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## Privatizing Highways in Latin America: Fixing What Went Wrong

A revolution in the way highways are provided took place in Latin America in the 1990s, when more than fifty projects, mainly in Argentina, Brazil, Chile, Colombia, and Mexico, were privatized using build-operate-and-transfer (BOT) contracts. The so-called lost decade of the 1980s resulted in low investment in infrastructure and inadequate maintenance, and it created a major highway deficit across Latin America. This deficit, together with chronic budgetary problems, led governments to embrace a scheme in which the private sector financed urgently needed infrastructure investments, thereby freeing up public resources for projects in other priority areas.<sup>1</sup>

This paper draws some lessons based on the evidence accumulated to date. In particular, we show that policymakers face unpleasant choices when considering how to provide highways in the future. The evidence suggests that private financing of new highways freed up fewer resources than expected. In several cases, public funds were diverted to bail out franchise holders in financial trouble.<sup>2</sup> Government guarantees for private highway franchises also added to the fiscal burden—and such guarantees

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1. Even though this is the main reason why roads were privatized, the economic validity of the argument is dubious if countries face an aggregate debt constraint. If the sum of a country's public and private debt must be lower than a given threshold, private investment in highways can crowd out both public and private investment in other sectors.

2. For example, Mexican taxpayers spent more than U.S.\$8 billion to bail out the franchise owners and the banks that lent to them.

were paid out mainly during economic downturns, when government budgets were already in deficit.<sup>3</sup>

Before we proceed, it is useful to clarify what we mean by public and private provision of roads. Under public provision (which we call the traditional approach), the government designs, finances, and operates the road. Private firms may participate in the construction stage and may be selected in competitive auctions, but once the facility is built, the government operates and maintains it. Taxpayers finance the road, and any tolls levied are usually unrelated to construction costs. When roads are privatized, a concessionaire finances, builds, operates, and maintains the facility. The franchise owner collects tolls for a long time—usually between fifteen and thirty years—and when the franchise ends, the road reverts to the government. Such BOT contracts can be awarded either through direct negotiations between the transit authority and an interested firm or through a competitive auction for the franchise of a well-defined project.

Highway privatization promised not only to free up government resources, but also to deliver some of the standard advantages expected from privatization.<sup>4</sup> First, a firm that is responsible for construction and maintenance has the right incentives to invest in road quality.<sup>5</sup> Second, private firms are better managers than state-owned highway authorities. Third, BOT contracts may be desirable on distributional grounds, since roads are paid for by those who benefit. In particular, cost-based tolls are easier to justify politically when infrastructure providers are private.<sup>6</sup> Finally, in contrast with public provision, under BOT, only privately profitable roads will be built, thus using the market mechanism instead of cen-

3. See, for example, “World Bank Warns of New Debt Dangers,” *Financial Times*, 30 May 1997.

4. For example, an official 1999 document from the Latin American Association of Financial Institutions for Development (ALIDE) states: “The fiscal and financial crisis . . . of the 1980s led to the end of the traditional model of infrastructure financing, which considered the state as the main investment agent, and opened space for important participation by the private sector . . . with the objective of not only bringing relief to the burden supported by public finances, but, more importantly, [improving] the allocation of risk and [improving] the efficiency of management.”

5. Tirole (1997).

6. This is important if trucks are ever to pay tolls that approximate the road deterioration they cause.

tral planning to screen projects. This reduces the likelihood of building a white elephant, which is a common problem in Latin America.<sup>7</sup>

Our review of the evidence suggests that the promised benefits of high-way privatization failed to materialize. The main reason for the failure was the continuous renegotiation of franchise contracts. In most countries, concessionaires renegotiated their contracts without public scrutiny. This facilitated shifting losses to taxpayers. 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.

Opportunistic renegotiations have been pervasive because of two design flaws that are present in all the franchising programs we examined. First, countries have followed a “privatize now, regulate later” approach. In Argentina and Colombia, the lack of a clear contractual structure led to cost overruns and renegotiation of the conditions of the original contract. Moreover, the government agency interested in the success of the franchise program was usually the same agency that supervised the franchise contracts. Since the success of these agencies is often measured by the percentage of the program they succeed in building, they tend to be lax in enforcing compliance with franchise contracts and are inclined to ease the conditions for franchise holders. This is clearly the case in Chile.

The second pervasive design flaw is that most concessions have been awarded using a fixed-term contract, which makes the franchise holder bear most of the demand risk and thus creates a demand for subsidies and guarantees. This is troublesome, since demand risk is particularly large for highways.<sup>8</sup> The franchise holder should not bear this risk because it has little ability to influence demand. The allocation of fixed-term franchises in competitive auctions all but ensures that firms will lose money in low-demand states, which generates pressure for renegotiations and guarantees.<sup>9</sup>

7. We define a white elephant as a project whose net (of costs) social value is negative. An extreme example of a white elephant is the Las Raíces tunnel built in the 1930s, which is still the longest tunnel in Latin America and was never put to its intended use.

8. See Engel, Fischer, and Galetovic (2001).

9. In the real world, the pressure for road expansion (and thus for highway franchise programs) usually occurs during upturns. The average conditions during the entire franchise are thus likely to be worse than those under which the program is conceived.

The evidence we present in this paper does not imply that the traditional approach is necessarily better. It does suggest, however, that neither option is Pareto superior. For example, a cash-strapped government facing the urgent need to build socially desirable infrastructure may choose BOT contracts even while knowing that the contracts will be renegotiated later to the advantage of the franchise holder. Alternatively, the traditional approach may be best for a government that can finance the highway by incurring debt and that is unable to avoid renegotiations of BOT contracts.<sup>10</sup> More generally, our point is that highway privatization so far has not been well-designed. Privatization will not represent a better option than public provision of highways without significant improvements, such as introducing variable-term franchises, imposing credible hard budget constraints on franchise holders, and establishing independent regulatory and supervisory bodies.

The evidence we present in this paper thus casts doubts on the proposition that privatization should always be preferred to the traditional approach. This motivates the theoretical part of the paper, in which we report progress in building theoretical models to analyze highway privatization and then use the models to explore the basic question of when privatization is socially desirable.

In our previous work, we rule out, by assumption, government transfers to the franchise holder (the self-financing constraint) and identify the franchise contract that incorporates the optimal trade-off between demand risk and toll distortions.<sup>11</sup> We also show how to implement the optimal contract using a competitive, variable-term auction. Imposing the self-financing constraint, however, rules out the possibility that the traditional approach—or any approach that requires government transfers to the franchise holder—could be optimal. In the current paper, we formally derive conditions under which the traditional approach is better than BOT, and we also characterize the conditions under which our earlier results extend to the more general setting considered here. If the optimal contract involves government transfers, then BOT is suboptimal and the traditional approach should be preferred. By contrast, when BOT is optimal, no government

10. Of the many purported advantages of the private approach, the only robust argument seems to be that the franchise holder has better incentives to invest in the quality of the road.

11. Engel, Fischer, and Galetovic (1997, 2001).

guarantees are needed. BOT contracts that involve government transfers for risk-sharing purposes are always suboptimal.<sup>12</sup>

We also use our theoretical framework to debunk the cost-of-funds argument often used in favor of privatizing highways. According to this argument, privatization is better than the traditional approach because private firms have a lower cost of financing projects, as government revenue is collected through distortionary taxes. This argument ignores the fact that a publicly owned highway can also collect revenue via tolls, and tolls reduce distortions under congestion conditions (the well-known double dividend). Since this potentially efficient source of revenue is unavailable to the government in the case of a BOT contract, the cost-of-funds argument does not justify private highways. On the other hand, the government's highway agency manages and spends fewer resources under BOT programs than under the traditional approach, and this may well provide an argument in favor of privatization if the agency is inefficient or corrupt.

The central role that opportunistic renegotiations play in our review of the regional experience is captured only partly by the theoretical framework described above. Indeed, the likelihood of renegotiations increases with the degree to which the franchise holder is forced to bear (uninsurable) demand risk. This motivates our explicit modeling of a BOT contract renegotiation. The results show that a variable-term contract can be used to eliminate demand risk while allowing the regulator to renegotiate contracts when socially desirable. Variable-term contracts are thus more flexible than fixed-term franchises.

The remainder of the paper is organized as follows. The next section discusses highway franchising in Argentina, Colombia, and Chile, concentrating on the issues most relevant for policy implications. The subsequent section presents our new formal results, and the final section concludes.

## Country Studies

The so-called lost decade of the 1980s left several Latin American countries with severe infrastructure deficits. Lack of maintenance and rising

12. If the highway produces externalities that are not internalized by users, it may be desirable to subsidize the socially valuable road under a BOT contract. This case is considered in Engel, Fischer, and Galetovic (2003).

traffic flows meant that transportation bottlenecks were becoming costly and could represent a major obstacle for future growth. Governments operating on a tight budget could not afford vast public works plans, and they lacked the human resources to undertake major investments in transportation infrastructure. Highway franchising seemed to promise a solution to these problems, by allowing the private sector to complement the meager resources of the public sector. Moreover, if competition for the franchises worked, roads would be less expensive and would be well built.

This section examines highway franchising in Argentina, Colombia, and Chile.<sup>13</sup> As these country studies suggest, there are many pitfalls that weaken the arguments for highway privatization. In Argentina, franchises have been expensive for both the government and highway users. Contracts have been repeatedly renegotiated, usually to the benefit of the franchise holders. It is conceivable that in some specific cases, most users ended up worse off. In Colombia, investment targets have not been met, some projects were awarded but never started, and the government has paid large sums in cost and traffic guarantees. Chile seems to have been somewhat more successful at avoiding the major pitfalls of highway franchises, having completely renovated its road system in time at a reasonable cost. Contract renegotiations are common even in Chile, however, and these have increased project budgets by 15 percent of their original estimates, on average. The regulation of concessions contracts has been lax, and there are signs of future renegotiations, to the detriment of users and taxpayers.

### *Argentina*

The Argentine franchise program began in 1990 and was the second major franchise program in Latin America, after Mexico's.<sup>14</sup> The government auctioned twelve twelve-year intercity franchises during the first stage of

13. The case studies that follow are far from exhaustive. Our objective is to provide some stylized facts about the Latin American experience, from which we draw observations and motivation for the models developed in the following section.

14. Highway franchises currently consist of 9,500 equivalent kilometers, a large fraction of Argentina's main highway system of 38,000 equivalent kilometers (see World Bank, 1999). An additional 12,000 kilometers are managed by the private sector, which takes care of maintenance and rehabilitation in exchange for toll revenue. Furthermore, 6,000 kilometers are maintained privately, but funded by the state. In the initial stage, only financially viable intercity roads (that is, roads between major cities) were franchised. The access routes to Buenos Aires were allocated in the second stage of franchising.

the process (1989–90). Traffic levels on these roads were sufficiently high (2,000 to 2,500 vehicles per day) to support private maintenance, rehabilitation, and capacity improvements, but they were not high enough to merit building totally new roads.<sup>15</sup> There was no toll revenue guarantee and no profit-sharing mechanism. Tolls were indexed to inflation to protect franchise holders. Service quality was measured by a quality index that was supposed to improve over the life of the concession. It was estimated that the service quality requirements would demand large investments in paving during the first few years of the franchise, and concessionaires were required to make the improvements before collecting tolls. This first round of auctions was very successful in attracting bidders, with more than a hundred bids for the simultaneous auction of the twelve franchises. The most important bidding variable in this first round of auctions was the rent (or *canon*) that would be paid to the government.<sup>16</sup> The total amount bid for such payments was U.S.\$890 million a year in 1990 dollars.

After only five months the government decided to renegotiate the contracts.<sup>17</sup> The main reason was the new policy of peso-dollar convertibility, which declared illegal all indexing provisions in contracts. A further reason to renegotiate the contracts was that several concessionaires were collecting tolls before performing the investments required in their contracts. The renegotiation reduced tolls by 50 percent, in exchange for which the canon was eliminated. In fact, the government granted subsidies totaling U.S.\$57 million a year to the firms. The program of road improvements changed. Though the road franchises became less attractive as business propositions, firms were receiving money rather than making payments.

Another round of renegotiations began in 1995, because higher-than-expected traffic led to congestion and the need for new investments. The government threatened to auction the expansion projects in order to force the franchise holders to accept extensions of the franchise term in exchange for the required investment. The negotiations were direct.<sup>18</sup>

15. See Estache (1999). Tolls were set uniformly across all concessions on the basis of distance and type of vehicle, using multiples of the basic toll for cars (U.S.\$1.50 per hundred kilometers).

16. Other variables such as the lowest toll, the highest quality, or investment were also used, but only occasionally.

17. For details, see World Bank (1999, annex 1).

18. According to Estache (1999), who quotes the Public Works Secretary, the franchises were extremely profitable at least until 1998, with rates of return between 26 and 38 percent.

Nevertheless, at least U.S.\$900 million in improvements agreed to in the 1995 renegotiations will not be built before the franchises end in 2003.<sup>19</sup>

Yet another renegotiation took place in December 2000. The renegotiated contracts specified additional government grants for the franchise holder, mainly because previous grants had not been paid. In exchange, the franchise holders agreed to additional investment, but again, the grants were not paid consistently. The new contracts also contained a trigger clause that limited the profit rate: when the target profit rate was reached, the franchisee would have to reduce tolls or undertake additional investments. Since these investments were not auctioned competitively, franchisees—which frequently included construction firms—chose to make additional investments, so as to keep the extra revenue within the firm rather than share profits with the government.<sup>20</sup>

The government learned from this experience and set better rules in the second round of franchising, which comprised the Buenos Aires access road concessions. Franchises were awarded to the bidder that asked for the lowest toll; franchise terms were set at 22 years; and the contracts were generally comprehensive and included no guarantees. The number of bidders was small, with at most two per franchise. As in the first-round franchises, contracts were amended frequently (five times since 1996) owing to the trigger clause.

The quality of roads clearly improved as a result of the franchise program. Intercity traffic increased from 73 million to 106 million traffic equivalent units from 1991 to 1998, though it remained approximately constant between 1996 and 1999 and has probably declined since as a result of Argentina's economic crisis.<sup>21</sup> Intercity toll revenues were approximately U.S.\$300 million a year (precrisis), plus an additional promised U.S.\$75 million in grants from the central government. This is a large sum, considering that the franchises only encompass 821 kilometers

19. One of the reasons for this is that the government did not make all the payments agreed on in the last renegotiation.

20. Trigger clauses like the one described above may lead to inefficiencies. On the one hand, if the road generates large revenues, it is probably close to congestion and lowering tolls may be inappropriate. On the other hand, unlimited expansion owing to the trigger program may lead to overcapacity or congestion at the points at which the franchised highway interconnects with the rest of the road network, as there is no coordination with the rest of the highway network.

21. See World Bank (1999).

of two-lane intercity highways. As a comparison, the budget for public expenditures on roads was only around U.S.\$500 million, of which 35 percent went to pay interest. The four Buenos Aires access routes, in turn, involved investments of \$1.7 billion and revenues that also came to U.S.\$300 million.

The Argentine experience reveals some of the potential social costs of franchise contracts that overlook important issues. For example, because the location of the toll booths was not specified, the franchise holder was able to place them strategically so as to maximize revenue by charging relatively high tolls to users of small sections of the franchised highway. The average cost per traveled kilometer is therefore much higher than the established rate of approximately U.S.\$1.50 per kilometer, because the average trip is short but pays the full toll. In fact, for the average twenty-five kilometer car trip, users are worse off than before the franchises.<sup>22</sup>

Another remarkable fact is that the reported operating costs of the interurban franchises range between 45 and 60 percent of revenues net of value-added tax (VAT). An estimated 40 percent of expenditures is for administration and collection, and of this, more than two-thirds is for collecting tolls. In fact, 21 percent of gross toll revenues is spent on administration and collection, which is as much as is spent on maintenance.<sup>23</sup> A possible explanation for these costs is that many intercity roads have low traffic densities, which means that collecting tolls can be expensive. An alternative explanation is that profits are being diverted to delay the application of the trigger clause. This is consistent with the large gap that exists between the profit rate estimates of the association of concessionaires (12.4 percent) and independent estimates (26–38 percent; see footnote 18).

Summing up, the Argentine concessions program has succeeded in providing a major upgrade in the country's highway network. Yet this upgrade has been expensive, in particular because of the incentives to pad costs in maintenance, administration, and collection and because of the continuous process of renegotiations, which have benefited concessionaires at the expense of toll users and tax payers.

22. See World Bank (1999).

23. These franchises did not require new construction, but rather rehabilitation, maintenance, and capacity improvements. Investment levels for the first through ninth years of the intercity franchises are estimated at U.S.\$1.45 billion (World Bank, 1999).

*Colombia*

The first generation of highway franchises, with investments of U.S.\$1.08 billion in thirteen projects, was awarded in the mid-1990s. It is clear in retrospect that this first wave of highway privatization had severe problems. Seven of the thirteen projects were not awarded in an auction, but were assigned in direct negotiations after no bidders showed up.<sup>24</sup> A partial list of the additional problems detected in the first round of franchising is as follows:<sup>25</sup>

—The National Institute of Roads (INVIAS) did not define the exact route of the roads.<sup>26</sup> Consequently, INVIAS was unable to expropriate the required land in time, which led to construction delays.

—The auction process was short and INVIAS made no promotional efforts to attract international bidders. This meant that most auctions had no bidders and most projects were handed to Colombian firms directly.

—Projects were franchised on the basis of feasibility studies, before the final project was defined. Moreover, traffic studies were preliminary.

—INVIAS did not assess the financial health of bidders. Some winners (or firms that negotiated directly with INVIAS) could not obtain financing, which led to delays.<sup>27</sup>

—Contracts were incomplete: there were no conflict resolution mechanisms, no rules for payment of guarantees, and no step-in procedures for possession of the franchise by lenders.

Because of these mistakes, the first round of franchises was plagued by contract renegotiations, delays, large payments for traffic and cost guarantees, and cost overruns in plot expropriations. On average, traffic was 40 percent lower than predicted by INVIAS, while costs were 40 percent above contracted costs. More than 40 percent of cost overruns was due to

24. In addition, many projects started out late as a result of lack of financing. A project awarded in 1995 and another awarded in 1996 had still not obtained financing by 1999.

25. From General Comptroller of the Republic of Colombia, "Evaluación de las concesiones viales," 2001.

26. INVIAS is the government agency responsible for major highways.

27. Despite this difficulty, the average delay of the first round franchises was seventeen months, against the average of three and a half years for similar government projects. See Darío Hidalgo, "Los impactos en las concesiones viales en Colombia: Vamos por buen camino?" *Estrategia*, 30 June 1997, cited in Pérez and Yovanovich, "Información sectorial sector carreteras," Corporación Financiera del Valle S.A., February 1999.

high expropriation costs.<sup>28</sup> A further 58 percent of cost overruns was due to design changes and the incorporation of additional features to the project.

The second round of franchising included only two projects. The design was improved somewhat, but not enough: the first project was cancelled owing to breach of contract, while the second was late and financially weak. In contrast with the first round, variable franchise terms were used: the franchise ends when a predetermined level of accumulated revenue is collected. This is similar to the present value of toll revenue (PVR) mechanism considered later in the paper. Unfortunately, revenue flows are not discounted, which means that some of the incentives to renegotiate remain, since the franchise owner bears more risk than under a standard PVR franchise.

Despite these flaws, however, the Colombian highway franchises show well when evaluated against the benchmark of government-mandated construction. Even though contracts were renegotiated and projects were frequently delayed, the average delay was about two years less than before the program. Similarly, most contracts had cost overruns, but they were about one-third of the amount under government-mandated construction.

Summing up, the main shortcomings of the Colombian approach to highway franchising have two origins: undue haste in preparing the first round of auctions and lack of experience with auctions. Haste led to constant changes in the projects, which increased costs. The lack of experience shows in the government's not having promoted competitive auctions internationally, which led to auctions with few bidders. Another facet of the inexperience is the lack of concern for financial guarantees, such that no penalties were established for firms that could not finance the project. A third source of problems was the inattention to incentives, which, coupled with traffic and construction guarantees, meant large contingent claims on the Colombian government.<sup>29</sup>

28. The government offered construction cost guarantees.

29. The Colombian government has put a lot of conceptual effort into valuing the contingent guarantees it offered in the franchises, but it has done little to improve incentives and avoid renegotiation of contracts and financial arrangements.

## Chile

In 1991 the Chilean congress passed a law that allows the government to franchise most public works, including roads, ports, and airports.<sup>30</sup> Franchises must be awarded in competitive auctions open to any firm, whether national or foreign. The law is quite flexible, leaving ample room to adapt the franchise contract to the requirements of each project. In particular, the tendering variables can include user fees, state subsidy, the duration of the concession, income guaranteed by the state, revenue paid by the franchise holder to the state for preexisting infrastructure, the risk assumed by the bidder during the construction and operation stages, the quality of the technical offer, the fraction of revenue (beyond a certain threshold) shared with the state (or users), and total income from the concession. By the end of 2002, the most important highways, seaports, and airports had been franchised, with cumulative investments of around U.S.\$5 billion.

The usual procedure for financing a highway franchise in Chile involves several stages. First, bidders must post call bonds (*bonos de garantía*) that the government can call in if the bidder cannot finance the project. Similarly, performance bonds are callable if construction targets are not achieved by predetermined dates or if quality maintenance standards are not met. Second, banks lend money for construction of the road. The law stipulates that banks are the only financial institutions that may lend funds to finance construction. Third, after the road is built, the franchise owner can issue bonds backed by toll revenues (securitization). These coupon bonds are usually bought by private pension funds and insurance companies. Finally, the law stipulates that the franchise owner cannot securitize more than 70 percent of the debt, so as to induce good behavior in the maintenance and operations phase of the franchise.

The law states that the concessionaire must build the project within the time limits established in the contract and must provide an uninterrupted service of a quality consistent with the terms of the bid. The Ministry of Public Works (MOP) supervises the construction and operation of the project and is allowed to fine, suspend, or even terminate the concession should the franchise holder fail to meet its obligations. The law also establishes a dispute resolution mechanism for reviewing conflicts between the state and franchise holders.

30. The Law of Public Works Concessions (DFL MOP 164) and the Public Works Concessions Law Regulations (DS MOP 240), both of 1991.

The original list of roads to be franchised and the auction timetable has been changed repeatedly. Nevertheless, the highway projects that have been put to tender or have already been built can be classified into four groups: the Pan-American Highway (Route 5) from La Serena in the north to Puerto Montt in the south, which extends over approximately 1,500 kilometers and which was divided into eight double-lane segments (only two segments remain under construction); several highways joining Santiago with nearby cities (including Los Andes, San Antonio, and Valparaíso); a number of local roads (for example, Camino de la Madera, the road between Nogales and Puchuncaví, and the northern access to Concepción); and four urban highways in Santiago (namely, the Américo Vespucio beltway, the Costanera Norte highway, the General Velázquez north-south axis, and the Acceso Sur–Las Industrias highway).

The concessions program was launched in 1993 with the twenty-three-year El Melón tunnel franchise. The auction mechanism used was unnecessarily complex, although this can be forgiven as the initial test of a new system. Firms bid on a weighted average of seven variables: the annual subsidy by or payment to the state; the toll level and structure (composed of six different tolls, with different weights for different classes of vehicles); the term of the franchise; the minimum income guarantee; the degree of construction risk borne by the franchise holder; a score assessed on the basis of additional services; and a CPI adjustment formula. While only two of these variables (the toll rate structure and payment to the state) were given weights that would affect the final outcome, the result of the tender was unexpected. Four firms presented bids for the franchise, and they all demanded the maximum toll and franchise term allowed by the auction. The selection was decided solely on the basis of the annual payment to the state. This outcome was inefficient, since a lower toll and a smaller annual payment to the state would have been better. Apparently, the weights on the toll rate variable were set incorrectly. Another surprise was that the winner outbid the second-highest bid by a factor of almost three.

MOP experimented with other mechanisms in subsequent auctions. For example, the concessions for the northern access to Concepción, the Nogales-Puchuncaví road, and the Santiago–San Antonio highway (Route 78) were awarded to the firm bidding the lowest toll. In the case of the Pan-American highway, the government wanted similar tolls per kilometer across all segments of this route; the auction thus incorporated a

mechanism that made firms compete first on tolls and then, after a lower bound was reached, on either the shortest franchise term or a yearly payment to the state (which was described as a payment for preexisting infrastructure). Some segments that were thought to be privately unprofitable were awarded subsidies, which were supposed to be similar in volume to the amounts collected as payments for existing infrastructure.

Route 68, which joins Valparaíso with Santiago, was the first road franchised using a flexible-term PVR auction. The auction was held in February 1998. The project contemplated major improvements and extensions of the 130 kilometer highway, together with the construction of three new tunnels. Five firms bid, of which one was disqualified on technical grounds. The government offered an optional minimum traffic guarantee at a cost; two of the bidders chose to buy a guarantee, while the winner declined. Bidders could choose between two real rates to discount their annual incomes: either a fixed (real) rate of 6.5 percent or a variable (real) rate given by the average rate of the Chilean financial system for operations between ninety and 365 days. A 4 percent risk premium was added to both discount rates. Three firms, including the winner, chose the fixed discount rate. Somewhat surprisingly, the present value of revenue demanded by the winner was below the construction and maintenance costs estimated by MOP.<sup>31</sup> One possible explanation for this outcome is that the regulator set the risk premium (and hence the discount rate) too high, neglecting the fact that PVR auctions substantially reduce the risk faced by the franchise holder. A return on capital in the 10–20 percent range is obtained with a more reasonable risk premium of 1–2 percent.

MOP's main reason for using the PVR mechanism—apart from pressure by the Ministry of Finance (discussed below)—is that it facilitates defining a fair compensation should the ministry decide to terminate the franchise early. This is an important feature of PVR, since MOP estimates that at some moment before the franchise ends, demand will have increased sufficiently to justify a substantial expansion. The contract for the Route 68 concession allows MOP to buy back the franchise at any moment after the twelfth year of the franchise, compensating the franchise holder with the difference between the winning bid and the revenue received to date, minus a simple estimate of savings in maintenance and operational costs owing to early termination. No such simple compensation is available if the franchise term is fixed.

31. The former was U.S.\$374 million, while the latter was U.S.\$379 million.

One of the main virtues of the Chilean concessions program is that legislation has been effective at dispelling fears of expropriation, a key feature of any successful franchising program. An important part of the credit for this feature can be attributed to reforms implemented in Chile since the mid-1970s, which considerably strengthened property rights. Perhaps the most evident indicator that there is little fear of expropriation among franchise holders is that they have been quite happy with the “build now, regulate later” approach followed by MOP.

A second merit of the Concessions Law is the specification that all concessions must be awarded in competitive auctions, open to foreign firms. This proviso limits the scope for regulatory capture and outright corruption and provides a degree of transparency. In most cases, tenders were reasonably competitive, since with few exceptions, the number of bidders was between three and six. A third merit of the Chilean toll roads program is the absence of cost sharing agreements between the state and the franchise holder (though they were used early in the concessions program). In principle, though perhaps not in practice, cost overruns are paid in full by the franchise holder. Limited exceptions have been made in the cases of tunnels and bridges, where cost estimates are more uncertain.

One of the main shortcomings of the Chilean concessions program, however, is the lack of an external regulatory framework. MOP is in charge of designing, implementing, and supervising contracts. Each project has been designed independently, and its rules are defined by the specific contract. The tension between the pressures for the success of a concessions program measured in terms of construction and the enforcement of contracts is evident. MOP has chosen development over regulation, as most sectoral ministries do under such circumstances. For example, after signing the concession contract for Route 78, MOP required additional works that were not included in the original contract. The franchise holder asked for a compensation for the additional construction, and the ministry agreed to increase tolls by 18.1 percent during a five-year period to compensate the franchise holder. No further explanation was given (the public learned of the agreement only after it was signed), and the calculations for determining the compensation were not made public.<sup>32</sup> It is undesirable for MOP to renegotiate a contract to

32. See “Estado compensará a privados por concesión,” *El Mercurio*, 15 July 1997, page C8.

correct the deficiencies in its own projects, since the ministry will be reluctant to expose its own mistakes in designing a concession contract. Public interest would have been better served if an independent agency had determined fair compensation and publicized the social welfare computations.

There is growing evidence that MOP has been lax in enforcing concession contracts. For example, a report issued by the National Comptroller in October 2002 concludes that the ministry relies solely on traffic data provided by franchise owners, having neglected to set up independent means of measurement.<sup>33</sup> Since government guarantees are triggered by low traffic flows, firms have incentives to underreport traffic.<sup>34</sup>

It is also likely that MOP has developed projects with low social returns. Chile has had a social evaluation program for government-financed projects for more than two decades. This procedure, which is performed by the Ministry of Planning, ranks projects according to their social return and screens projects with low returns. MOP seems to have subverted this procedure by removing parts of the projects before submitting them to the Ministry of Planning. These components were reincorporated after the approval and adjudication of the project, via so-called complementary contracts with the franchise holder, which are privately renegotiated.<sup>35</sup> MOP has often claimed that it has estimated the expected outlays generated by traffic guarantees, but these estimates have never been made public. In those cases in which subsidies have been provided, the social project evaluations that justify the subsidies have not been made public, either.

During the early years of the franchise program, the government avoided renegotiations even in those cases in which they would have increased welfare, as in the case of the El Melón tunnel, so as to build a reputation for not renegotiating. More recently however, many highway projects have been renegotiated during the construction process. Twelve of the sixteen highway projects awarded by 1998 had been renegotiated by May 2002. The renegotiations generated thirty-one modifications to the original contracts, with a total value of U.S.\$518 million. These projects were originally valued at U.S.\$3.4 billion, which implies an average cost

33. "Contraloría critica sistema de control de concesiones," *La Tercera*, 22 April 2003.

34. In the case of Route 68, the concession length is inversely related to traffic flows.

35. See "Informe de la U. de Chile revela suerte de embaucamiento del MOP a MIDEPLAN," *La Segunda*, 13 May 2003.

increase of 15.4 percent. This average hides significant variations, however: in some cases the renegotiations were negligible, whereas the budget for one franchise increased by 112.7 percent. The conditions under which the contracts were renegotiated remain secret. Additional construction work or early completion of sections of the highways were repaid with extensions of the franchise length, direct payments from MOP, higher tolls, early operation of toll booths, and reductions in other construction work. There was no external supervision to ensure that the renegotiation process was fair.

MOP's objective of attracting bidders conflicts with those of the Ministry of Finance, which is responsible for the budgetary process. This has forced an independent evaluation of the toll road program and provides a check on MOP's activities. Press reports suggest that on more than one occasion the Ministry of Finance successfully stopped MOP from offering particularly generous government guarantees to franchise holders. The Ministry of Finance worries that the budget will be affected if guarantees become effective. More generally, however, MOP can transfer rents to franchise owners via favorable regulations. These transfers are unlikely to worry the Ministry of Finance if the budget is not affected.

The Chilean concessions program shows signs of worsening. The first symptom was the case of TRIBASA, a large infrastructure company from Mexico that was an important participant in the first stage of Mexico's franchise program. At that time, it was saved from bankruptcy by the Mexican government. Notwithstanding that experience, it became an aggressive participant in Chile's infrastructure program and was awarded three major franchises: the northern access to Concepción, and the Chillán-Collipulli and Santiago-Los Vilos segments of the Pan-American Highway. The latter included complementary contracts worth almost 50 percent of the original project. After completing the northern access to Concepción, the firm ran into liquidity problems and sold the Chillán-Collipulli concession in July 1999. Moreover, the northern access to Concepción has been plagued by unconfirmed rumors of deficient construction, and associated MOP project supervisors are under investigation. In 2000, TRIBASA was late in completing the Santiago-Los Vilos section of the Pan-American Highway. MOP allowed the delays to accumulate without collecting the performance guarantees TRIBASA had posted.<sup>36</sup> Public

36. At the time, TRIBASA was going bankrupt in Mexico, and it later went bankrupt in Chile.

pressure eventually forced MOP to acknowledge the breach of contract. The franchise was transferred from TRIBASA to another concessionaire without a formal auction procedure.

The Chilean government recently decided to provide the franchisees with an ex post insurance contract, in which it insures traffic flows higher than the minimum guaranteed in the original contract in exchange for additional works. MOP argues that since it is more optimistic than franchise holders about future growth rates of the economy, there is room for a mutually beneficial agreement. The problem with this argument, of course, is that by believing in a sufficiently high growth rate, MOP can grant the franchise holders any subsidy they desire. There is no limit (and no independent assessment) to the space for mutually beneficial agreements. A further problem is that the franchise holder pays for the insurance by building additional works that are not assigned competitively. The franchise owner may thus be receiving an additional subsidy from MOP.

### *Some Conclusions from the Country Evidence*

This small sample of countries illustrates recurring problems in highway franchises. First, contract renegotiation has been pervasive. This really is not surprising—as Williamson points out, franchise contracts are inherently incomplete.<sup>37</sup> Moreover, the possibility of open-ended renegotiations tends to attract bidders that specialize in negotiations rather than in the operation of the contract. Second, the system has no governance structure: regulation and supervision are entrusted to the same agency that designs the projects. Third, fixed-term franchises exacerbate the problems of long-term contracts by needlessly increasing demand risk and by institutionalizing inflexibility.

The country evidence thus casts doubts on the proposition that privatization is always better than the traditional approach. The success of privatization clearly hinges on a well-structured regulatory framework, in which regulators are independent of the agency in charge of promoting franchises.

37. Williamson (1976).

## Highway Franchising: When and How

This section addresses the basic question of when privatization is desirable. In our previous work, we rule out, by assumption, government transfers to the franchise holder (the self-financing constraint) and then find the franchise contract that makes the optimal trade-off between demand risk and toll distortions.<sup>38</sup> We also show that this contract can be implemented with a PVR auction. These results are briefly reviewed in the first three subsections, below. Imposing the self-financing constraint rules out the possibility that the traditional approach—or any approach that requires government transfers to the franchise holder—could be optimal. Nevertheless, pervasive renegotiations and government guarantees reveal a tendency to privatize profits but socialize losses. It is therefore realistic to relax this constraint, allowing the government to subsidize the franchise holder (at a cost). We do this in the subsequent two subsections.

Relaxing the self-financing constraint allows us to formally derive conditions under which the traditional approach is better than BOT. We find that with the exception of a knife-edge parameter configuration, if the optimal contract involves government transfers, then BOT is suboptimal and the traditional approach should be preferred. When BOT is optimal, neither government guarantees nor subsidies are desirable. Hence, BOT contracts that involve government transfers are always suboptimal.<sup>39</sup>

We also use this extended theoretical framework to debunk the cost-of-funds argument often given in favor of privatizing highways. According to this argument, the private approach to highway provision is better than the traditional approach because private firms have a lower cost of financing projects, as government revenue is collected through distortionary taxes. This argument is incorrect because it ignores the possibility that governments can collect tolls on publicly owned highways; these tolls can reduce distortions in the case of congestion, thus providing a double dividend. On the other hand, an apparently unnoticed advantage of privatization is that the government highway agency manages fewer funds, and we show formally that this may be an argument in favor of the BOT approach if the agency is corrupt or inefficient.

38. Engel, Fischer, and Galetovic (1997, 2001).

39. This does not exclude the possibility of subsidies for the construction of socially desirable projects that are not privately profitable (see Engel, Fischer, and Galetovic, 2003), but it excludes subsidization of projects in which all the benefits are internalized by users.

Our theoretical framework only partly captures the central role of opportunistic renegotiations uncovered in our review of the regional experience. Indeed, the likelihood of renegotiations increases with the degree to which the franchise holder is forced to bear (uninsurable) demand risk. In the final subsection, we directly model renegotiations and the related concept of franchise contract flexibility. We show that a PVR franchise grants flexibility to the regulator without inducing opportunism, unlike its fixed-term counterpart.

### *A Simple Model*

For simplicity we assume that demand for the road is constant and completely inelastic.<sup>40</sup> Demand may be high ( $Q_H$ ), with probability  $\pi_H$ , or low ( $Q_L$ ), with probability  $\pi_L$ , where  $\pi_L = 1 - \pi_H$  and  $Q_H > Q_L$ . The cost of building the highway is the same for all firms and equal to  $I$ . There are no maintenance or operation costs, and the toll is equal to  $P$ , which is constant across demand states given our assumption of completely inelastic demand.<sup>41</sup> After the franchise ends, toll revenue goes to the government. All firms are identical, risk-averse expected-utility maximizers, with preferences represented by the strictly concave utility function,  $u(\cdot)$ .<sup>42</sup>

### *The Planner's Problem*

We begin with the problem solved by a benevolent planner who knows  $I$ . Denote the present value of toll revenue received by the franchise holder with high demand by  $PVR_H$  and with low demand by  $PVR_L$ . Then,

40. This follows Engel, Fischer, and Galetovic (1997). All the results in this section can be extended to the more realistic case of incompletely inelastic demand; see Engel, Fischer, and Galetovic (2001, 2003).

41. Ignoring maintenance and operations costs is not a serious limitation for two reasons. First, these costs are usually much smaller than the cost of building the highway. Second, if maintenance and operations are proportional to road usage, which often is a good approximation, then our framework extends trivially to the case with maintenance and operations costs, as follows: the regulator estimates per-user maintenance, and firms bid on the PVR of toll revenue, net of maintenance costs. Since maintenance costs are roughly proportional to road usage, the only residual source of risk will be errors in the estimates of maintenance costs and operational costs, both of which are minor.

42. This should be interpreted as a reduced form for an agency problem that prevents the franchise holder from diversifying risk. See Engel, Fischer, and Galetovic (2001, appendix D) for a model along these lines.

$$(1) \quad PVR_i \equiv \int_0^{T_i} PQ_i e^{-rt} dt = \frac{PQ_i(1 - e^{-rT_i})}{r}, \quad i = H, L,$$

where  $r$  is the discount rate, common across firms and the planner, and  $T_H$  and  $T_L$  denote the length of the franchise when demand is high or low, respectively.

The maximization problem assumes that the planner wants to transfer the fewest resources to the project.<sup>43</sup> It also assumes that the planner can collect toll revenues after the franchise ends and then use this revenue to reduce taxes that generate distortions,  $\lambda_\tau > 1$  per dollar, in the rest of the economy. Since private participation is voluntary, the planner solves the following problem:

$$(2) \quad \begin{aligned} \text{Min} \quad & \sum_{\{T_H, T_L\}} \sum_{i=H,L} \pi_i \left[ PVR_i - (\lambda_\tau - 1) \left( \frac{PQ_i}{r} - PVR_i \right) \right] \\ \text{s.t.} \quad & \sum_{i=H,L} \pi_i u_i(PVR_i - I) = u(0), \end{aligned}$$

where  $u(0)$  is the level of utility attained by a firm not undertaking the project.

$PVR_L = PVR_H = I$  solves the planner's problem. Since the franchise holder is risk-averse, complete insurance is efficient. The planner thus fixes any toll that ensures that the franchise holder loses no money when demand is low (that is,  $P \geq rI / Q_L$ ).<sup>44</sup> Since  $Q_H > Q_L$ , it follows from equation 1 that the planner chooses  $T_H < T_L$ , so that the term of the franchise is shorter when demand is high. Users pay the same amount in both states of nature and thus face no risk.

### *The Optimal Auction*

We use this model to study highway auctions. Consider first the standard auction mechanism whereby the government sets a fixed franchise term, and firms bid tolls. Under competitive conditions, the winning bid,  $P$ , satisfies

43. A more general objective function results when demand is not infinitely inelastic; see Engel, Fischer, and Galetovic (2001).

44. There is no loss of efficiency, given that demand is perfectly inelastic. As mentioned earlier, this assumption can be relaxed.

$$(3) \quad \sum_{i=H,L} \pi_i u_i \left[ \frac{PQ_i(1 - e^{-rT}) - I}{r} \right] = u(0),$$

which means that  $PQ_H(1 - e^{-rT}) > I > PQ_L(1 - e^{-rT})$ . The winning bid does not reproduce the planner's solution, since the winning bidder is required to face risk.

An alternative auction mechanism is to have bidders compete on the present value of toll revenue they require to finance the highway. In this case, the winning firm bids PVR such that

$$\pi_L u(PVR - I) + \pi_H u(PVR - I) = u(0),$$

and the winning bid satisfies  $PVR = I$ . It follows that a PVR auction implements the social optimum derived in the preceding subsection. Furthermore, the planner can implement the optimal contract using a PVR auction even if the values of  $I$ ,  $\pi_i$ , and  $Q_i$  are not known.

### *Subsidies and the Cost-of-Funds Argument*

It is often claimed that highway franchising is desirable because private firms have access to funds at lower cost, whereas governments must resort to distortionary taxation to finance highways. Is that enough to make the case for highway franchising? We now relax the self-financing constraint and allow for transfers from the planner to the franchise holder. We thus extend the model to allow for both traditional contracts, in which governments finance roads, and BOT contracts.

Assume that the government subsidizes the project in amounts  $S_H, S_L \geq 0$  depending on the state of demand. Then equation 2 extends to

$$(4) \quad \begin{aligned} \text{Min}_{\{T_H, T_L, S_H, S_L\}} \sum_{i=H,L} \pi_i & \left[ (PVR_i + \lambda_\tau S_i) - (\lambda_\tau - 1) \left( \frac{PQ_i}{r} - PVR_i \right) \right] \\ \text{s.t.} \quad \sum_{i=H,L} \pi_i u_i & (PVR_i + S_i - I) = u(0). \end{aligned}$$

Any combination of  $T_H, T_L, S_H,$  and  $S_L$  such that the franchise holder's income in both states is equal to  $I$ —that is,  $PVR_i + S_i = I, i = H, L$ —solves this problem. The planner's optimum can be attained with no subsidies at all, by setting  $PVR_i = I$  and  $S_i = 0, i = H, L$ . Alternatively, the road can be financed only with subsidies, by setting  $S_i = I$  and  $PVR_i = 0, i = H, L$ . The

former solution can be attained with a PVR auction, while the latter corresponds to the traditional approach. This multiplicity of possible subsidy-toll combinations indicates that distortionary taxation ( $\lambda_\tau > 1$ ) is not sufficient to make BOT contracts preferable.

The standard line of reasoning is that subsidies are a more expensive means of financing roads, because they are paid from distortionary taxes. This argument suggests that the franchise holder should finance the road's construction cost by resorting to subsidies (and the ensuing distortions needed to finance them) only when strictly necessary. This ignores an essential aspect of highway franchising, namely, that the highways may also be used to collect public funds, which can be used to reduce distortionary taxes elsewhere.<sup>45</sup> Hence, under the assumptions we made above, one additional dollar of government subsidy generates one additional dollar of toll revenue for the government. This becomes apparent if we rewrite the objective function of equation 4 as

$$\sum_{i=H,L} \pi_i \lambda_\tau (PVR_i + S_i),$$

where we have ignored a term that does not depend on the planner's choice variables.<sup>46</sup> Social welfare depends on total transfers to the franchise holder, regardless of whether these come in the form of a subsidy or toll revenue.

### *When Is Franchising Desirable?*

We have shown that the cost-of-funds argument is not sufficient to justify franchises in our model, but we have not modeled other alleged advantages of BOT contracts. One of the main arguments in favor of franchises is that governments are unable to induce the public works ministry to spend efficiently, perhaps because of political economy considerations. This argument can be captured, in an admittedly simplified manner, by assuming that subsidies are costly. We thus let  $\lambda_s \geq 1$  be the cost of ensuring that one dollar of subsidies intermediated by the public works ministry

45. For example, under the franchise contracts considered earlier, the government collects all tolls after the franchise ends. The government could also obtain a fraction of toll revenue during the franchise period.

46. The problem at hand is analogous to the one faced in the case without government transfers, with  $PVR_i + S_i$  in the role of  $PVR_i$ .

reaches the franchise holder's pocket. This leads to the following planner's problem:

$$(5) \quad \begin{aligned} \text{Min}_{\{T_H, T_L, S_H, S_L\}} \sum_{i=H, L} \pi_i & \left[ (PVR_i + \lambda_S S_i) - (\lambda_\tau - 1) \left( \frac{PQ_i}{r} - PVR_i \right) \right] \\ \text{s.t.} \quad \sum_{i=H, L} \pi_i \mu_i (PVR_i + S_i - I) & = u(0). \end{aligned}$$

Note that  $S_i$  is multiplied by  $\lambda_S$  in the planner's objective function, but not in the franchise holder's participation constraint. The solution to this problem depends on whether  $\lambda_S$  is larger than, equal to, or smaller than  $\lambda_\tau$ .<sup>47</sup> If  $\lambda_S > \lambda_\tau$ , the optimal contract involves no government subsidies and the same present value of toll revenue,  $I$ , for the franchise holder in all states of demand; this contract can be implemented with a PVR auction. If  $\lambda_S = \lambda_\tau$ , which is the case considered in the previous subsection, the planner's optimum can be implemented via any combination of  $T_i$  and  $S_i$ ,  $i = H, L$ , such that  $PVR_i + S_i = I$ ,  $i = H, L$ ; this includes, in particular, the BOT contract associated with a PVR auction and the traditional approach to highway financing, whereby the road is fully financed with general funds. Finally, if  $\lambda_S < \lambda_\tau$ , the optimal contract is such that all income received by the franchise holder comes from subsidies; direct government financing is to be preferred to a BOT contract in this case.

It follows from this result that the desirability of franchising highways is closely connected with the self-financing constraint: when  $\lambda_S > \lambda_\tau$  the planner would prefer to avoid transferring money to the franchise holder, and this imposes the self-financing constraint. A corollary is that guarantees, which are transfers contingent on traffic being low, are undesirable whenever privatization is optimal. Furthermore, and again except for a borderline case, profit sharing arrangements are never optimal even if we ignore their negative effect on incentives.

Our result raises the question of whether one of the three parameter configurations ( $\lambda_S > \lambda_\tau$ ,  $\lambda_S = \lambda_\tau$ , or  $\lambda_S < \lambda_\tau$ ) is more likely to prevail in practice. We argue next that the most relevant case is  $\lambda_S > \lambda_\tau$ . Indeed,  $\lambda_\tau$  in equation 5 captures the distortions associated with distortionary taxation. These distortions are also part of  $\lambda_S$ , since government transfers to the franchise holder are generally financed with tax revenue.<sup>48</sup> Yet  $\lambda_S$  also

47. Engel, Fischer, and Galetovic (2003).

48. See Engel, Fischer, and Galetovic (2003).

includes any source of additional inefficiency associated with the highway agency's management of resources. Even the slightest inefficiency—and the country case studies suggest the presence of inefficiencies—leads to the conclusion that  $\lambda_s > \lambda_r$ . It then follows that highway privatization should indeed be preferred over the traditional approach. With the traditional approach, the government agency manages more money than with the BOT approach, thereby increasing the scope for inefficient management by this agency (for example, in the form of regulatory capture or outright corruption). Privatization is better because it limits resources managed by the government. Of course, our model does not consider elements that may point in the opposite direction, such as the greater possibility of opportunistic behavior under BOT contracts than under the traditional approach.

### *Modeling Flexibility*

A desirable feature of a franchise contract is that it should be easy to calculate fair compensation for breach of the original contract. Suppose that the project must be expanded or rates must be increased for efficiency reasons. How should expansion costs be divided among the franchise holder, the government, and users? How much of the additional income from user fees is to be appropriated by the franchise holder?

In such cases, two options are open to the planner. The first is to renegotiate, which carries with it all the problems of bargaining in a situation of bilateral monopoly. The second option is to cancel the concession and pay a fair compensation for the profits forgone by the franchise holder. The fair compensation is the expected present value of future profits had the concession continued under the original terms. This amount cannot be deduced from accounting data and is highly subjective, so endless disputes are likely.<sup>49</sup>

The issue of flexibility also arises when user fees are set. In the case of a fixed-term franchise, it is advisable to reduce risk by specifying the schedule of user fees (in real terms) before the franchise begins. Yet this often leads to fees that are *ex post* inefficient. For example, consider an urban highway that is franchised for twenty years. The high demand uncertainty discussed earlier implies that user fees set in advance will

49. The case of Orange County's State Route 91 Express Lanes vividly illustrates this problem; see Engel, Fischer, and Galetovic (2002) for details.

almost surely lead to either inefficiently high levels of congestion or politically untenable levels of underutilization. In contrast with fixed-term contracts, PVR franchises are amenable to changes in user fees to respond to changes in demand, since tolls may vary substantially without affecting the franchise holder's present value of user-fee income.<sup>50</sup> In the urban highway example, a PVR contract could stipulate that tolls will be reset every year by an independent agency or commission in response to demand conditions, so that users internalize congestion costs.<sup>51</sup>

A useful definition of flexibility is that one party can act as if the original contract does not exist.<sup>52</sup> The problem is that flexibility may be misused. On the one hand, giving regulators the right to cancel the contract whenever they see fit may lead to opportunistic expropriation. This is particularly serious for infrastructure projects, in which most of the costs are sunk, so investors are exposed to regulatory takings. On the other hand, renegotiation may allow firms to obtain opportunistic benefits.

To formalize this, let  $\theta_i$  be the per-period flow of additional social benefit obtained in state  $i$  when the original contract is not carried out and an additional investment  $\Delta I$  is made. We assume that the contract is cancelled at time  $t = 0$ . We also assume

$$(6) \quad \frac{\theta_L}{r} - \Delta I < 0 < \frac{\theta_H}{r} - \Delta I,$$

so that it is socially convenient to cancel the contract and invest  $\Delta I$  only in the high-demand state. Also, let  $R_i \equiv PQ_i$  denote the flow of revenue per period in state  $i$  if the contract is executed and the additional investment is not made. As before, we assume that all uncertainty dissipates just after the road has been built. Also as before, the planner's objective is to transfer the least resources possible to the franchise holder.

50. Profits are affected, since the franchise term determines maintenance and operational costs, yet the PVR contract can be modified to incorporate maintenance costs. See footnote 41.

51. Discretion in toll setting may be limited by fixing a lower and upper bound (in real terms) on possible tolls.

52. For flexibility to be socially desirable, it should incorporate the objectives of the theory of contract remedies: "A key objective of an enforcement system is to induce a party to comply with its obligations whenever compliance will yield greater benefits to the promisee than costs to the promisor, while allowing the promisor to depart from its obligations whenever the cost of compliance to the promisor exceeds the benefits to the promisee" (Schwartz and Sykes, 2002).

The contract should be renegotiated and  $\Delta I$  invested if and only if  $\theta_i / r - \Delta I \geq 0$ , that is, when the present value of the social benefit obtained by investing,  $\theta_i / r$ , exceeds its cost,  $\Delta I$ . From equation 6 it follows that an optimal complete contract allows the regulator to buy back the project only in state  $H$  and paying the franchise holder  $PVR_H$ , which is the amount that would have been received had the contract not been modified. Nevertheless, demand states are not verifiable in practice, since  $PVR_i$  is difficult to estimate; this implies that such a contract cannot be enforced.<sup>53</sup>

To ensure that  $\Delta I$  is invested only when it is socially desirable, the regulator may be allowed to cancel the contract at will with no compensation, under the condition that it invests  $\Delta I$ . The problem is that this arrangement makes it attractive for the regulator to cancel the contract not only in the high-demand state, but also in the low-demand state, and it is therefore not optimal. When the low-demand state materializes, the incremental benefit of canceling the contract and investing is equal to the difference between the planner's benefit with and without the expansion:

$$\left[ \int_0^{\infty} (\theta_L + R_L) e^{-rt} dt - \Delta I \right] - \int_{T_L}^{\infty} R_L e^{-rt} dt = \frac{\theta_L}{r} - \Delta I + PVR_L.$$

It follows that the planner expropriates the franchise owner to cash in  $PVR_L$  as long as  $(\theta_L / r) + PVR_L > \Delta I$ , a condition which holds when the franchise holder's original revenue exceeds the cost of the expansion.<sup>54</sup>

Next consider a PVR auction coupled with the following clause: the regulator can cancel the contract at will but only after paying the winning bid, denoted by  $B$ , to the franchise holder. Contrary to a fixed-term franchise, in which  $PVR_i$  differs across states, with a PVR auction  $PVR_i$  is the verifiable outcome of the auction,  $B$ , and is the same across states. This amount can be written in an enforceable contract.

In this case, the government has the right incentive to cancel the contract, that is, it cancels only in the high-demand state. In the low-demand state, the incremental benefit from canceling and investing  $\Delta I$  is

53. One could arguably write a contract in which the government can expropriate the franchise holder only after paying  $PVR_H$ . While true in this model with only two states of nature, it is not possible in a model in which terminating the contract is efficient in at least two states, since the scope for opportunism by one of the parties remains.

54. In particular, for a PVR auction, the condition above simplifies to  $(\theta_L)/r + I > \Delta I$ .

$$\left[ \int_0^{\infty} (\theta_L + R_L) e^{-rt} dt - \Delta I - B \right] - \int_{T_L}^{\infty} R_L e^{-rt} dt = \frac{\theta_L}{r} - \Delta I,$$

where no expansion takes place if the contract is not renegotiated. Under PVR we also have

$$\int_0^{T_L} R_L e^{-rt} dt = B = I.$$

It follows from equation 6 that the regulator does not cancel the contract in the low-demand state.

Consider next the high-demand state. In this case the incremental benefit of canceling the contract is:

$$\begin{aligned} & \left[ \int_0^{\infty} (\theta_H + R_H) e^{-rt} dt - \Delta I - B \right] - \left[ \int_{T_L}^{\infty} (\theta_H + R_H) e^{-rt} dt - e^{-rT_H} \Delta I \right] \\ & = (1 - e^{-rT_H}) \left( \frac{\theta_H}{r} - \Delta I \right), \end{aligned}$$

where the regulator expands the road at the end of the franchise should the contract not be canceled (see the second term in the second set of brackets on the left-hand side). Again, under PVR we also have

$$\int_0^{T_H} R_H e^{-rt} dt = B = I.$$

The key point of the optimality result derived above is that the value of the concession for the franchise holder,  $B$ , is the same in all states of demand. By contrast, this value is state contingent with a fixed-term contract because  $PVR_H > PVR_L$ .

## Conclusion

Highway franchising promises to combine the benefits of privatization with the advantages of competition. To achieve this goal, franchises should be periodically reaucted, thereby letting competition *for* the field substitute for competition *in* the field. Just as Demsetz argues for utilities, competition should yield tolls equal to average costs, no excess profits, and projects that are run efficiently even though highways are local

monopolies.<sup>55</sup> In practice, these avowed benefits of franchising have not materialized thus far because government guarantees and pervasive contract renegotiations have allowed firms to shift losses to taxpayers. Profits remain in firms' pockets, while losses are socialized. Renegotiations in Argentina, Colombia, and Chile illustrate the common experience with franchising in Latin America, which is not limited to highway franchises. Guasch examines more than 1,000 concessions awarded during the 1990s and finds that terms changed substantially within three years in over 60 percent of the contracts.<sup>56</sup>

As Williamson points out, franchise contracts are inherently incomplete.<sup>57</sup> He argues that opportunistic behavior will inevitably emerge unless franchises are regulated more or less like standard monopolies and a governance structure is set up. Does the Latin American experience with highway franchising suggest, then, that countries chose the wrong model? The international experience demonstrates the inadequacies of the "privatize now, regulate later" approach that governments have followed. The root of the problem is that the government agency that promotes franchises is almost always also in charge of monitoring compliance with the incomplete contract. The result is lax enforcement, because these agencies are usually embedded in the ministry in charge of building public works, whose objective function is to build as much as possible. This probably explains why governments subsidize firms that have made incorrect decisions. Renegotiations occur, however, even after roads have been built and sunk. If a government wants to franchise new projects, it will be easier to attract bidders if the regulators are seen to be soft on current concessionaires, which might also be the participants in future franchise auctions. The desire for future investment softens the regulator and increases the likelihood of a contract renegotiation. An alternative (or complementary) explanation is a rather more direct form of regulatory capture. For example, concessionaires in Chile made irregular payments to MOP (and to façade companies closely related to MOP), which suggests that franchise owners obtained financial favors in exchange for such payments.<sup>58</sup>

Regardless of the means by which countries choose to privatize highways, a separate regulatory authority should be established to monitor

55. Demsetz (1968).

56. Guasch (2001).

57. Williamson (1976).

58. These transfers are currently being investigated by the judiciary.

compliance with contracts. Should countries do away with temporary franchises? Our formal analysis suggests that if they deem subsidies (and guarantees) desirable or unavoidable, they should seriously consider returning to the traditional model of state-financed highways. On the other hand, if they are convinced about the advantages of privatizing roads, they should impose credible self-financing constraints on the projects.<sup>59</sup> If privatization is chosen subject to the previous caveats, then temporary franchises that are periodically reauctioned offer a mechanism for introducing competition, provided that fixed-term franchises are abandoned in favor of present-value-of-revenue auctions. As we have shown, present-value-of-revenue contracts reduce the motivations behind opportunistic renegotiations and guarantees, because they reduce demand risk and allow considerable flexibility in modifying contracts for the right reasons.

59. At least for those projects in which users internalize all benefits.

## Comments

**Ernesto Schargrodsky:** In the 1990s, many Latin American countries transferred the operation of several economic activities from public to private provision. There is currently no agreement on the welfare evaluation of this privatization process. Public opinion polls and press articles suggest widespread discontent with privatization, whereas academic research shows improved results under private operation relative to public performance.<sup>1</sup> This divergence of opinions may reflect the fact that the benign impact of privatization was below original expectations.

Engel, Fischer, and Galetovic look at the Latin American experience of highway privatization. The provided evidence suggests that the promised benefits of privatization failed to materialize. In this sector, contract renegotiations and opportunism were pervasive, the diversion of public funds to bail out franchise holders was frequent, and consumers sometimes ended up worse off after privatization. The authors look at one of the sectors in which privatization results were most disappointing and ask themselves, in a thoughtful and unbiased analysis, how to improve franchising design and when highway franchising is superior to public operation.

Two main contributions for the improvement of highway provision stand out from their work. The first regards the appropriate franchise term structure. Most concessions were awarded using fixed-term contracts, which make franchise holders bear the demand risk and thus creates pressure for subsidies and guarantees during bad states. The authors suggest the use of present-value-of-revenue (PVR) auctions, in which all demand risk is borne by the state (which ultimately bears it in practice after inefficient renegotiations). Under these contracts, franchises are automatically extended in low-demand states, so franchisers do not need to ask for bailouts. PVR auctions offer the additional advantage of reducing con-

1. See, for example, IDB (2002), McKenzie and Mookherjee (2002), and Chong and Lopez-de-Silanes (2003).

tractual incompleteness. The contract indicates the noncontingent amount that the state should pay when it prefers to buy back the project.<sup>2</sup>

The second contribution lies in the analysis of the cost-of-funds argument and the desirability of highway privatization. As they explain, a typical argument in favor of highway franchising is that private firms have access to funds from toll revenue at lower social costs than public sector funds obtained from distortionary taxation. They show the fallacy of this argument: the government can also use the highways for fund collection, reducing distortionary taxes elsewhere. The desirability of highway franchising then depends on the relationship between inefficiencies in subsidization and tax distortions. Although franchises with government subsidies and guarantees are very frequent in practice, the authors show that when government subsidies are required (on grounds other than externalities), full public highway provision should be preferred over privatization.

In addition to these insights, the article opens several roads for empirical research. First, a remaining question is whether highway franchising has improved or diminished social welfare. The evidence provided in this paper focuses the discussion about the success or failure of franchising on supply variables, such as contract characteristics, investment, and frequency of renegotiations. The analysis could usefully be furthered by a study of the impact of privatization on variables measuring users' welfare, such as transportation costs, motor-vehicle insurance costs, or road accidents. The impact on taxpayers could also be quantified. Of course, the relevant counterfactual should be public provision, not a comparison with the first best.

Second, it would be interesting to analyze the main determinants of the likelihood of renegotiation. The authors argue that the two flaws in regulatory design that induced opportunistic renegotiations were the use of fixed-term contracts and the lack of a proper *ex ante* regulatory structure. The effect of these contractual characteristics could be confirmed through empirical study on a sample of highway franchises.

2. PVR contracts, however, could facilitate corruption, a pervasive problem in public contracting in Latin America. It may be less scandalous for a corrupt regulator to allow for revenue underreporting, which would extend the franchise length under PVR, than to extend the length of a fixed-term concession. The contract-theory advantages of PVR may not compensate for the political economy disadvantages.

Finally, it would be productive to examine why privatization has been particularly unsuccessful in this sector.<sup>3</sup> The features described in this article are not exclusive of highway franchising. Other privatized activities also suffered from high demand risk, were transferred to private operation under the “privatize now, regulate later” approach, or used fixed terms in concession contracts. Future cross-industry comparisons could shed light on the determinants of the problematic performance of the highway sector.

**Juan-Pablo Montero:** After reviewing the highway privatization experience of three Latin American countries (Argentina, Colombia, and Chile), Eduardo Engel, Ronald Fischer, and Alexander Galetovic raise two very relevant policy questions in their paper. First, when is privatization (that is, BOT contracts awarded in an auction) as opposed to government provision the right policy choice in the provision of infrastructure? Second, if privatization is to be pursued, what is the best privatization mechanism?

As mentioned in the paper, the arguments in support of privatization include the following: it eliminates the need to raise new taxes; it reduces construction and operation costs (for a given level of quality monitored by the authority); it is more desirable on distributional grounds since the road is financed directly by its users; and it effectively screens projects that are not socially attractive (that is, it prevents the building of white elephants). The authors argue that many of these benefits have failed to materialize for the countries studied. They attribute this outcome to the lack of an adequate regulatory framework prior to privatization and flaws in the privatization design (namely, the use of fixed-term auctions).

Highways are typically franchised using a fixed-term auction, and companies bid on the lowest toll or highest payment to the government. Because road provision is subject to significant demand uncertainty, fixed-term auctions have a serious shortcoming: they cannot adapt to different realizations of demand (the franchise holder may either go bankrupt or make more than normal profits), and they are thus likely to prompt undesirable contract renegotiations. Given that uncertainty is mostly exogenous to the firm providing the service, the authors propose an ingenious mechanism (which is fully explained in a series of their papers) for addressing this shortcoming: a present-value-of-revenue (PVR) auction. One of the main arguments in the paper is that the use of this approach as

3. Bid rigging also seems to be particularly pervasive in this industry.

opposed to fixed-term auctions can greatly help materialize the benefits from privatization.

I agree with many of the points made by the authors. The theoretical arguments deployed in the paper (and in closely related papers) for the use of PVR are very compelling: it can prevent white elephants, solve the adverse selection problem of cost differences, facilitate renegotiation when this is socially beneficial and prevent it when it is not. However, the evidence presented in the paper raises some important issues that are only partially addressed. The first is a political-economy question. If PVR is unambiguously superior to fixed-term auctions in terms of managing demand uncertainty (and not inferior in other aspects, at least after some design accommodations are incorporated to prevent, for example, lower effort to maintain quality), then why has this auction scheme not been adopted more widely in Latin America and other regions? I fully agree with Engel, Fischer, and Galetovic that PVR seems to be the best approach if privatization is to be pursued. Before policymakers implement this approach further, however, they need to better understand the reasons for its limited use today.

The second issue requires the construction of a counterfactual—not a trivial task. What would have happened if PVR, as conceived by the authors or even as implemented in Colombia without discounting revenues, had been used more widely in the countries studied? How much of the unfortunate renegotiation process discussed in the paper would have been avoided? My impression is that not much would have changed, because most of the renegotiations occurred right after the franchise was awarded and during the construction process, that is, before demand realization. I do believe, however, that PVR would have certainly helped to prevent undesirable renegotiations along the road.

The third issue concerns the net benefits of this imperfect privatization process relative to continuing to rely on the traditional approach of government provision. The evidence discussed by the authors makes it clear that many of the benefits of an ideal privatization process have not materialized. Engel, Fischer, and Galetovic go further and suggest that this evidence raises the possibility that privatization may not be the right policy at all. Given the poor government record on infrastructure provision, I find it hard to believe that the privatization programs carried out in the different countries have, on average, not provided substantial net benefits. Rather

than exploring the magnitude of these net benefits (which is quite demanding), the authors generate a theoretical model to address the question of whether highway franchising is desirable. Unfortunately, the analysis in this section sheds little light on the policy debate because it fails to incorporate the very elements that are responsible for the poor government record that prompted the privatization programs in the first place. Furthermore, if I restrict my focus to the model in equation 4, I would argue that franchising is never optimal because the government can use roads as efficient money revenue machines. Since demand for road use is quite inelastic (totally inelastic in the model), it pays to increase its price beyond what is needed for self-financing (as in franchising) and reduce distortionary taxation elsewhere.

With regard to the two policy questions laid out above, Engel, Fischer, and Galetovic do an admirable job on the second question by presenting an alternative, more flexible approach to franchising that is easy to implement in practice. Although the reasons for its limited use are not yet evident, the one message that is clear from this paper is that PVR auctions should always be considered in a privatization program. On the first question, however, the analysis is less insightful. Neither the case studies nor the theoretical model makes a clear case as to when franchising is superior to the traditional approach of public provision. If anything, the poor government records on infrastructure provision suggest that the privatization programs have provided substantial net benefits. I would rather have a monopolized market than no market at all.

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