery, 1999).

US-style rate of return regulation provides less incentive to perform efficiently, but *ex post* profit is limited to a maximum rate of return. Based on the “used and useful” doctrine, regulators can also vary allowed revenue and provide lower revenue during low demand states and higher ones during high demand states, thus matching revenue and utilized capacity more closely. The incentives to renege on the regulatory compact are thus lower under US-style regulation and investors are more likely to invest and expand an infrastructure system. A pricing rule that enhances commitment may

3. South Africa provides a vivid illustration of the politics of pricing in a state-owned water system. Government efforts to raise prices, so as to cover more costs were strongly attacked by opponents under an anti-privatization banner, even though no privatization was actually proposed, just price reform. The word “privatization” provided emotional pull.

4. For state-owned firms, governments may use performance contracts, such as the contract-plans found traditionally in France.

well be superior particularly for countries where expanding access, and thus new investment, is a priority.

Other schemes exist that can help build credibility. For example, the German electricity company RWE originally escaped nationalization by allowing government to share 50-50 in its profit. This is similar in spirit to the sharing of resource rents sometimes found in mining contracts, for example resource rent taxation.

4.4 Legal and contractual framework

Any pricing rule will be laid down in some form of legal document. It may, for example, be written in the law, in a regulatory statute, a license or a contract. Depending on the country, different types of legal arrangements may have greater or lesser commitment value. Where independent regulators are functioning well, a statute-based approach may be adequate. In countries where investors seek protection from potentially arbitrary regulators, they may prefer contracts that are subject to supervision by courts or even regulation enshrined in the law, which may make it hard to change. The legal form that regulation sensibly takes is thus dependent on the quality of the institutions safeguarding and administering the regulation.

4.5 Organizational and procedural arrangements

At the same time, a trade-off exists between establishing commitment and leaving room to adjust regulations in response to unforeseen circumstances. Managing the trade-off between providing firm commitment and discretion is the key design issue in establishing regulatory institutions. Typically the search is for insulating the regulatory body from undue political interference and influence peddling by regulated firms, while at the same time providing the regulator with necessary flexibility in applying rules. Autonomy of the regulator needs to be balanced with accountability. The detailed design parameters are fairly standard and include such issues as whether to locate the regulator in a ministry or at arms-length from the executive branch, who nominates and selects regulators, who pays them and how, how much budgetary autonomy they obtain, the circumstances under which regulators may be dismissed, and the processes they have to follow to establish transparency (Smith, 1997).

4.6 Dealing with problem firms

Not only regulators or policymakers may fail to honor a bargain, firms may do so as well. Firms may bid low in an auction to obtain a regulated franchise and later attempt to renegotiate contracts, notably prices (Guasch, 2004). State-owned firms may become virtual states within the state. Firms may also simply perform poorly. They may clearly violate undertakings or they may perform poorly without explicitly breaking commitments. Poor performance may lead to higher costs or lower quality. At the time of a price review, regulators may then be under pressure to accommodate poor performance being *de facto* held hostage by incumbent firms.

To some degree, the process of choosing a firm when a franchise is awarded can mitigate such risk. Pre-qualification rules help select financially and technically strong providers. Performance

bonds can provide a financial incentive for firms to live up to agreements. Choosing firms that have an interest in maintaining good reputation helps, rather than “fly-by-night” operators who may not be around for long.

Yet, no such mechanism is perfect and even well-selected providers may develop problems after some years. Whoever is in charge—policymakers, regulators or conceding authorities—need the ability to change providers who end up not performing. Typically, the rules of a franchise, for example a concession contract, can set out deliverables and standards. Alternatively, such requirements may be laid down in licenses, laws or other types of regulations. When firms, too, do not meet their obligations, they may be liable to pay fines, make up for sub-standard service or at the extreme face termination. For example, French concession contracts just as British privatization licenses contain clauses that allow for termination based on defined faults committed by operators.

Still, a regulatory body of infrastructure firms may come to the view that the firm is just not performing well enough even without committing legally punishable faults.⁵ Hence it can be useful to allow for termination without fault. Again this may be accomplished in various ways, such as in concession contracts that by definition run out after some time or as in British privatization licenses where the secretary of state is given the power to terminate a franchise without fault. Typically, such “concession” periods extend to one or more decades to provide adequate certainty to providers. A big issue tends to be the incentive for franchisees to invest as the end draws near. This depends crucially on compensation rules for the case of termination without fault.⁶

4.7 Implications for ownership

The structural choices outlined above lead to choices of ownership. Where competition in the market or for the market with repeat bidding is chosen, the default option tends to be private ownership. A common feature of these structural options is that incumbents are “free to fail”. New entrants can out-perform them and force them to exit the market in some fashion. Free entry and exit are the essence of competition. For such systems, private ownership tends to be the preferred ownership form. Private investors have their own money on the line.

State-owned firms may also compete with private ones or with other state-owned firms. In electricity, for example, France’s EDF is a frequent bidder in “privatization” processes abroad. Yet, state-owned firms often benefit from open-ended taxpayer support.⁷ That enables them to stay in a market even if they are not performing well. By the same token, new entry is deterred as *de facto* subsidized state-owned firms can undercut private commercial ventures. Sometimes governments allow state-owned firms to fail as if they were private. However, usually political pressures militate against this.

5. This is just as in the case of an employment relationship, where a supervisor may judge the quality of the work of an employee poor even though no transgression has occurred that is verifiable in dismissal proceedings.

6. A concession scheme that yields a compensation payment mechanism as a by-product of bidding is the Least-Present-Value-of-Revenue bidding scheme (Engel *et al.*, 2001).

7. When a company such as EDF operates in a foreign market and is bailed out by French taxpayers that may, of course, not trouble the foreign country.

The same presumption for private ownership applies to free-entry approaches even where workable competition may be problematic. In these cases, it is still possible for new entrants to displace an incumbent by expanding market share.

Choices of ownership are less straightforward when dealing with a regulated natural monopoly. Existing evidence shows little evidence that private providers systematically outperform public ones.⁸ The key consideration is whether one wants a system that is designed to allow firms to be changed when they do not perform well, for example under concession contracts. In this case, it may be advantageous to use private firms. When state-owned firms fail, governments may, of course, resort to some form of privatization. Having it clear from the beginning that firms can fail and be replaced by others either by re-awarding franchises or by allowing corporate takeovers may be the more prudent policy. Generally, private firms operate a bit more at arms-length from government agencies than state-owned firms. Conflicts of interest may thus be easier to avoid or manage.

The choice of ownership form may not just extend to the basic choice of private- vs. state-owned. There is a continuum of ownership arrangements, loosely called “public-private partnerships” (PPPs) ranging from fully state-owned firms to fully privately owned ones. The most basic choice that governments have is to unbundle ownership such that business segments that lend themselves to head-to-head competition or competition in the market are separated from segments that do not. For example, ownership of physical infrastructure in a water system may be separated from responsibility for physical and commercial operations under lease or affermage systems. Governments then have the option to bring more competition into one part of the system. However, there may be co-ordination costs between the provider of physical infrastructure and the operator. For example, higher quality infrastructure may reduce operating costs for the operator. Alternatively, governments may change management in state-owned firms. If such changes are possible, this can be an effective method. Another way of changing management is to use management contracts with non-state providers.

Ultimately, it may be in governments’ interest to have multiple firms in different jurisdictions, for example, water companies in different areas that can be replaced with each other. The threat of replacement disciplines firms. Having several firms available to take over, in-country or from abroad, make the threat more credible.

5. Finance

5.1 Two tales of infrastructure finance

One often hears claims that government funds are insufficient to finance all needed investments. For example: “The World Bank estimates that in the next ten years, developing economies alone will need to invest over [US]\$200 billion per year, \$2 trillion by 2005, in basic infrastructure. ... Raising these vast sums and effectively implementing this development is clearly far beyond the capability of governments alone” (Cobb, 2002).

8. Kirkpatrick *et al.* (2006), Nellis (2012).

The other story emphasizes the cost of private finance as in this recent review of private financing for public projects in the United Kingdom. “The cost of capital for a typical PFI (Private Finance Initiative) project is currently over 8%—double the long-term government gilt rate of approximately 4%. The difference in finance costs means that PFI projects are significantly more expensive to fund over the life of a project” (House of Commons, 2011).

Taking the stories at face value, there is, of course, a possible synthesis. Private finance may be expensive, but one may just not be able to do without it. So the policy recommendation would be: If you want to expand infrastructure services, bite the bullet and accept expensive private finance. Much of the debate about innovative infrastructure finance may then be seen as an attempt to limit the cost of finance via some type of public-private partnership, where governments shoulder some of the risks.

Both stories are misleading. Typically, governments can finance infrastructure just as well as private firms. It is only when they are credit-constrained and thus cannot borrow extra amounts at current rates that some form of private finance may be superior. As for the cost of capital, governments typically pay lower interest rates than private parties in the same jurisdiction because taxpayers stand behind the credit. That is a social cost that is not reflected in ostensible interest rates. In general, it is not clear that this cost is lower than the ostensible risk premium of private finance.

5.2 Basic accounting

What does it mean that governments do not have enough money to fund all infrastructure needs? It may well be that they do not have sufficient tax revenues to fund all desirable infrastructure projects without borrowing. However, private financiers have no tax revenues at all. How can they finance projects? They, of course, do so when they feel that there is enough revenue from a project to service debt and equity. Where does the revenue come from? Private financiers need a mix of user fees and/or government subsidies that generate sufficient cash flow to amortize a project.

Yet, when there is enough revenue from user fees and/or taxes to pay for infrastructure ventures, governments can also borrow from the private sector and pass the funding to infrastructure projects. That tends to be called government funding rather than private finance of infrastructure.

Governments may want to reduce their fiscal deficit and, therefore, turn to private finance. This may look good on one set of accounts, but overall it does not change the financial position of a government when the government is creditworthy. Consider the following illustrative cases.

Some governments decide to privatize infrastructure ventures so as to obtain added resources. However, when one considers the balance sheet of a government, all this does is to convert an illiquid asset (the infrastructure company) into a liquid one. Net wealth remains unchanged if the sale is at market prices. To obtain liquidity, governments could also have borrowed an equivalent amount. If they sell an infrastructure company, they lose its future revenues. If they borrow, they need to pay the debt service in the future. When credit constraints play no role, these transactions are equivalent.

Finally, some infrastructure services rely on tax funded payments as revenue. This is, for example, the case for toll roads that are funded by a “shadow toll” paid from tax revenue as a

function of road utilization. When governments “privatize” these roads, they sell the right to operate the road to a concessionaire, but the obligation to pay shadow tolls in the future remains. Governments could also have borrowed against the future stream of shadow tolls—without “privatization”.

“Private finance” programs may actually be motivated by government attempts to hide obligations through off-balance sheet operations. For example, when the borrowing for a toll road is not by the state, it does not show up as a public sector borrowing requirement or fiscal deficit. However, the future obligations to pay shadow tolls remain. The government thus has as much of a future obligation to pay as before, but it does not show up in most fiscal accounts. For that to happen, governments would need to maintain accounts that are more akin to those of corporations, which would, for example, imply publishing a balance sheet for the government as well and accounting for the present value of guarantees (Irwin and Mokdad, 2010).

Normally, all these “privatization” activities only make sense if private provision brings more efficient investment or operations. This may be the case, but in natural monopoly areas, the supporting evidence for superior private performance is weak in general. Hence, as discussed above, the case that remains for “privatization” is the decision to change providers if and when the government judges that the incumbent is performing poorly.

5.3 Credit constraints

There may, however, be a special case for private infrastructure on financial grounds when governments are credit-constrained. Some governments may not be credit-worthy, even if they receive user fees from infrastructure customers. Financial markets may not trust that the state will apply the user fees to service financial obligations in the future and fear the government may be tempted to divert user fee income to other uses. This may also be the case when the infrastructure venture is run by a separate state-owned enterprise and it is feared that the government may withhold or tax the revenues in some fashion.

In this case, privatization can act like a form of collateralization. The act of privatization establishes an arms-length vehicle (a firm) that receives the user fees for the infrastructure service it provides. The creation of private property rights may in many jurisdictions provide stronger protection for investors than promises by the state or its enterprise. This form of collateralization or introduction of “hard budget constraints” may make finance flow again to infrastructure ventures and help expand systems. The strongest evidence on the superiority of private solutions over public ones is consistent with this (Galal *et al*, 1994). For example, the infrastructure privatization episodes analyzed in the heydays of privatization in the 1990s show that the main benefit was a relaxation of constraints on investment. This then led to system expansion and greater overall benefits. At the same time, the government may obtain liquidity in this way that may be very valuable when it is credit-constrained.

5.4 The cost of capital

Almost everywhere, the sovereign borrows at a cheaper rate than sub-sovereign entities, including private parties. Is it, therefore, generally preferable to use sovereign finance?

To a large degree sovereign finance is cheaper than private finance simply because government borrowing benefits from unremunerated credit insurance by taxpayers. If taxpayers charged a market price for the insurance, the difference between public and private borrowing would often disappear (Klein, 1997). A recent report to the French Prime Minister provides a detailed statement of the rationales and policy implications (Baumstark *et al*, 2011).

In sum, private finance is neither a solution to bad project economics, nor excessively costly. The decision to go for some form of private rather than state solutions generally needs to rest on grounds of efficiency of an incentive regime, not on grounds of finance. The only time when private finance can *per se* have some notable advantages is in times of fiscal crisis with severe credit constraints for the sovereign.

Sometimes arguments are made that subjecting infrastructure projects to the discipline of private finance will bring efficiencies via “capital market discipline”. In regulated sectors, regulators tend to set prices at levels that cover the cost of capital. This also means that the discipline that capital markets bring to such an infrastructure company is only as strong as the regulation that sets the price.

5.5 Financing structures

Many times one hears calls for “innovative” financing structures to unlock extra infrastructure investment. Some types of structuring deal with real risks and allocate them well. Other types of structuring are more like “snake oil” trying to hide reality. Consider first the main structuring issues.

Whether an infrastructure is incorporated as a state-owned or private firm, the key factor driving financial structuring options is the choice of market structure for the infrastructure sector in which the venture operates. Broadly, one can distinguish situations where firms earn their revenues in markets with real competition and those where they receive a regulated return on a monopoly position. In the first case, there is market risk; in the second, there is not. Without market risk, investors are often willing to provide high levels of debt. In competitive markets, new disruptive entry is possible and by the same token exit and bankruptcy of incumbents. Therefore, when there is market risk, financiers tend to require significantly higher equity cushions.

Some “innovative” financing schemes exploit regulatory arbitrage. For example, a guarantee might need less regulatory capital than the same risk embedded in a loan. Some schemes try to find ways of avoiding complications with decision-making. For example, off-balance sheet finance for private infrastructure would not affect the public sector borrowing requirement as typically reported. In that case, governments might be able to skirt, for example, parliamentary approval. In many cases, complex financial engineering shifts risks to taxpayers in not always fully transparent ways to paper over inadequate cash flow from a project. When governments are and remain credit worthy, this is like a (non-transparent) subsidy. When credit constraints kick in, the schemes may become useless, because the sovereign cannot or does not want to honor the guarantee.

Overall, financial structuring can help finance infrastructure ventures, but nothing can be done about projects that suffer from inadequate cash flow. Only sound pricing decisions can help. That includes decisions to have taxpayers subsidize a service. However, this is not a financing decision; it is a pricing decision. This leads to the last building block of infrastructure policy—subsidy schemes.

6. Access and subsidies

“When the toll upon carriages of luxury, upon coaches, post-chaises, etc. is made somewhat higher in proportion to their weight, than upon carriages of necessary use, such as carts, waggons, etc. the indolence and vanity of the rich is made to contribute in a very easy manner to the relief of the poor, by rendering cheaper the transportation of heavy goods to all the different parts of the country.”

Adam Smith (1776)

Policymakers may also want access to infrastructure to be extended to customers with willingness to pay below the cost of service (Brook and Irwin, 2003). First, it should be noted that poor people often pay higher prices per unit, for example of water or energy, than rich people. Water vendors may charge prices that are several times that of unit costs of modern water services. As exemplified, for example, by the market for water in Lagos, that does not typically reflect excessive profit taking but cost of service. The electricity that poor people typically buy first is a battery to power basic appliances such as a TV and refrigerator. This is one of the most expensive forms of power. Hence, merely allowing people to pay full price for a service tends to expand access. Based on the limited evidence available, access to water or power may cover several extra tens of percent of the population, if effective pricing schemes are implemented. This may require allowing free unregulated entry as discussed in Section 1.

Another way to help poor people is to offer a special and appropriate price-quality mix. They may get a flexible service offering and more appropriate quality standards—better than what they have, but less demanding than found in some of the most modern water or power systems. For example, it may be worth having access to water even if it is not fully treated. For many uses, such as flushing toilets, treated water is not needed. Boiling may be the preferred way to make sure drinking water is safe. They may get more flexible payment terms. As discussed before, allowing entry of “unconventional” service suppliers can be helpful ranging from for-profit vendors to community-based organizations.

Governments may provide subsidies to deal with affordability concerns. Yet, many subsidies do not effectively enhance access. For example, subsidies in an existing utility may simply help those already connected. The subsidies may then just benefit the better-off as evidenced in a number of studies (World Bank, 1994; Komives *et al.*, 2005). A key issue is thus focusing subsidies on expanding access. This may, for example, be done by providing subsidies for new connections. A second core issue is targeting subsidies to poor people. This requires either means-testing, as in the Chilean water subsidy system, or targeting certain areas where poor people tend to live or the so-called life-line rates that provide a minimum level of service at low rates. In the latter case, there remains, of course, the issue that such subsidies benefit all customers regardless of income level and only those that are connected to the system.

User fees tend to be paid when service is actually delivered. Similarly, subsidies can be made dependent on service delivery by infrastructure providers. However, many times, subsidies are embedded in financing terms upfront. This is obviously preferred by providers and it suits those who can sweeten financing terms with subsidy, because they get more business. However, incentives to deliver efficiently would suffer.

The subsidies may be funded by recourse to various types of tax revenue, or they may be funded in the form of cross-subsidies. Here, some consumers, for example urban consumers, pay tariffs in excess of cost, which allow the franchisee to live with lower tariff for poorer customers, say in rural areas. The way in which such cross-subsidies can be used depends on the scope for competition in the infrastructure sector. When there is head-to-head competition, expensive tariffs in urban areas may attract new entrants that undercut the incumbent who is cross-subsidizing from urban tariffs. In this case, a general tax scheme on all providers can be implemented as in the case of several telecommunications regimes, where a general levy goes into a “universal access” fund.

Cross-subsidies have one potential major political benefit. They may render service provision possible without dependence on the regular fiscal budget. Cutting the link (“the umbilical cord”) between fiscal accounts and utility accounts can serve as an important shield against undue political interference in utility business and enhance the credibility of pricing policy. This is similar to the argument for privatization, so as to protect the financial integrity of a utility.

In sum, subsidies can help. Yet, the first line of defense for expanding access remains the choice of market structures that provide the incentives and the flexibility to provide service to the maximum number of citizens based on cost-covering prices.

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