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PRIVATE PROVISION OF HIGHWAYS: ECONOMIC ISSUES

By Kenneth A. Small

EXECUTIVE SUMMARY

Privately financed and operated highways are an idea whose time has come, ended, and returned. The idea returns, however, as part of an infinitely more complicated system than that of America's 19th-century turnpike era. Throughout the 20th century, public expenditures were successfully used to finance, design, and implement the transportation infrastructure that helped to open the United States for its great economic expansion — most famously, the Interstate Highway System.

Several factors have brought the private sector back into transportation infrastructure, although this involvement is more limited in the United States than in the rest of the world. One significant factor is the changing economic pressures on government funding. Fuel-efficient vehicles and high gasoline prices have decreased gas tax revenues. Higher taxes in other sectors have made it more difficult for officials to increase taxes or issue bonds to fund further infrastructure needs. Maintenance requirements alone require a significant percentage of current revenues. These reasons and others have led to an increased consideration of private funding for highway construction and maintenance.

Along with the enormous potential that private financing represents, several issues and questions need to be addressed. For example, it is not enough to say that tax-exempt public bonds automatically save money over private funds. A detailed analysis must consider the taxes that the government will collect from private funding, taxes lost to government from asset depreciation, and any deadweight losses.

In addition, there are significant tradeoffs between various public goals and resulting costs, which can be addressed in the design of franchise contracts. Environmental and safety concerns, financial stability, and limits on future toll increases can be achieved, but at a cost in lower up-front value as reflected in bids. Some monopoly power is inherent in private

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road projects, and deciding how much to allow will also impact the return received by the public sector.

The economic analysis of these issues, and others like them, is the focus of this study.

INTRODUCTION

Privately owned or operated roads, common in the turnpike era but mostly gone by 1930, have made a startling comeback.

Privately owned or operated roads, common in the turnpike era but mostly gone by 1930, have made a startling comeback. Several European nations, including Spain, Portugal, Italy, and France, have long used toll roads as the predominant form of high-speed intercity expressways, and have recently converted most of them to private systems. Other countries, including the UK and Finland, have taken steps in that direction. Australia and Canada have important private road projects, and even in Latin America, privately built and operated toll roads are not unusual.[1]

The United States has moved more slowly. Nevertheless, private toll roads are gathering momentum here as well. Launched by 1990 California legislation promoting private infrastructure, new roads have now been privately financed in California, Virginia, and Texas, while existing public toll roads have been privatized in Illinois and Indiana. Other states are sharply debating whether to follow suit. Much of this activity proceeds opportunistically, as illustrated by the ability of Chicago to raise $1.8 billion, and Indiana to raise $3.8 billion, in up-front payments for long-term leases of existing toll roads. By contrast, Texas has adopted an ambitious long-term plan to integrate private highway builders and operators into future highway expansion, although implementation has been slowed by political controversy. In these situations, private firms offer funding, management of construction and operations, tolling technology, and innovative pricing structures. Consortia of such firms have acquired the expertise and financial ability to bid on multi-billion-dollar projects of great complexity. Some have even made unsolicited proposals.

What accounts for this revival? The most potent factor is probably financial difficulties in the public sector that inhibit the maintenance and expansion of infrastructure. In the United States, these difficulties largely stem from a traditional heavy reliance on fuel taxes to fund that infrastructure — a financial base that is being undermined by rising fuel efficiency, alternative fuels, and public reluctance to accept raises in tax rates that would be large enough to keep pace with inflation. A second factor is experimentation in the private provision or partial deregulation of other public services, such as electricity, water, and mass transit. A third factor is the desire to lower the cost of providing infrastructure. A final and important factor is urban congestion, the intractability of which leads policymakers to seek alternatives to a “business as usual” approach to highway provision. These alternatives include pricing, which in turn makes private provision more natural. Indeed, much of the current wave of private involvement is motivated by a desire to relieve congestion through building new roads or expanding existing roads.

Each step toward greater private involvement raises public concern

about such issues as toll rates, market power, double payment by users, risk bearing, cost overruns, bankruptcies, traffic diversion, constraints on future public works, government use of up-front payments, and uneven application of tax provisions regarding bond finance and asset depreciation. Most of these are economic issues, amenable to objective analysis, but they are complex, and in many cases answers are not definitive. Furthermore, such analysis tends to be technical and specialized, creating a gap between professional and public understanding.

The purpose of this study is to review the main economic issues involved in private provision of roads in terms that do not require specialized training to understand. This effort cannot be expected to produce a "winner" in an overall debate about privatization; rather, it is aimed at identifying the factors that determine whether any given privatization initiative is in the public interest. Insights drawn from widespread, accumulating experience with private provision of highways should also help us formulate some more general principles about when such private provision is likely to be in the public interest and what is the best form for it to take.

By private provision of highways, I mean delegating to private firms substantial decisionmaking and financial authority over roads — not just assigning to them specific well-defined tasks under contract. Most of the policies covered by this definition fall into a loose category called "public-private partnerships" (PPPs). This term, although vague, points to a common feature whereby the private sector takes a significant decisionmaking role in an arena that remains under overall public stewardship.[2] These decisions may include road design, method of finance, timing of construction, price schedules, methods of charging and enforcement, billing procedures, public relations, maintenance policies, and emergency response services.

I do not deal with more radical proposals to fully privatize street networks because there appears to be no significant political constituency for them at this time, and because in the absence of empirical experience it would be difficult to describe how such a system might operate.[3] Nevertheless, one should keep in mind that specific instances of privatization could constitute demonstrations of, experiments in, or stepping stones toward a more fully private road system.

In order to provide concrete institutional context, I focus primarily — although not exclusively — on national policy in the United States. The U.S. road system is the product of the nation's largest public works program, with assets valued today at around $1.7 trillion.[4] The requirements for maintaining and expanding this network are overwhelming the current system of financing, which is based primarily on fuel taxes that raised $86 billion in 2006 — compared to $161 billion spent on highways by all levels of government in the same year. The financial base represented by federal and state fuel taxes has been eroding relative to the size of the road network, as tax rates fail to keep pace with inflation and as motor vehicles become more fuel-efficient. Furthermore, federal policy allocates much of the money by formula

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with little regard for which investments would generate the greatest social return. Sporadic attempts to use pricing to improve the efficiency of this vast capital asset have made only small inroads, and tend to be overshadowed by the prospects of large federal grants for conventional highway expansion. It is in this context that private highway provision has caught the interest of public officials and private entrepreneurs.

1. BASIC ISSUES: CAPITAL, FINANCING, AND INCENTIVES

Perhaps the most basic features that distinguish capitalism as a form of economic activity are those governing disposition of capital and the resulting incentives of economic actors. Unsurprisingly, they are at the heart of the cases both for and against private road provision. It is useful, then, to consider how they apply to private firms operating in a sector with heavy public involvement.

Sources of Funds

As noted, a prime motivator for turning to the private sector to build and manage roads is that the public sector is short of funds. In several cases, PPP programs have accomplished desired improvements, especially congestion relief, much faster than normal pay-as-you-go public financing typically would. Should this apparently greater efficiency be regarded as a genuine advantage for the private sector, or is it just an accounting shuffle?

Ultimately, the availability of investment funds depends on the savings rate in the overall economy and how funds are allocated to specific sectors. One could argue that if road investments are deemed important, citizens would be equally willing either to tax themselves to accommodate public-sector spending, or to encourage private investment funds to flow from other sectors of the economy into roads. Thus, relying on the private sector does not increase the inherent ability of the economy to support road investment.

However, there are practical constraints on both the public and private sectors that can reduce their ability to accommodate citizens' investment priorities. On the private side, significant tax considerations — especially taxes on capital — drive a wedge between the social returns from investment and the returns realized by owners of firms. On the public side, restrictions on debt financing by state and local governments sometimes make it difficult for them to raise investment funds even if they could pay off the debt with toll proceeds. They may instead have to rely on current tax proceeds — and, therefore, on unpopular tax increases in the short term — to fund investment projects.[5] To some extent, these debt restrictions can be overcome through inter-governmental transfers from the federal government, which can readily issue unsecured debt. Such transfers are, of course, an important source of road finance for U.S. state and local governments today; but the excruciating negotiations over the last three re-authorizations of federal road finance make it clear that the federal government

too is limited politically in its ability to fund infrastructure.

The private sector, meanwhile, has a current source of investment funds that is particularly well suited to road projects: namely, pension funds. Managers of pension funds need long-term investments with relatively stable returns, and consequently have helped fund the boom in road investments financed by private consortia of infrastructure firms.

Arguably, then, the private sector is a legitimate way to expand the public's ability to finance desired road investments. The proviso is that the public sector could in principle provide such financing itself, and perhaps would do so through the political process if the private option were unavailable.

Cost of Capital

An oft-cited drawback of private financing is that the private sector must earn a higher rate of return on capital than does the public sector because of taxes on capital and the government's use of tax-free bonds. To assess this argument, one must take into account all the social costs involved, not just the financial cash flows. There are at least three issues to consider.

(1) Tax considerations: From the point of view of a state or local government, the federal tax exemption of interest payments on state and local bonds is clearly an important cost saving, often highlighted in comparisons of public and private options.[6] The same is true of tax-exempt Private Activity Bonds (PABs), authorized in 2005 by federal legislation for private road projects and slated for early use in Virginia and Missouri.[7] Missouri chose a private firm, Zachry American Infrastructure, to undertake up to $800 million in investments and long-term maintenance expenditures for its Safe and Sound Bridge program. This funding agreement has since been canceled because of the credit crisis, and the state will issue public bonds to fund the program instead. However, under the terms of the original agreement the firm would have received payments from the state, spread over 25 years or more, following the end of construction. Thus, the effect on Missouri's state finances would have been virtually identical to issuing tax-free bonds to fund the work, although the state actually would have formed a PPP agreement and let the private firm issue the tax-free bonds (supplemented by a relatively small amount of private equity). These bonds would have been PABs authorized by the U.S. Federal Highway Administration for up to $700 million, thus possibly covering most of the project costs.

However, the tax-free status of a bond is not a social saving in comparison to taxable forms of finance. Rather, any comparison of financing alternatives from a social cost perspective should use after-tax interest rates; these will tend to be similar, though not necessarily identical, in both public and private sectors. By the same token, for public policy purposes, a true comparison of costs of any kind must subtract from the private costs any taxes included, because the latter are transfers from one entity to another rather than a net cost to society. More precisely, a full comparison of net costs must subtract tax payments multiplied by a factor measuring

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the "deadweight loss" from collecting other taxes that would otherwise be required to produce the same revenue. The deadweight loss is a measure of how much extravalue consumers must ultimately give up, because of the higher prices and/or less efficient production, in order to finance each dollar of tax revenue (over and above the amount of revenue). While measures of such deadweight loss vary widely and depend on circumstances, a common assumption in applied economics in the U.S. is that they represent 15 percent of the revenue collected.[8]

To illustrate, suppose the interest rate on tax-free public bonds is 6 percent per year, and the interest rate on private corporate bonds is 10 percent. We can represent this as

$$R = 0.06 \quad r^P = 0.10 \quad (1)$$

where r and r^P are the rates of interest expressed as fractions. Market equilibrium suggests that this would occur if an investor who is indifferent between purchasing the tax-free and taxable bonds is in a 40-percent income tax bracket (of combined federal, state, and local taxes). This is because that investor must pay taxes of $4 out of every $10 received in private bond income — making the net return from the two bonds equal. In other words, the equilibrium condition in bond markets implies that

$$r = r^P \bullet (1 - \tau) \quad (2)$$

where τ is the investor's tax bracket, also known as the *marginal tax rate*. In our example, substituting the values from equation (1) into equation (2) confirms that $\tau = 0.4$ (i.e., a 40 percent tax bracket). Assuming the bond issue is small enough that we can treat all of its purchasers as being in the same tax bracket, this implies that for every $100 in bond proceeds, federal and state governments receive $40 in tax revenue if the funds are raised privately, but nothing if they are raised publicly.

Now we can compute the annualized social cost of raising $100 million of capital, denoted by C, through the two types of transactions. Suppose the term of the bonds is long enough so that we can ignore amortization payments — this does not change the result, but simplifies the exposition. Using public bonds, the issuer of $100 million in bonds must pay $6 million annually in interest charges (r = 6 percent). Using private bonds, the issuer must pay $10 million annually ($r^P$ = 10 percent), but 40 percent of those payments flow back to various governments in the form of income tax payments. Thus, the combined costs of the two transactions to the bond issuer and other government agencies, each expressed as a net revenue stream, are equal at $6 million per year:

$$r \bullet C = r^P \bullet C - \tau\, r^P \bullet C = \$6 \text{ million}$$

This also follows from equation (2). If we also believe that the $4 million in tax revenues can substitute for $4 million in other taxes whose distorting effect on economic activity is measured as a deadweight loss of 15 percent ($\lambda = 0.15$), then there is an additional offset to the cost of the private transaction, namely 15 percent of $4 million per year, or $0.6 million. The comparison of social cost is now modified to:

Public: $r \bullet C = \$6$ million

Private: $r^P \bullet C - (1 + \lambda)\, \tau\, r^P \bullet C =$ $5.4 million

Thus, with these assumptions, private financing is actually cheaper to all parties combined, because it reduces the total government tax revenue that must be raised from other sources to provide the same services in the two cases.[9]

In reality, of course, several types of tax considerations affect the use of private capital for public works projects. The primary ones are the taxes on capital income levied through both the corporate and personal income tax systems. (Applicable tax provisions are complex, so this factor is not measured simply as the sum of the applicable tax brackets stated in the tax code.) The next most important tax consideration is one working in the opposite direction: depreciation deductions to corporate income tax, allowed for private capital investments. Indeed, one of the major incentives for the recent private purchases of long-term toll-road leases in Chicago and Indiana was the ability of private corporate investors to realize depreciation deductions; analysts have suggested that this one factor accounts for a significant fraction of the bid price. Thus, these private tax *savings* need to be added to the cost of private capital, just as tax *liabilities* need to be subtracted from it. The rationale for doing this does not depend on whether corporate income taxes or depreciation deductions are good tax policy; the point is that they represent a net diversion of revenue to governments that occurs in the private but not the public financing alternative, so they must be accounted for in a comparison.

It is worth mentioning that the distorting effects of taxes are also relevant to setting tolls, or, more generally, to establishing provisions for government subsidies or government sharing in profits. Both subsidies and returns to the government are worth more than the amounts of money transferred, given the assumption that they add to or offset the need for other sources of public revenue that will involve economic distortions.

(2) Risk-bearing ability: Like any investment, road investments involve uncertainty with respect to key determinants of economic returns: construction cost, traffic levels, future interest rates, future operating costs, future public-sector regulations, and the nature of competing investments, to name a few. Is either the public or the private sector inherently better at bearing the risks posed by these uncertainties?

To address this question, it is important to distinguish between pure risk aversion and the ability to alter the uncertain incomes; the latter is called "moral hazard" in the insurance industry and "controlled risks" in the finance literature. We consider pure risk aversion here, and controlled risks in the next subsection.

It is widely agreed that the party best positioned to bear pure risks — i.e., risks beyond anyone's control — is the one with the least risk aversion. This is also the party with the lowest cost of capital (other factors being equal), because risk aversion creates a "risk premium" that raises the rate of return required to raise capital.

Risk aversion arises from problems created by inability to predict with certainty the outcome of one's affairs. For example, individuals are likely to be risk-averse in matters of large investments because their future standard of living can be greatly

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affected by the uncertain outcomes. Similarly, small firms are often risk-averse because the livelihoods of the managers or owners may depend heavily on the firm's earnings. These risks are often reduced by pooling diversified projects, as in the case of a large firm or a diversified investment pool such as a pension fund. Even a small firm may show little risk aversion if its investors can diversify their portfolios elsewhere and its managers are rewarded for risk-taking.

By comparison, the public sector can in principle diversify its projects almost infinitely. The U.S. federal government and the national governments of most developed nations can therefore issue bonds that are widely regarded as risk-free, and most states are regarded as offering safe debt, indicating that risk aversion is minimal for those entities. (This is not true for many less developed nations, because of financial problems that include past defaults.)

But the same factors that limit direct government investments also limit their risk-taking ability. Citizens are not necessarily prepared to give *carte blanche* to their elected leaders to cover cost overruns or other undesirable outcomes of risky projects, in part because they do not trust those leaders to always act in the public interest rather than in some private interest. (Similar problems influence stockholders of large corporations, but usually less so.) Furthermore, in a federal political system such as the United States, state and especially local governments are subject to considerable fluctuations in fiscal health because of national and regional economic factors. Even worse, some project risks are correlated with those very factors; for example, just when a recession creates a fiscal squeeze, toll revenues may dry up because of a decline in travel. These risks can in principle be ameliorated (diversified) through grants from higher levels of government. But, as discussed earlier, this solution is limited in practice. They could also be ameliorated by granting states flexibility in using unsecured debt finance, or by states themselves setting up "rainy-day funds"; but, for practical and political reasons, these solutions are rarely exercised.

There is another type of risk aversion that arises in both public and private organizations, because the ultimate stakeholders (taxpayers or shareholders) have different interests from those of the people they hire as managers. Suppose that taxpayers or shareholders are well diversified in their overall investments, so that they are not really concerned with uncertainty about the benefits from one particular project. They would then want their managers to invest in that project if its expected return (net benefits divided by initial investment) is greater than the applicable cost of capital. However, a project manager is likely to be much less diversified than the stakeholders in terms of the portfolio of professional projects with which he or she is associated. If the project turns out to be a bad one, that manager's professional reputation may be damaged simply because it is difficult to determine whether the failure can be attributed to that manager's performance. Thus, the manager may suffer disproportionately from an adverse outcome, and hence may exhibit greater risk aversion than the stakeholders. Well-run organizations attempt to compensate

for this effect through incentives to encourage appropriate risk-taking, but they are difficult to implement in such a way as to have just the right effect. Ideally, one would like to eliminate such excessive risk aversion from consideration when estimating the social cost of capital.

For all these reasons, there are genuine barriers to full diversification even by large government bodies in developed nations, potentially causing citizens and officials to shun the risks represented by individual public projects with an uncertain public benefit. These risks are a social cost, exactly analogous to the social cost reflected in the risk premium required for a private firm to raise funds for capital investments. However, this cost is not fully reflected in the market interest rate on government debt, because a large, fiscally responsible government can force taxpayers to cover defaults, a sort of compulsory insurance pooling. Instead, the cost is reflected in a shortage of public funds for projects that would be warranted under those market rates — precisely as argued above under the topic "sources of funds." The social cost of capital includes a "shadow value" reflecting this scarcity of funds, causing this cost to be higher than observed interest rates on public bonds. This is because the projects with which a given proposal competes for scarce public funds will tend to have rates of return that are somewhat higher than interest rates on government debt. We do not know whether this scarcity raises the social cost of public capital all the way to the level of private capital — or, equivalently, whether this shadow value of publicly raised capital is as great as the risk premium required by the private sector.[10]

To summarize, it is not obvious that the public sector always has a lower cost of capital because of lower risk aversion. I would therefore propose the following procedure in practice: As a starting point, measure the actual applicable interest rates — those on government debt and on private sources of funds (a mix of debt and equity). Subtract any net change in tax liabilities that a private firm would incur as a consequence of the investment. (which could be positive or negative) The resulting value provides an upper limit to the relative advantage of the public sector in cost of capital. The actual advantage might be less if capital constraints do prevent the public sector from funding all the projects that might seem cost-effective at prevailing interest rates.

(3) Debt structure. A private firm's mix of debt and equity, and the term structure of that debt, have an important influence on the firm's cost of raising capital. A highly leveraged structure — i.e., one with a high rate of debt to equity — increases the chance of bankruptcy because debt instruments require payments regardless of the performance of the project. This is relevant when policymakers consider long-term franchises, because the public interest may be harmed if a private operator goes bankrupt — depending, of course, on the exact terms of the franchise. Furthermore, debt structure may be and often is changed drastically following the conclusion of a franchise, as the franchisee seeks to restructure its finances — usually in the form of more leverage to reduce its cost of capital.[11] For these reasons, a franchise agreement may need to specify conditions for debt-to-equity ratios and refinancing.

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Debt holders and bond rating agencies also have criteria for debt structures they are willing to support. Equity holders would like to see debt instruments that repay loans slowly in the early years, thus matching the typical revenue profile, but such instruments are likely to achieve lower ratings and thus be more expensive. Furthermore, debt holders will want to see "[e]quity stakeholders' investments [that are] unequivocal, direct, and at risk if the transaction under-performs" (Forsgren and Macdonald, 2005, p. 44). In other words, in order to attract investment-grade debt financing, equity investors must be strongly committed and willing to accept a dividend profile that is heavily weighted toward the later years of the project. Debt holders may also insist on monitoring the asset value over time to ensure that the project owners will not postpone vital maintenance or capital expenditures and then run out of money.

Public entities also require monitoring. "An exposed agent is thus necessary to gain [the] confidence" of those paying for a public project (Klein 1997, p. 37). As discussed earlier, this monitoring requirement creates undiversifiable risk for responsible officials. In addition, public entities need to pay attention to the amount of their debt, because it affects their credit rating and creates obligations for future taxpayers. The debt obligation raises an interesting question about the sale of a long-term lease on an existing revenue-producing road, as illustrated by the Chicago Skyway and the Indiana Toll Road. The effect of such a sale is to convert future revenues, occurring over an extended period, into a single cash infusion. One consequence is that some of the uncertainty over the size of the toll revenues is shifted to the private franchisee. Another, however, is that the government receives a big block of capital funds in return for giving up future revenue — which is comparable to receiving capital funds in return for agreeing to make future payments. Thus, this type of "monetization" of future revenues is similar in effect to issuing government debt, and the same kinds of limitations to protect future taxpayers are appropriate. Presumably, now that monetization of public assets is becoming more common, debt-rating agencies will develop standardized procedures to account for such changes in future revenues.

Controlled Risk Factors

When the outcome of a risk can be influenced by one of the parties involved with an infrastructure project, it is desirable for that party to bear the risk. This encourages the most efficient tradeoffs between risk and other factors. For example, if a private firm bears the risk of cost overruns, it will work to ensure that its design and construction strategies account for the effects of unexpected events on costs.

The same example, however, also illustrates the complexity of incentives. Some cost-cutting measures available to the private firm may reduce the quality of the product in ways that cannot easily be detected until later. Examples are legion in the construction industry: poorly mixed cement, inadequate steel-reinforcing bars, substandard electrical wire or plumbing. A good franchise agreement seeks to prevent such

undesirable cost-cutting. This might entail specified quality indicators, inspections, or the use of reputation as a selection criterion. Another method combines construction and operation into a single long-term franchise, so that the firm itself suffers the consequences of any poor-quality construction — thereby, perhaps, expanding the scope of privatization. (Indeed, this is one of the arguments often made for privatization, on the assumption that private firms can make decisions about construction and maintenance in a more integrated manner than can public agencies.) If none of these methods of controlling undesirable cost-cutting are feasible, it may be that a cost-plus contract, rather than a true PPP, is the best option, even if it entails some inefficiency.

Irwin (2007) elaborates the principles of both pure and controlled risk:

> [E]ach risk should be allocated, along with rights to make related decisions, so as to maximize total project value, taking account of each party's ability to:
> 1. Influence the corresponding risk factor.
> 2. Influence the sensitivity of total project value to the corresponding risk factor — for example, by anticipating or responding to the risk factor.
> 3. Absorb the risk. (p. 5)

Irwin's first point is the one just made here; the third states that pure risk should be borne by the party with lowest risk aversion. The second point is an important addendum: Even events that are outside anyone's control can be handled in ways that make them more or less costly, and a good franchise agreement will assign the risk accordingly. For example, a project designer may be able to minimize the damage from the (uncontrolled) risk of an earthquake, whereas the government may better be able to minimize the damage from economic fluctuations.

Another phrase in Irwin's principle is worth noting: "along with rights to make related decisions." It is of little use for a private franchisee to bear a controlled risk if it lacks authority to implement the most efficient responses to that risk. Nash (2005) provides an example from UK road franchises, in which the franchisee was paid on the basis of the amount of traffic generated (thereby shifting the traffic risk to the private sector). However, the government retained the power to build competing roads and restricted the franchisee's right to build interchanges that might generate traffic — thereby nullifying most of the incentive effects of shifting the traffic risk. Another decision related to control of risk is the timing of an investment. For example, some traffic risk may be effectively absorbed by a franchisee if it has the authority to build the road in increments rather than all at once (Irwin, 2007, p. 59).

This brings us to the question of who can best bear the risk posed by uncertain future traffic projections. It is not an easy question, because uncertainty over revenue-generating traffic arises from several sources. Some such uncertainty, as noted, comes from unknown competing services, which are most often under the control of a highway authority. Some comes from land-use and tax policies, which are under the control of local or higher-level governments. Some comes

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from the state of the local economy, which is under some very limited control by both local and national governments, through economic development and macroeconomic policies. Demand also depends to some extent on ride quality, ease of toll collection, and marketing policies, which are controlled by the operator.[12] Finally, there is the risk of political manipulation or changes in contractual terms, which are real possibilities unless contracts carefully specify the franchisee's rights. This brief review suggests that an ideal arrangement will allocate risks in rather complex ways, and may require some predefined measure of how much any deviations between observed and forecast traffic can be attributed to these various factors.

One advantage of the franchise process is that it permits sophisticated allocation of risk through formulas or other provisions. For example, most franchise agreements cap future toll rates using a formula involving inflation and/or some measure of economic activity. Some also specify sharing of surpluses or shortfalls of projected revenue. Others, especially in the UK, do not even use real tolls but instead compensate the franchisee using public payment of "shadow tolls," i.e., payments at a specified rate that is proportional to the amount of traffic. These schemes enable the public entity designing the franchise to allocate traffic risk in a rather flexible manner. By contrast, public operation imposes most traffic risk on future taxpayers and/or future users, with the mix depending on how toll rates will be adjusted (which itself may be unpredictable, adding yet another element of risk to be borne by those same parties). On the other hand, complete privatization (permanent private asset ownership) imposes traffic risk fully on the private firm and any creditors or citizens who would suffer from a private firm's bankruptcy.

Cost Efficiency

One of the hoped-for advantages of private involvement is that private firms will be more efficient, thereby lowering the cost of building and operating roads. There are several reasons why one might expect such efficiency. Private firms have stronger financial incentives to save on any costs that come out of their own profits. Public firms are more prone to political interference in economic decisions; they also operate under numerous rules governing procurement, civil service, union bargaining, incentives to small businesses, affirmative action, and so forth, which may serve a valid social purpose but at considerable cost. The private sector may also promote greater innovation through incentives and operating procedures.

In the case of private highways, there are anecdotal examples of such savings. One example is the use of better traffic management during construction, in order to complete the job faster.[13] It also appears that in the highly bureaucratic environment of French road administration in the 1980s, the private firm Cofiroute achieved a considerably lower cost per mile of motorway constructed than its publicly owned counterparts (Gómez-Ibáñez and Meyer, 1993, p. 201).
It is difficult to find more systematic evidence, probably because site-specific

factors affecting costs inhibit statistical comparisons.

There have, however, been systematic comparisons of two factors somewhat related to costs: namely, cost and time overruns. Allen Consulting Group (2007, Table 4.1) examines 54 Australian projects, 25 of them in transportation, to compare PPPs with traditional public procurement. The study shows that PPPs exhibited a discrepancy between actual cost and the cost specified in the initial contract that was smaller by an average of 11.4 percentage points than the discrepancy for public procurements (overrun of 2.4 percent of contract cost, vs. 13.8 percent for traditional public procurement). PPPs also exhibited slightly smaller time overruns (2.5 perent vs. 3.6 percent) than public procurements (Allen Consulting Group 2007, Table 4.3). In both cases, the differences were larger for larger projects, so the total cost differences between PPPs and public procurements were considerably greater than these amounts.[14]

The problem with such comparisons is that we do not know whether the use of PPPs, as opposed to traditional procurement, affected how costs and times were specified in the contracts. It is possible that the shifting of controlled risks to the private sector in PPPs forced public authorities to more carefully specify the nature of the project, knowing that bidders would be deterred by too much uncertainty. Thus, these figures may not represent true cost savings. They do suggest that public planning and budgeting might be carried out with more reliable data in the case of PPPs. However, even this is an uncertain advantage, for the traditional cost-plus contracts and heavy use of cost overruns provide flexibility to the public sector that can expedite contracting (while design details are still being worked out) and permit flexible response to unexpected developments (such as a surge in local economic growth). As noted by Dewatripont and Legros (2005), some cost overruns can be expected as an equilibrium phenomenon, even in an efficient contracting system.

Thus, it appears that the conclusion of Gómez-Ibáñez and Meyer (1993) still holds, namely, that "experience provides only limited support for the enhanced efficiency of [road] privatization" (p. 201). They suggest that private roads might not achieve the kinds of efficiency gains seen in other sectors, because the bidders are basically the same firms (in both construction and finance) as those that would bid under public procurement, and therefore do not realize any additional gains from experience or scale. Still, Gómez-Ibáñez and Meyer suggest that some modest efficiency gains can likely be attributed to greater flexibility and innovation in design. They also note that private firms may be in a better position to form alliances with local developers, sharing in the windfall that a road brings to land prices and thereby taking on the landowners' incentives to have the road built quickly. Engel, Fischer, and Galetovic (2005) carry this argument further by suggesting that developers be encouraged to bid on PPP contracts so that some of their financial gains can be captured by the public sector.

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Commercialization works best when there is some competition for the service provided, so that the commercialized firm can exercise its creativity in maximizing profits within the constraints imposed naturally by the industry structure.

There is evidence elsewhere in the transportation sector of somewhat greater efficiency by private operators, especially in the case of bus transportation.[15] A typical finding is that private firms operate with 20 percent lower costs, although some of this savings is achieved from lower wages rather than from increased efficiency.[16] Another typical finding, however, is that there is wide variation among both private and public firms. The primary factor affecting costs appears to be not so much the form of ownership as the types of management incentives used; for example, this is the conclusion of a review of the contracting out of bus transit in the United States during the 1980s (Perry, Babitsky, and Gregersen, 1988). This leads to a further question: Can management incentives be improved through other forms of organization than PPPs?

One clue to an answer is that some nations, especially the UK and France, have promoted "commercialization" rather than privatization of some industries (Heggie, 2006). This is done through publicly owned corporations that are supposed to act like businesses, but within guidelines aimed at promoting public objectives that are incompatible with profit maximization. Some public toll road operators in the U.S. fall partly into this category, but usually they are closely controlled by state and local governments and so do not have much independence. A bigger problem, however, is that commercialization works best when there is some competition for the service provided, so that the commercialized firm can exercise its creativity in maximizing profits within the constraints imposed naturally by the industry structure. With roads, either competition is lacking, or — as we will see in the case of express lanes — the existence of highly congested competing roads makes it desirable not to charge a price as high as would be commercially attractive. Furthermore, commercialized firms work best when they can focus on profitable routes; however, as we will see, once the most promising parts of a network are complete, the remaining parts are not necessarily profitable even if they are regarded as publicly desirable. The U.S. experience with Amtrak, the quasi-privatized passenger rail carrier, is not an encouraging model for providing unprofitable public services on a commercial basis.

Another response to the desire to improve management incentives is to improve conventional procurement by governments. Substantial efficiency gains have been reaped through contracts that are more tightly specified than is the case with a PPP. A prominent example is the contracting out of bus service in London and in many U.S. cities, which seems to reap cost savings comparable to those of the fully privatized bus sector elsewhere in the UK, but without some of the problems caused by lack of competition (White, 1995).

Of course, toll collection itself involves a considerable cost, often 10 to 20 percent of revenues. Therefore, if the choice is between a free road and a toll road, collection costs must be taken into account when comparing the costs of alternatives. This is undoubtedly one reason for the use of shadow tolls rather than actual user payments on all but one

of the privately operated roads in the UK (Albalate, Bel, and Fageda, 2008).

Innovation

Private operators are sometimes quite innovative in proposing solutions for difficult social problems that can also be viewed as business opportunities. Examples abound from other recently deregulated industries. I mention here just two. Deregulated railroads developed long-term negotiated contracts that greatly expanded the kinds of service provided to shippers — including, for example, dedicated mine-to-power-plant coal trains that increased the use of low-sulfur coal for pollution control in power generation. Deregulated telecommunications firms accelerated the use of microwave relay stations for long-distance telephone communications, as well as for building cellular networks and offering numerous services for data transmission.

Is there scope for similar advances in highway networks? On the face of it, highways may seem less flexible in their ability to adapt to customer needs. Yet there are surprising examples of creativity. Cofiroute, a private French company with worldwide toll road experience, proposed to complete the A86 outer ring road around Paris using a tunnel under a world-famous tourist attraction, the Versailles palace. In order to provide the greatest possible congestion relief at a reasonable cost, the tunnel is restricted to autos, and uses narrow lanes and short overhead clearances, with a consequently low speed limit of 42 miles per hour.[17]

Yet the greatest innovations may come in the form of pricing. It was a private firm that proposed and implemented the toll schedule for California's State Route 91 express lanes, the first U.S. example of time-varying tolls for congestion management. Private firms have also promoted innovations in the technology of toll collection. As discussed later, the possibility that private firms better promote pricing innovations could be an important contribution to innovation in the urban highway sector.

Other Issues

One concern sometimes raised about private toll roads is that users are already paying for roads through fuel and other taxes, and now are asked to pay again through tolls. Of course, this objection applies to publicly operated toll roads as well, but the perceived onus seems to be greater when the second payment is escaping the public sector. This concern is most justified if the arrangement is structured so that tolls cover the cost of the road. In that case, any fuel tax meant also to cover road costs should be refunded, if practical. This would also have the advantage of creating a more level playing field between the private and public sectors in cases, such as in Texas, where businesses and governments directly compete for a franchise.

However, the practical significance of the problem is small. User charges, including fuel and vehicle taxes, do not fully cover the cost of roads in the United States; and because they do not vary by road type, they are even less likely to fully fund high-cost roads like those usually subject to tolls. Furthermore, user charges (such as the fuel tax) can also be regarded

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as externality charges that compensate for the fact that individual drivers do not fully bear the costs of congestion, pollution, and motor vehicle accidents resulting from their individual decisions. Parry and Small (2005) estimate that the desire to promote efficient motor vehicle use in light of such externalities justifies by itself gasoline or mileage taxes well above those currently charged in the U.S. Thus, it is somewhat subjective to argue whether a given tax payment should be regarded as paying for the road on which it is generated.

Another issue is how the public sector will use the revenues — especially when they occur in a single lump-sum payment, as in several recent cases. This is a question of political economy more than of economic efficiency. As already noted, the sale of such a lease is similar to issuing public debt; but it is unlikely to be subject to the same political controls, such as requiring a supermajority vote or a referendum. Therefore, it is legitimate to require that some political mechanism be in place to ensure that the revenues are used for projects that produce benefits over time periods similar to that of the lease. In the words of the governor of Indiana, who sponsored the Indiana Turnpike lease sale: "As in business, in government it is a mistake — a misdeed, even — to take value from a capital asset and use it for short-term operating purposes" (Daniels, 2006). The lease of the Indiana Toll Road and the proposed lease of the Pennsylvania Turnpike meet the criterion of using proceeds for long-term benefits by putting funds into infrastructure accounts with restrictions on the types of projects they can fund. Sometimes an even tighter restriction is suggested, namely that toll revenue from any road be used only for investments in the same highway corridor; but this is inefficiently restrictive, because there is no reason why the highest priority for investment should be in that same corridor.

2. PRICING

One of the most widely held views of professional economists about transportation is that the way users pay for public roads serves the public interest very poorly. Most critical is that prices are much too low for highly congested roads and do not vary in a helpful manner with time of day. One of the innovations accompanying the private provision of roads has been a move toward pricing that takes congestion into account.[18] This raises the question of whether the private sector can do a better job of designing and implementing efficient pricing structures.

Market Structure and Pricing

Some theoretical results are helpful as starting points. First, it is clear that a profit-maximizing road owner would use congestion pricing if possible. To be more precise, such an operator would vary prices by time of day according to changes in the marginal social cost resulting from congestion — that is, in a manner that would maximize economic efficiency.[19] The reason is that the owner has an incentive to make the road as valuable as possible to its users, as they

would then be willing to pay higher tolls; it can do this by offering good service, including low congestion. In addition, however, the profit-maximizing operator would add a markup to marginal social cost reflecting the same consideration motivating a monopolist in any other market: namely, the less willing or able users are to switch to other options, the greater the feasible markup.[20]

These observations warrant two policy conclusions. First, private operators are indeed likely to seek to implement innovative and beneficial pricing structures, as noted also by U.S. GAO (2008, pp. 24–25). But, second, private operation will often need to be accompanied by regulation to keep overall price levels from becoming excessive. An example is provided by the privately built and operated M6 Toll Road in the UK, which enables vehicles to bypass Birmingham while traveling between London and Liverpool or Manchester. The toll is unregulated, and the resulting high toll has been criticized as contrary to the congestion-relief goals for the previously existing roads that were prominently cited when the road was authorized.

The situation becomes more complex when two or more private road owners compete. De Palma and Lindsey (2000, 2002) confirm that private operators have some incentives to introduce time-varying prices, but argue that these incentives may be thwarted by fear of provoking a price cut by a rival. Winston (2000, p. 420) suggests that, as with U.S. railroads after deregulation, competing private operators might reach an equilibrium via contracts negotiated with large user groups or their representatives. If there were a large number of separate competitive road owners, the prices charged would tend toward precisely the theoretically optimal ones involving true congestion pricing.[21] It is difficult to envision such a situation, however, because road networks exist in space and many users will strongly prefer one route to another for geographical reasons.

Thus, it seems likely that in actual situations, the private sector would often adopt congestion pricing in some form and could be further encouraged to do so through franchise terms. In some cases, especially when a new road is being built using private financing, the public may accept novel pricing arrangements more readily from a private than from a public operator. These conclusions are nicely illustrated by the experience with several private toll-road franchises in Santiago, the capital of Chile, all of which operate with time-varying prices and appear to be relatively well accepted.[22]

Priced Express Lanes

Another way the private sector may introduce pricing innovations is by building and operating special express lanes that parallel a congested road and operate at higher speeds, available for a price that varies by time of day. In most cases, these express lanes are “High Occupancy Toll” (HOT) lanes, in which carpools drive for free (or at a reduced price) and other vehicles pay the toll. A primary example is the “91 Express Lanes” in Orange County, Calif., part of State Route 91. These express lanes were proposed, built, and initially operated by a private consortium under the nation’s first modern legislation

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fostering private road projects.[23] Other examples include the recently opened HOT lanes in Colorado, Minnesota, and Washington State; an unsolicited proposal for new privately built express lanes on the Washington Beltway in northern Virginia; and several projects in the Trans-Texas Toll Corridor for which proposals were solicited beginning in 2004. The U.S. Department of Transportation actively encourages such projects through its Express Lanes Demonstration Program (U.S. DOT, 2008b).

These examples raise two questions. Are such express lanes an efficient policy by themselves? And might they lead to a fuller application of economically based pricing tools?

The answer to the first question depends on how diverse people are. If people vary widely in the values they assign to time savings, they will probably sort themselves into two groups, both of which benefit from the express-lane scheme: one group with high time values using the toll lanes, and one with lower values using the regular, congested lanes. This is an example of offering differentiated products, similar to what happens in many consumer industries; it pays off if people care enough about the differing benefits of the different products (in this case, one of them being faster but more expensive than the other). If, by contrast, most people have similar time values, then little is gained by separating out some of them onto express lanes, and something may be lost; namely, if the price is set at a profit-maximizing level or even at a level designed to make the express lanes congestion-free, it will cause too many to use the regular lanes, which then become even more congested than necessary.[24] In this case, it would be better for the express lanes to be designated as free general-purpose lanes instead, provided that there are funds to build them in the first place. Preliminary evidence from State Route 91 suggests that users do, in fact, vary greatly in their valuation of time — in some cases, there is variation even for the same person taking trips on different days.[25]

The second question is one of political economy. If private initiatives accustom motorists to the idea of paying more for faster travel, and people see the implementation and charging technology working in practice, will they be amenable to more far-reaching pricing schemes? The evidence is far from clear, but it seems possible. Following California's privatization initiative in 1989, the state of Washington passed similar legislation and the state's transportation commission approved several solicited proposals for implementation, including one that would gradually turn lanes on Interstate 5 into express lanes, one by one, until the entire freeway was priced. Although this proposal did not survive public scrutiny, it shows how far political leaders were willing to go, even then. Today, federal and state officials are venturing much further, even to the point of a proposal by the mayor of New York City to place a toll ring around all of southern Manhattan. That proposal ultimately was approved by all but one of the parties whose assent was required for implementation, the holdout being the New York State Legislature.

Private-sector involvement in express lanes, then, gets a mixed review. If the

private sector can fully finance new capacity through tolls, as on State Route 91 in California, then there are really no losers among users or taxpayers. (Environmental effects are another story, but this qualification applies to any road.) Furthermore, if users are diverse in their valuations of travel time, they are likely to benefit as a group from being offered two different levels of service — so that those who value their time highly on a particular trip can pay for a fast trip, while others can settle for the lower-cost, congested option. On the other hand, the case for a priced express lane, as opposed to a general-purpose lane, is not very strong; on balance, it may be beneficial or not, depending on the price and the degree of diversity among users. Thus, the question comes down partly to the demonstration value: Will privately sponsored express lanes lead to better public policies with respect to pricing other roads? This is certainly one of the hopes underlying the federal demonstration program mentioned earlier, which is an outgrowth of the Value Pricing Pilot Program, formerly called the Congestion Pricing Pilot Program.

Types of Regulation

Private roads with little direct competition are a different case, because they confer a degree of market power on the franchisee. One example is California State Route 125, serving far eastern suburbs of San Diego and opening in phases beginning in 2008. Another is the proposed Front Range Toll Road, which would serve a north-south corridor east of Denver. Market power in private toll roads raises the same public policy issues as market power in any other industry, where such power is generally either prohibited by antitrust laws or carefully regulated, as in the case of electric utilities. Regulating a toll road is less complicated than regulating an electric utility, but it still raises the question of whether regulation should specify prices, rates of return, performance standards, and/or required investments. I return to this question in Section 3, because the most important regulations of this type are specified at the time of the franchise award.

3. FRANCHISING ARRANGEMENTS

One of the main arguments for private-sector involvement in road provision is that even though there is little scope for direct competition among private road owners, effective competition can be fostered at the time a franchise is awarded. Furthermore, the terms of the franchise can be structured to fine-tune the incentives, the degree of risk-sharing, and the division of economic returns between public and private sectors. Thus, the nature of franchise agreements and the procedures for awarding them are critical to obtaining public benefit from private participation.

Such agreements involve quite technical aspects of financial markets. Franchising therefore requires market sophistication from officials in the public sector. One of the benefits of the initial steps toward private involvement is that such expertise will be fostered, making later steps more likely to be successful.

The terms of a franchise agreement constitute a type of government regulation.

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Therefore, in designing a franchise, all the issues of regulatory policy that have received voluminous discussion are potentially relevant. To review them systematically here would be prohibitive.[26] Instead, I outline several key issues especially relevant for highway franchises and the choice between public and private provision of highway services.

Transparency

Most people believe that transparency is inherently valuable in public affairs. It also is needed to facilitate public acceptance of new arrangements. How do public-private partnerships compare with traditional public procurement with respect to transparency?

On the positive side, the franchising process makes certain planning assumptions explicit. Expectations, commitments, and financial projections often must be specified to establish contractual terms, or to obtain third-party financing. An example is provided by the franchise for the Chicago Skyway. Prior to authorizing the franchise, the city not only required the franchisee to meet specified technical standards, but also commissioned a detailed financial projection. Neither of these had occurred during the long years of public operation.[27]

On the negative side, the agreements themselves may be highly technical and their provisions difficult to explain to the public. Some details may be considered proprietary, and thus not made public at all. Private firms may be able to bypass rules that require public agencies to fully expose their decision-making. Even when the initial investment is publicly visible, subsequent private transactions — such as refinancing of debt, or corporate buyouts of participating firms — may obscure accountability for specific decisions.

Thus, transparency is not automatically promoted by private franchising, but it can be if it is an explicit goal. For example, the franchise agreement can specify public availability of certain information; it can also specify conditions under which the sale or refinancing of a lease is permitted — as, for example, is the practice in France.[28]

Public objectives

The franchise agreement is a natural place to stipulate any public objectives that might differ from private ones. Examples include environmental practices, links to the larger road network, price stability, and worker protection.

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Requiring the franchisee to meet objectives other than those that increase profits will naturally tend to reduce the value of the franchise to the private operator, and hence the amounts of private bids for that franchise. This tradeoff is vividly illustrated by Bel and Foote (forthcoming), who estimate the value of various provisions of the franchise terms for five recent road privatizations: two in the U.S. (Chicago Skyway and Indiana

Table 1: Value of Chicago Skyway Concession Under Alternative Conditions

	Value ($ Billions)	Multiple of Earnings
ACTUAL BIDS		
Winning Bid	1.83	**63.1**
Second Highest Bid	0.70	24.1
French Toll Roads (average)	—	**12.3**
SIMULATED BIDS		
"Base Case" (winning bid)	1.83	**63.1**
Individual Parameter Adjustments:		
(1) Term Length (99⟶23 years)	1.03	35.6
(2) Toll Growth Rate (3.78%⟶2.08%)	1.06	36.5
(3) Traffic Growth Rate (1.23%⟶0.23%)	0.93	31.9
Combined Parameter Adjustments:		
(1) + (2)	0.72	25.0
(1) + (2) + (3)	0.43	15.0
(1) + (2) + (3) + higher cost of capital (9.38%⟶11.71%)	0.36	**12.5**

Source: Bel and Foote (forthcoming, sec. 4 and Tables 3, 4, 5, 8).

Toll Road) and three in France (three parts of its motorway network). The two U.S. franchises were won with bids of 60 and 63 times current earnings, whereas the three French cases had multiples between 12 and 13.[29] Several factors accounted for this striking difference in contract value. Three of the most important — concession length, maximum rate of toll increases, and maximum leverage ratio — are also highlighted by Forsgren and Macdonald (2005).

The U.S. auctions, which specified very long franchise durations, also exhibited a much larger spread between the first-highest and second-highest bids. This variation may be explained by the probability that different bidders assumed different growth rates for operating expenses and traffic. Traffic growth would probably be even more important if these were "greenfield" projects (i.e., new roads) rather than "brownfield" projects (i.e., enhancements to existing roads).

The quantitative effects on bid price of the three factors just mentioned are detailed in Table 1, which reports the results of simulations by Bel and Foote (forthcoming). Bel and Foote compute the present value of future cash flows, discounted using a nominal annual cost of capital of 9.38 percent, which is a weighted average of 12.3 percent for equity and 8.0 percent for debt.[30] They then subtract 2.7 percent to represent transaction fees. Their "basic case" simulation uses assumptions aimed at explaining the actual winning bid for the Skyway franchise. The other simulations change key parameters in ways approximating their likely values in the French toll road auctions. Changing any one parameter has the effect of cutting the bid nearly in half; changing two or three simultaneously can cut it by 60 to 76 percent. Accounting, in addition, for the higher cost of capital implied by the French limitation on the ratio of debt to

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earnings (maximum 7.0) cuts the value by another four percentage points, and the result nearly matches the ratios of bid price to earnings that was observed in the three French concessions. Thus, it is plausible that these differences between the U.S. and French situations explain most or all of the differences in the resulting ratios of bid price to earnings.

Because three of these four parameters may be regarded as attempts to protect the public interest (through a shorter term length, lower tolls, and more secure financing with less leverage), much of the difference between the French and U.S. winning bids can be regarded as the cost borne by French taxpayers for these protections. Are these public benefits worth the costs? This is a difficult question whose investigation requires further information and analysis, some of which is discussed in the next subsection. Ultimately, any answer involves value judgments. But at least the question can be formulated quantitatively, given the information revealed by the bidding process, and thus is open to public discussion.

Toll Rates

Most road franchises specify toll rates, usually in terms of a starting price and formulas for growth. This practice has the advantage of removing future toll changes from the political process — at least, that is the hope. But it also has problems. First, it removes pricing flexibility and so may prevent an innovative fine-tuned pricing structure. Second, it requires projections of a desirable toll rate far into the future — as far as 99 years, in the case of the Chicago Skyway.

Theoretical studies and simulations have found that the public benefits from toll roads are quite sensitive to the toll rate. This is especially true when unpriced substitutes are available nearby, which is common and often specified as a prerequisite for allowing toll roads. In this case, setting the toll too low will encourage too much overall corridor traffic, while setting it too high will encourage too much of that traffic to remain on the already-congested free road. Pulling traffic away from the unpriced road is often a high priority, because the free road is likely to be a highly congested arterial serving local as well as through traffic, increasing noise and pollution levels in densely occupied areas, and having a worse safety record than expressways. Thus, it is important to set toll rates in a manner that balances these considerations, which is virtually impossible to do decades in advance.

An alternative to specifying the toll is to specify a maximum rate of return, as was done with California's State Route 91. This provides substantial flexibility. The history of rate-of-return regulation of public utilities is not entirely encouraging, but the main problem seems to be its tendency to encourage padding of the capital base in order to increase allowed earnings. This is more easily controlled with roads than with other types of utilities, because, with respect to the former, the capital exists mostly in an easily observed form — the road itself — and the desired road characteristics can be specified fairly readily. The main exception would be a case in which the franchise is intended to include expansion of future capacity, which raises the question of how capacity

would be chosen by a private franchisee under various forms of franchise agreement. We turn to this subject next.

Capacity and Profitability

Once we consider private decisions to provide capacity, we immediately come to a critical question about private financing. Under what conditions will providing such capacity, and pricing it under various schemes, be profitable?

Two results are well known in the economics literature. First, if capacity is added and priced according to the theoretically ideal prescriptions of investment analysis and congestion pricing, then it will just pay for itself if there are no scale economies or diseconomies in its construction (Small and Verhoef, 2007, sec. 5.1.1). In the more common case, where there are some scale economies in construction (e.g., some fixed cost), this form of pricing will not cover the costs of an adequate amount of capacity because optimal pricing will ignore the fixed cost.[31]

But what decisions about price and capacity would a franchisee in fact make, under various forms of franchise? Ubbels and Verhoef (2008) investigate this question theoretically. Their analysis highlights exactly the issue discussed in the previous subsection, the case where there is an alternative free road with high congestion or other external costs. They find that simply pricing the new road to maximize profits gives rather poor results, considerably poorer than can be achieved with lower tolls (even with a break-even constraint for the private operator). For the same reason, awarding the franchise on the basis of the minimum subsidy needed from the public sector yields too high a toll; whereas awarding it on the basis of the lowest toll consistent with making a profit yields too low a toll. The best results occur when the objective for awarding the franchise takes into account a combination of all three forms of payment by users and taxpayers: their own costs of congestion, toll payments, and the subsidy required. This is a highly stylized model not suited for designing a franchise for a specific road, but it does highlight the importance of considering not only toll payments and subsidies but also congestion costs incurred by users of both roads.

Perhaps the most important lesson of this discussion is that when a toll road is set up to compete with free roads for traffic, it is desirable to set toll rates at something less than those that maximize private profits or payments to the public authority, and probably less than those that will cover the cost of construction. Thus, subsidies are likely to be desirable, especially for the lower-volume, less financially attractive roads that many regions want in order to encourage regional integration and economic development. The postwar experience of France and Spain illustrate this well (Gómez-Ibáñez and Meyer, 1993, ch. 8, 11). Both began building their motorway networks using franchises to private firms, with no public funds. This worked well while the most heavily traveled routes were built, but proved an inadequate financial base for filling in the rest of the desired motorway network. This fact, plus various auxiliary factors such as rising fuel prices during the 1970s, led to partial

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socialization of the expressway networks, a process only recently being reversed through additional privatizations. The net result is that most of the expressway networks in France and Spain are now in private hands, but were built in large part with public funds. Similarly, Hungary enjoyed initial success in getting the private sector to fully finance its top priority for motorway expansion after the opening of its border with Austria in 1989, but subsequent projects were unable to attract private capital with government participation (Joint Transport Research Centre, 2008, pp. 209–211). These experiences are consistent with an analysis of bond ratings by Forsgren and Macdonald (2005), who conclude that "new and heavily debt-financed toll projects — absent an overwhelming demand profile … — will require a significant level of public involvement and, perhaps, public investment, to reach investment-grade levels" (p. 44).

Term Length of Franchise

As noted, the value of a franchise can be substantially greater for longer-term franchises, e.g., 50 years or more. This is because the traffic growth expected over the life of the road results in much greater profits in later years than in earlier ones. Indeed, almost every road constructed privately plans on a "ramp-up" period of many years, in which tolls are insufficient to cover operating expenses, interest, and depreciation. Thus, the ability to rely on private financing is greatly enhanced by long terms.

As also noted, however, a long-term franchise makes it more difficult to specify toll rates. By the same argument, other conditions that may be part of a franchise — safety measures, capacity enhancements, maintenance standards, and conditions for adding parallel capacity — are more difficult to specify far in advance. How can anyone know what circumstances will prevail, or what standards will be deemed appropriate, many decades later?

Another factor is the role of political decisions. A long-term franchise, if enforceable, has the advantage of minimizing political tinkering later on, which might otherwise undermine some of the goals for which the franchise was originally conceived — for example, future politicians may want to capitalize on a populist appeal for lower toll rates. But what is to prevent a future government from reneging on a contractual agreement for a long-term franchise even if the agreement does fully specify its terms? There may be various protections in the court system, but changing conditions of the public interest might result in a consensus that the original terms have become outmoded. Furthermore, the public sector retains many other powers, such as regulation and taxation, that can reduce the profitability of the franchises. Thus, even a fully structured long-term lease is attended by some political risk for the private operator.

An auction mechanism proposed by Engel, Fischer, and Galetovic (2001) avoids some of these problems by letting the term length of the lease depend on experience in a specified way. The specific proposal is a "least present value of revenues" auction. To understand how this auction works, consider the case in

which a road is expected to be profitable. Instead of submitting bids based on toll rates or on annual profits to be shared, firms could bid on the present value of future revenues they would receive, with present value calculated using one or more interest rates specified as part of the bidding process. The firm proposing the lowest present value of revenues wins the bid. The firm is allowed to collect revenues until that present value is achieved; the franchise then lapses and the road reverts to the public sector. The advantage of this scheme is that it maintains most of the desirable incentives of other franchise arrangements — to build cost-effectively, to provide good service, to keep collection costs down — but it also allows the public sector to retain much of the risk of long-term uncertainty in traffic levels and future allowed toll rates. If a future government wants to adjust the toll formula or build competing capacity, it can do so without upsetting the franchise so long as the franchisee can still earn enough to reach the specified present value eventually.

Renegotiations and Bailouts

One of the less-easily described features of franchise agreements is that they sometimes lead to renegotiations when conditions differ from those anticipated by one or both parties. Reasons could include impending bankruptcy, unanticipated congestion, changes in political governance, or adverse publicity over some aspect of the public-private relationship. In Spain, renegotiations are an expected and normal part of the franchise process, allowing provisions to be "rebalanced" to reflect new information (U.S. GAO, 2008, p. 47). The UK government changed its mind about private operation of the Skye Bridge in Scotland, and ultimately purchased the bridge from the private operator. In the United States, impending bankruptcy forced reconsideration of the terms of the Dulles Greenway concession in Virginia, and public outcry over a non-compete provision caused the private "91 Express Lanes" in California to be bought out by the local public transportation authority. Such renegotiations, and attempts to prevent them at the initial contract level, can add substantially to the transactions costs of public-private partnerships (Vining et al., 2005) — which are already quite high, perhaps 3 percent of project costs as opposed to about 1 percent for public procurement (Välilä, 2005, p. 109).

Engel, Fischer, and Galetovic (2003) argue that prevalent renegotiations of highway franchises in Latin America prevented hoped-for benefits of highway privatization from being realized. Unlike the original franchise arrangements, renegotiations tended to take place outside of public view; furthermore, such renegotiations "negate the public benefits of private highways by giving an advantage to firms with political connections, limiting the risk of losses, and reducing the incentives to be effective and cautious in assessing project profitability" (p. 131). They attribute these renegotiations mainly to two factors. First, governments enacted and implemented private road policies in haste, failing to install regulatory mechanisms beforehand and then letting regulation be carried out by the contracting agency — which had

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a vested interest in seeing the project go forward no matter what the difficulties. Second, the use of fixed-term contracts caused all the demand risk to be borne by the private party, which, as we have seen, makes it subject to factors outside of its control. Another factor, which may be endemic, was that highway plans tend to be made during economic booms, causing a systematic tendency to overestimate future revenues through extrapolation from recent trends. Guasch (2004) provides further detail.

Thus, for the privatization process to proceed smoothly throughout the life of a franchise, it is important to include as many factors as possible as contingencies in the agreement, and/or to set out a framework for renegotiations that leaves neither party at the mercy of the other.

4. CONCLUSION

The public sector's use of private firms to provide highway infrastructure can expand the range of funding sources available for timely investments, because of the fiscal and political constraints on governments and the desire to avoid economic distortions resulting from high tax rates. There are sources of private funds whose desire for long-term stability and ability to diversify over project-specific risks make road investments a good idea for them as well. Furthermore, private firms can usually react more quickly to opportunities than can the public sector, and thus can expedite the process of coping with a backlog of needed infrastructure improvements.

The use of private firms can produce substantial benefits with respect to risk-bearing. However, their use should not be viewed simply as a way for the public sector to shed risk. Rather, through the franchising process it is possible to specify flexible forms of risk-sharing that allow each entity to bear the risk for which it is most suited. The public interest is enhanced when a franchise agreement provides incentives for each party to minimize the consequences of unexpected detrimental events by taking measures to reduce either the likelihood of such events or the financial consequences to which such events expose them. As for bearing the remaining irreducible uncertainty, there is no strong reason to believe that either the private or the public sector has much advantage; rather, the balance depends on specific situations.

There are theoretical reasons to expect private firms to realize some cost efficiencies relative to direct public provision of the same services. However, the reasons are not as strong in the highway sector than in others because many of the same firms would be involved with either public or private provision, whether as contractors or as private partners; and many of them are large enough to have already reaped scale economies and expertise. Furthermore, there is little empirical evidence for such cost savings for private highways. Rather, it appears that the most important factor is the nature of managerial incentives, which varies widely within both the public and private sectors but does not vary systematically between them. Private partnerships do follow the original budgets and time schedules more closely; but these plans are almost certainly affected by whether the provider is public or

private, so that this observation offers little if any evidence for actual cost savings.

Because road services cannot plausibly be made to resemble a competitive market, any use of private operators must be accompanied by various controls. Most obviously, some restraint on market power is almost certainly in the public interest, unless the need for a funding source is so great that it overwhelms other considerations. Such restraint can be achieved by toll regulation, but doing so will tend to eliminate desirable price flexibility and requires information about future conditions that cannot plausibly be known in the case of a long-term contract. A more promising approach is an auction that specifies a particular financial target, the amount of which is the subject of the firms' bids, allowing toll rates and the duration of the franchise to adjust to achieve the target that is agreed on. Other public concerns can also be addressed in an auction and the subsequent franchise agreement, including safety, environmental goals, service quality, and financial stability of the private provider.

Private provision of express lanes, in direct competition with a publicly owned free road, is a special case. Express lanes require an especially difficult balancing act for setting tolls or related financial targets. This is because their social benefit depends critically on balancing the traffic between the two roadways so as to allow the express lanes to offer a premium service (beneficial when users differ considerably in the value they place on fast and reliable service), but without producing too much congestion on the free road (which becomes highly inefficient when extreme). In most cases, the public interest is best served if express lanes are priced somewhat below a level that would cover their construction cost. More generally, whenever a toll road has a reasonably close substitute that is free or low-priced and congested, it is desirable to keep the toll lower than otherwise in order to help relieve that congestion.

Private highway provision can produce useful experimentation with pricing structures. When there is congestion, a private operator has an incentive to adopt time-of-day variation in toll rates because the resulting greater value to users can be at least partly captured in revenues. Such pricing is quite similar to the kinds of congestion pricing that are increasingly recognized as a key to making urban roads more efficient. Thus, by demonstrating viability and stimulating improvements in charging technology and implementation, valuable lessons from the private sector can be applied more widely. This possibility especially argues for the importance of designing franchises or toll regulations that allow the operator to price flexibly.

To summarize, the private provision of highway services offers benefits in many situations. It deserves a prominent place in highway policy, especially given its potential to provide new capacity in a fiscally constrained and congestion-challenged environment. In order to realize these benefits and to prevent undesirable outcomes, however, the public sector must be sophisticated in setting the terms under which private firms operate.

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APPENDIX: DISCOUNTED PRESENT VALUE

Projects with different time patterns of cash flow are usually compared on the basis of a single number, which summarizes the value to an investor of a given project's cash-flow pattern. Suppose the applicable interest rate is i, which would be r for a public project and r^P for a private project in the example given in Section 1. We can understand the principle of present value by working backward. Suppose we invest an amount P today in a bank account that pays interest at rate i for as long as the account remains active. If interest payments are left in the account to accumulate, the account balance will be $P \cdot (1 + i)$ after one year, $P \cdot (1 + i)^2$ after two years, and so forth. After t years it will have a *future value*:

$$F_t = P \cdot (1 + i)^t \qquad \textbf{(A1)}$$

Equivalently, if we consider an amount of money F_T in year T, it has the same value as a "principal" today equal to:

$$P = \frac{F_t}{(1+i)^t} \qquad \textbf{(A2)}$$

Thus, a series of money values F_t extending from years 1 to T has present value equal to the sum of terms like that in (A2):

$$P = \sum_{t=1}^{T} \frac{F_t}{(1+i)^t} \qquad \textbf{(A3)}$$

The quantity F_t can represent any financial figure, for example, a net revenue (revenue minus cost). Equation (A3) thus tells us how much the entire series of net revenues is worth today, in the sense that a single investment today could produce precisely that pattern of future funds.

Equation (A3) can be interpreted as representing nominal values of future payments (i.e., values not adjusted for inflation), with the interest rate being the actual market interest rate. The equation can also represent real (inflation-adjusted) values of F_t, with a "real" (inflation-adjusted) interest rate approximately equal to the nominal interest rate minus the inflation rate.

The value of P in equation (A3) is often quite sensitive to the interest rate, especially if — as is common for roads — the pattern of future net revenues F_t grows over time. To illustrate, consider a project with lifetime T = 23 years, and a stream of annual net revenues that begins at $34 million and grows at 4 percent per year — reaching $80.6 million by the end of the project. Its present value, as computed by equation (A3), is $0.43 billion at an interest rate of 9.38 percent, but only $0.36 billion at an interest rate of 11.71 percent. This example approximates the results for the two interest rates, with and without debt limitations, shown at the bottom of Table 1 for the hypothetical Chicago Skyway lease modified to resemble terms for the French toll roads. The result would be even more sensitive to the interest rate if net revenues were to start as negative values, and only later increase to positive values — as is typical for a new toll road. Because of this property of present value, project analysis (including potential bid values for a franchise) is often very sensitive to the cost of capital.

It is sometimes useful to note a special case of equation (A3) when

payments are constant over time at some value ***F*** and the project life is infinitely long (as, for example, is often assumed for projects whose initial cost is mainly land acquisition). Then

$$P = F\sum_{t=1}^{\infty}\frac{1}{(1+i)^t} = \frac{F}{i} \qquad \textbf{(A4)}$$

This formula can be useful for roughly calculating the relationship between a relatively stable revenue stream and its present value. Such a calculation is most often useful when the quantities are expressed in real (inflation-adjusted) terms. At a real interest rate of 6 percent, the present value is 1/0.06 = 16.7 times the annual stream of real net revenues; whereas at a real interest rate of 10 percent, the present value is only 10 times the annual real net revenue.

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NOTES

1 For a comprehensive review of recent experience with private toll roads, see: Joint Transport Research Centre (2008), especially sect. 2.5 and Annex. Gómez-Ibáñez and Meyer (1993), ch. 7-11, describe earlier experience. Forsgren and Macdonald (2005) provide a more detailed recent U.S. history.

2 Standard & Poor's uses the following definition: "any medium- to long-term relationship between the public and private sectors, involving the sharing of risks and rewards of multi-sector skills, expertise, and finance to deliver desired policy outcomes" (Forsgren and Macdonald 2005, p. 46).

3 See Roth (2006) for a discussion.

4 Small and Verhoef (2007), p. 112.

5 Taxes have also "deadweight" costs because of the distortions they impose on private incentives. A distortion is any factor that causes private incentives to deviate from those that would engender a more socially efficient economic system. As shown by Adam Smith, this also means — under certain well-defined conditions — any factor causing deviations from conditions of competitive free enterprise. The distortion itself does not favor either public or private provision, however, unless private provision makes possible a higher toll. This is because the taxes needed for up-front investment today (in the public funding option) are balanced by fewer taxes needed later as the public sector receives revenue from toll payments. This is a fundamental point of Engel, Fischer, and Galetovic (2007).

6 An example is a report commissioned by the Democratic Caucus of the Pennsylvania House of Representatives (Gray, Cusatis, and Foote, 2008), which finds that the Pennsylvania Turnpike Authority could finance future Turnpike operations more cheaply than could a private franchise. Tax-free finance and the resulting lower cost of capital are the main factors informing this conclusion. In Texas, each proposed new road franchise is required to first obtain a bid from any interested public-sector agency, based on a pre-negotiated franchise value. tThe calculation of whichthis figure is based on the (relatively high) private-sector rate of return on capital, and thus tends to be lower than would be calculated using an after-tax social rate of return.

7 See "Private Activity Bonds Issued for I-495" and "Missouri Bridge Design Work Begins" in *Public Works Financing*, vol. 228 (June 2008), pp. 8–9, 13. In Virginia, PABs issued in June 2008 are intended to cover about 30 percent of the cost of new Capitol Beltway express lanes.

8 See Small and Verhoef (2007, pp. 147, 177–178) for a more complete discussion of deadweight loss. The total cost of raising each dollar of revenue, including deadweight loss, is called the *marginal cost of public funds* — in this example, equal to (1 + 0.15) = 1.15.

9 This discussion has omitted certain complications, including the possibility that the interest payments themselves could require distorting taxes if they are financed by the public sector, or that they could exacerbate other tax distortions if they are financed by user charges, which tend to raise the cost of living and thereby may lower work incentives. See Small and Verhoef (2007, pp. 146–147) for a discussion specific to transportation, and Parry and Oates (2000) for a more general discussion of how tax distortions are affected by user fees and other changes in consumer prices.

10 This view is similar but not identical to that expressed by Klein (1997) and Irwin (2007, pp. 65–66). They argue that the true cost of capital is the risk-free rate of interest plus a risk premium that depends only on the project-specific risk, not on who bears it. The rationale behind their argument is that governments are able to secure financing with investors requiring only low risk premiums by forcing taxpayers to guarantee payment for the project under consideration, and that these taxpayers therefore bear project risks for which they are not compensated. The view taken here is that some portion of the project-specific risk is in fact truly diversified through the tax system, so that taxpayers do not exhibit risk aversion to it, but that some other portion remains undiversified because taxpayers need it to be borne by government officials in order to monitor their performance. Unfortunately, the current state of knowledge does not enable us to know exactly what these portions are.

11 An example is the Skyway Concession Company, which won the bid for a 99-year lease of the Chicago Skyway. Six months later, the company refinanced so that its debt-to-equity ratio rose from 53 percent to 68percent (Gray, et al., 2008, Tables 2, 3).

12 It also depends on some factors controlled by the operator that might be privately profitable but socially counterproductive, for example,

political maneuvering to prevent competing investments.

[13] The California Private Transportation Company, the consortium franchised to build the express lanes on State Route 91 in Orange County, reduced construction time substantially for a complex freeway-to-freeway interchange at one end of the express lanes by obtaining approval for an alternative to standard protocols for handling traffic during reconstruction. Lower construction time lowers cost considerably, because a substantial part of construction cost is the extra financing needed to bridge the time between start of construction and opening to traffic.

[14] Based on Allen Consulting Group (2007, Figure 4.1), it appears that the cost overrun is approximately proportional to size of project for traditional procurement, whereas it is independent of size for PPPs. Thus, for example, the largest three traditional projects examined, with combined sizes of roughly $1,930 million, experienced combined overruns of $400 million, or 21 percent (even though one of the three experienced no overrun), while the three largest PPPs examined (with combined sizes of $3,320) all experienced zero overruns.

[15] For reviews see Gómez-Ibáñez and Meyer (1993), especially ch. 2–6, 13; Preston (2005); Karlaftis (2007); and Small and Verhoef (2007, sect. 6.3).

[16] The cost reduction from paying lower wages represents a social benefit if it enables the firm to perform the same work with less skilled workers, because this releases the skilled workers for other more productive occupations. However, if it only causes a given set of workers to be paid less than before, it constitutes a transfer from one group (workers) to another (taxpayers), rather than a social benefit.

[17] See Poole (2006, pp. 28–31) for discussion of this and other urban congestion-relief tunnels.

[18] The U.S. Department of Transportation has given this high priority in its use of various demonstration programs authorized by Congress since 1990, the latest of which — the Urban Partnerships Program — offers large grants to local regions willing to try out some form of congestion pricing; see U.S. DOT (2008a).

[19] For reviews of congestion pricing, including the rationale for it, see Button (2004), Small and Verhoef (2007, ch. 4), and papers in Button and Verhoef (1998) and Santos (2004).

[20] See Small and Verhoef (2007, sect. 6.1.1) for a precise statement and demonstration. Formally, the markup is inversely proportional to the absolute value of the demand elasticity. A monopolist operating in a market where users have few other choices faces a low elasticity, and so can "charge what the market will bear."

[21] This limit is described by DeVany and Saving (1980). Convergence to the limit as competition increases is described by Engel, Fischer and Galetovic (2004).

[22] See "Santiago pikes make own charges — draw on central customer database," *Toll Roads News*, June 3, 2005 (http://www.tollroadsnews.com/node/1141).

[23] The legislation was California Assembly Bill 680 (AB680), in effect from 1989 through 2002. See Sullivan (2006) for a detailed account of the 91 Express Lanes.

[24] These statements follow from simulations by Small and Yan (2001) and Verhoef and Small (2004). Another factor is that some capacity is lost by dividing a road into two parts; see Lee (2008) for a quantification.

[25] Small, Winston, and Yan (2005); Sullivan (2000).

[26] Gómez-Ibáñez (2003) provides an excellent review of these issues as they pertain to infrastructure. A central theme is that regulating a monopoly is a variant of the more general problem of designing procedures to protect parties who are vulnerable to exploitation after irreversible investments in long-term assets have been made, especially when those assets have uses only in the specific relationship (such as between users of a highway and owners of a long-term lease for that highway). Similarly, Laffont and Tirole (1993) have applied principles of relationship-specific assets to analyze optimal procedures for public procurement.

[27] U.S. GAO (2008, p. 42); Bel and Foote (forthcoming).

[28] Bel and Foote (forthcoming); Joint Transport Research Centre (2008, Annex 1.2).

[29] Earnings are here measured on a partially net basis: specifically, earnings net of operating expenses but not net of interest, depreciation, and amortization — known formally as "earnings before interest, depreciation and amortization" (EBITDA).

[30] See Appendix for an explanation of discounted present value.

[31] For urban roads, by contrast, high and rising land costs as well as the costs of intersections may produce diseconomies of scale, in which case the ideal road will still entail substantial congestion, so that its optimal price is able to more than cover construction cost.

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