An Economic Argument for Privatization of Highway Ownership

DAVID GELTNER AND FRED MOAVENZADEH

There are four potential economic justifications for privatizing highways: greater revenues without increased taxes, improved highway use efficiency, production efficiency of maintenance, and quality of highway services. However, because of market imperfections of laissez-faire private provision of highways, the economic feasibility and desirability of privatization depend on regulatory structures to efficiently control and mitigate potential problems of excess tolls and inadequate maintenance. Possible types of regulatory structures are discussed.

Throughout history, and in virtually all lands, most highways have been built, owned, and maintained by governments. There have been some important exceptions to this rule, perhaps most notably the case of Great Britain during the Industrial Revolution before the advent of the railroads. But for the most part, highways have been part of the government sector. There are no doubt several reasons for this, including military and political concerns, especially in previous times or other countries, but one of the most fundamental reasons why government ownership of highways is so widespread is that it may often be more economically efficient for the government to provide highways than to leave this task to the private sector.

The reason for this is that highways are subject to various types of "market failure," or market "imperfections," in economic jargon. Because of this, the private highway market could not be expected to behave according to the classical model of "perfect competition" in which rational private agents are guided "as by an invisible hand" to an efficient (i.e., welfare-maximizing) outcome in equilibrium without any centralized control. As a result, even though profit maximization might lead private owners to be efficient with regard to the internal cost of highway production, the overall highway market would not be efficient in the "allocative" sense. That is, the efficient quantity or quality of highways would not be provided by the private sector, or the highways that were provided would not be used efficiently, or both. In other words, society's allocation of its production and consumption capabilities between highways and other goods would not be efficient.

There are a number of reasons for market failure in the case of highway production: *(a)* Some highways (namely, nontoll roads) are "nonexcludable" goods (i.e., nontoll roads are like "public goods" in that consumers cannot be excluded from "consuming" whatever level of highway quality is provided). *(b)* Highway supply cannot be perfectly competitive because, even though there would be some competition between parallel highways or alternative routes between two points, no two highways would be perfect substitutes due to geographic uniqueness (thus, private highways would have "market power," like monopolies or cartels, and it would be found feasible and advantageous to charge tolls that were too high and to provide too little quantity or quality of road, from a social perspective). *(c)* Related to the preceding two points are "externalities" associated with highway production (i.e., costs or benefits of producing highways that cannot be traded in any market, such that the highway producer cannot "experience" these costs or benefits and take them into account in his production decision). Another source of market failure sometimes mentioned regarding highways is economies of scale or "lumpy" capacity in highway production, but this is just a technical reason underlying *(b)*.

These sources of "imperfection" represent the basic theoretical justification for government provision of highways, and no doubt they underlie the historical fact that most highways have been provided by the government, not only in this country but in all other countries as well.

It is important to realize that although these imperfections make it necessary in the interest of economic efficiency for the government to play some role in the highway market, they do not necessarily imply that the government should own the highways. Indeed, imperfections exist in many markets in which the government does not own the productive assets. For example, national defense is the classical example of the nonexcludable commodity, yet the government, though it provides the national defense, does not itself own all of the assets that produce the national defense. For example, the factories that produce fighters, missiles, and tanks are all privately owned. Electric power distribution exhibits scale economies and natural monoply that prevent perfect competition, but the government, at least in this country, does not own most electrical distribution systems. Many industries cause pollution, which is an "external" cost of production, but that does not compel the government to nationalize all polluting industries.

RATIONALE FOR PRIVATIZATION OF EXISTING HIGHWAYS

In this section the concept of privatization of highway ownership is examined from the perspective of economic efficiency. The focus is primarily on existing highways, although much of what is said would also be applicable to building new highway capacity.

Highway privatization is an appealing concept during these times because of the combination of growing need for infrastructure maintenance and strong political pressures for fiscal austerity and reduced taxes. The attractiveness of the privatization concept may be attributed to four reasons:

1. Revenues might be raised without increasing taxes,
2. Efficiency of highway usage might be improved,

Center for Construction Research and Education, Massachusetts Institute of Technology, Cambridge, Mass. 02139.

3. Production efficiency of highway maintenance might be improved, and
4. Quality of highway services might be improved.

Highway privatization could certainly raise additional revenues for existing highways without recourse to tax increases if the privatization were accomplished by converting previously nontoll roads to toll roads or if it resulted in increasing the tolls charged on existing toll roads, or both. Of course, this could be done without privatization, but it might be easier, for political or administrative reasons, to accomplish this type of tolling in connection with a program of privatization.

(It should be noted that private development of new highway capacity, to provide access to a private real estate development, for example, could raise highway construction revenue without the road necessarily being tolled, if the real estate development provides enough excess profit to pay for the road. In this paper, however, attention is focused on existing highway capacity.)

Two questions that beg to be seriously considered when the revenue-raising argument for privatization is invoked are *(a)* are more revenues really needed for highways and *(b)* what would be the economic efficiency impact of converting nontoll roads to toll facilities or raising tolls on existing toll roads? There is a substantial body of evidence, beginning with the Choate and Walter study *(1)* and continuing through the Joint Economic Committee's report *(2)* and more recent studies *(3, 4)*, to the effect that the answer to the first question is yes; more revenues, perhaps quite a bit more revenues than are currently being collected, are needed to maintain existing highways and provide necessary new capacity. The second question relates to the second reason listed previously as a justification for highway privatization.

When the toll or price charged for highway usage is changed, the quantity and pattern of highway usage is also changed because of the user demand function that relates highway usage demand to highway price. If the highway usage price was previously too low, then an increase in tolls could well improve the economic efficiency of highway usage, at least as long as the tolls are not increased too much. Thus the second reason that potentially justifies the privatization of existing highways only applies to privatization by means of toll roads, and the key question is whether private toll roads would charge an efficient toll (or at least a more efficient one than the status quo). Again, privatization is not necessarily required because the government could in theory institute efficient tolls on publicly owned highways. Nevertheless, political or administrative expediency might argue for a policy of efficient tolling coupled with a policy of privatization.

The evidence is that current highway prices (usage-sensitive excise taxes and user fees plus tolls, if any) are far below the economic efficient level on congested highways, such as most urban expressways during daytime hours. Tolling such roads would be efficient from the perspective of overall social welfare, though all the parties directly affected (those who continue using the highway and pay the tolls, those who switch to alternate routes to avoid the tolls, and those already using the alternate routes) would be made worse off one way or another unless they were compensated by receiving some of the toll revenues. Uncongested roads are probably not underpriced in general, at the existing prices.

This leads to the third reason in the list of potential economic justifications for highway privatization, to improve highway maintenance production efficiency. Normally, private companies have profit-maximization incentives to minimize production costs. This implies that, unless government regulation distorts the normal incentives, private highway companies would be at least as efficient as the government in providing highway maintenance in the sense that, for any given physical maintenance operation, a private highway owner would incur costs less than or equal to those incurred by a government owner. Or, equivalently, for any given level of expenditure on highway maintenance, a private highway owner could provide at least as much physical highway maintenance as could a government owner.

The "at least" in this point is important. Many would argue that private owners would be significantly more efficient than government owners in maintaining highways, especially over the long run. This argument is perhaps more sociological or cultural than economic, because there is nothing in economic theory that explains why the government could not minimize maintenance production costs. Nevertheless, perhaps because of the different types of incentives that operate within a bureaucratic-political organization as opposed to a private for-profit organization, or perhaps because of the various administrative regulations and restrictions that constrain management flexibility in government organizations, it could be argued that it is quite likely that private highway owners would be significantly more efficient than public highway owners. This is a proposition that is difficult to test now because there are almost no privately owned highways to compare with government-owned ones.

It should be noted in this regard that highways could be privatized in a manner that would almost guarantee that maintenance would be produced more efficiently on them by their new private owners than would be possible for the government. This could be accomplished simply by the government refusing to accept any bids for highway purchases that did not include some capitalization of maintenance production efficiency improvement over what the government estimates it could do. Or, equivalently, government highway departments could be allowed to compete on an equal footing with private bidders in the process of auctioning off the highways. In this way, any highways that were sold to private bidders would necessarily be sold to buyers who at least believed (and were willing to put their money where their beliefs were) that they could maintain the highways more efficiently than the government. Furthermore, the public would obtain, through the highway sale price, the capitalization of this maintenance production efficiency improvement.

The cost of national highway maintenance is so huge (easily $30 billion per year just to maintain existing highway and bridge capacity, including necessary rehabilitation and reconstruction) that even a small percentage improvement in the efficiency of this maintenance would yield large absolute savings. For example, a 5 percent improvement in highway maintenance efficiency would be like getting at least $1.5 billion more per year in revenue for highways. Though there would probably be substantial administrative costs associated with highway privatization in the form, for example, of needed regulatory oversight of the private highways for safety and economic efficiency purposes (discussed in the next section),

these administrative costs might well be much smaller than the highway maintenance production efficiency gains.

Furthermore, the same technique described earlier for ensuring that privatized highways bring production efficiency improvements could also be used to ensure that these efficiency improvements are large enough to more than offset any administrative costs. The government would simply have to estimate the administrative costs required to regulate the highway being offered for sale and then announce a minimum qualifying bid price that would include enough capitalization of maintenance production efficiency improvements to cover the expected capitalized administrative costs, or highway owners could be assessed fees to support their own regulation, as is typically done by state utility commissions to the companies they regulate.

It should also be noted that the production efficiency argument for highway privatization applies to private nontoll roads as well as to private toll roads, at least potentially. For example, the government could sell a nontoll road to a private owner and pay the private owner an annual public access fee, say, per vehicle using the road. In this way the road could be privatized without being converted to a toll facility. The maintenance production efficiency incentive would be preserved as long as the fee per vehicle paid by the government for public use rights was not some "cost-plus" type of fee based on maintenance expenditures by the owner.

For all of these reasons, the third of the justifications for highway privatization, to improve maintenance production efficiency, may well be the most general and powerful economic reason for privatization of highway ownership at least for existing highways.

The fourth and final reason listed at the beginning of this section as a possible economic justification for privatization of highway ownership is to improve the quality of highway services. It might be expected that private highway owners would bring a more vigorous and innovative approach to managing traffic flow and servicing their traveling "customers." Private highway companies would not be in perfect competition with each other or with competing government-owned roads in the same travel markets, but there would be some competition. And highway company revenues would be directly proportional to usage of the roads, whether the privatization were accomplished by toll roads or by private nontoll roads as described previously (with public access fees paid by the government per vehicle using the road). So private highway companies might have more of an incentive than the government does to provide services and amentities and to manage traffic flow in a manner that pleases their users, the traveling public. With the present "monoculture" of nothing but government-owned highways it is hard to test this hypothesis.

POLICY CHALLENGE: EFFICIENT GOVERNMENT REGULATION OF PRIVATELY OWNED HIGHWAYS

As was argued in the preceding section, highway privatization can potentially bring important production efficiency and revenue-generation benefits, but, unless private roads can be regulated or controlled efficiently, these benefits will probably not materialize or not be worth the likely loss in allocative efficiency associated with excessive tolls and suboptimal highway quality, which private highway owners would provide, due to the highway market "imperfections" described in the first section. Therefore the economic feasibility and desirability of highway privatization depend critically on whether the effects of such market imperfections can be efficiently controlled and mitigated without negating the potential benefits. If the prospects for such efficient regulation appear good, then the overall argument to at least experiment with some highway privatization would appear to be quite strong.

Laissez-Faire Result: How Bad Could It Be?

How "bad" would things be if privatization were undertaken without any government intervention? There would be two basic problems, price and quality.

If privatization occurred with no government intervention, the private roads would virtually all have to be toll roads because the highway owners would have little other source of revenues. So the first question to ask is "When should existing highways be tolled?"

Viewed purely from the perspective of overall economic efficiency, this question is rather easy to answer. It is efficient to toll a previously untolled road only if

$$ACC < \frac{T^2 \varepsilon}{2P}$$

where

ACC = average cost of collection of tolls per vehicle mile traveled (VMT),
ε = absolute value of the elasticity of demand for travel on the highway with respect to average total user cost (P),
T = efficient toll per VMT, and
P = average total user cost per VMT including value of time and inconvenience and money cost including wear and tear on vehicles.

In this formula, the efficient toll (T) represents the so-called "Pigouvian tax," which would induce efficient usage of the highway. The efficient toll is equal to the difference between the marginal social cost of highway usage (including the marginal effect on congestion) and the average private cost of highway usage actually experienced by the user, both taken at the efficient usage level on the highway. The efficient usage level is that at which the marginal social value of usage equals the marginal social cost of usage.

On uncongested existing highways, the efficient toll would typically be only about a cent or two per VMT, perhaps quite a bit less for light vehicles. The efficient toll consists essentially only of the additional maintenance cost caused by marginal highway usage. In effect, this efficient toll for uncongested roads is already being paid in the form of gasoline taxes and other usage-sensitive highway user fees. On congested urban expressways the efficient toll might typically be 10 or 20 cents per VMT, even for light vehicles, because of the marginal congestion cost of traffic.

To get some idea of the practical implications of the formula,

some "ball park" numbers can be plugged in for the relevant variables. A typical value for P would be 40 cents per VMT, and a reasonable guess for ε would be 0.75. ACC consists of tollbooth delay time costs for the highway users plus monetary (administrative) costs for the toll-collecting agency. Suppose the value of time for the average vehicle using the highway is \$5.00/hr, a figure consistent with econometric findings in studies of travel demand. And suppose the average vehicle stops at toll gates for 10 sec per trip on the highway. Then, in cents, the time cost is $1.4/L$, where L is the average vehicle trip length on the highway (in miles). Suppose 24 person-hours per day are required for toll-taker wages for each 5,000 vehicles per day using the highway and toll-taker wages are \$10.00/hr including fringe benefits. Then the monetary collection costs are $4.8/L$. Thus $ACC = 6.2/L$, and the formula expressed in terms of L becomes

$$T > 25.7/L^{1/2}$$

Thus, if L is 10 mi, the efficient toll must exceed 8.1 cents per VMT; if L is 100 mi, T must exceed 2.6 cents per VMT; and if L is 500 mi, T must exceed 1.15 cents per VMT. Otherwise, the losses from the cost of toll collection will exceed the gains in highway usage efficiency. It therefore appears to be clear, considering that users already pay a gasoline tax, that the only existing nontoll highways that could be efficiently tolled, using existing toll collection technology, are roads that suffer from significant traffic congestion.

As a result of this, if potential changes are limited to the toll road model of highway privatization (as would be implied by a pure laissez-faire approach), then the number of miles of existing highway that are candidates for privatization are greatly reduced, at least assuming existing toll collection technology.

But what of that relatively small portion of the total highway mileage but important fraction of the total highway usage, consisting primarily of the major urban freeways and beltways, that is congested? Here, the economic efficiency problem from the pure laissez-faire approach to privatization would not be that the roads would be tolled but that they would be tolled at too high a level. The profit-maximizing toll would greatly exceed the efficient toll, even under conditions of congestion. Table 1 gives a comparison of the efficient toll with the profit-maximizing toll assuming that the zero-toll demand is 80 or 95 percent of the facility capacity and demand elasticity is either one-half or one (conditions currently typical in urban areas in the daytime). Although the profit-maximizing toll might be closer to the socially optimal toll than the current zero-toll under relatively high congestion (95 percent saturation) with unit elasticity, it is nevertheless clearly above the socially optimal toll. With relatively low congestion or inelastic demand, the profit-maximizing toll greatly exceeds the social optimum and would be worse even than the currently typical zero-toll. If constant elasticity were assumed instead of linear demand, the profit-maximizing tolls would diverge even further from the efficient level.

TABLE 1 COMPARISON OF OPTIMAL AND PROFIT-MAXIMIZING TOLLS ON CONGESTED URBAN EXPRESSWAYS (cents per VMT)

	Zero-Toll Demand as Percentage of Capacity	
	80%	95%
Elasticity = 1/2		
Profit-maximizing toll	38.0	46.0
Optimal toll	7.5	17.7
Elasticity = 1		
Profit-maximizing toll	23.0	28.5
Optimal toll	7.5	17.7

NOTE: Linear demand is assumed over the range. Elasticities are point elasticities at the zero-toll price, where price is defined as total user cost (value of time and inconvenience as well as monetary outlays).

Now consider the problem of highway quality, or maintenance policy, under laissez-faire privatization. It can be shown that the profit-maximizing maintenance policy will differ from the efficient policy whenever the marginal social benefit (MSB) of highway quality differs from the marginal private benefit (MPB) of highway quality to the owner. Furthermore, if MPB is less than MSB, the profit-maximizing maintenance policy will provide too little highway quality over the long run. MSB is here defined as the gross value society obtains from a marginal unit of highway quality at any given time. MPB is defined with reference to the private highway owner, and it equals the additional usage revenue obtained by the private highway owner from one more unit of highway quality at any given time. It can furthermore be shown that, no matter what level the toll is set at, the result will be that MPB will be less than MSB [see Geltner *(3)* for details]. Thus the laissez-faire highway will not only charge too high a toll but it will provide too little maintenance of the highway.

Efficient Solutions to the Excess Toll Problem

The excess toll problem described in the previous subsection can be dealt with, at least in theory, by appropriate government privatization policy. There are two main alternative policy approaches that could control or avoid this problem.

The first possibility is simply not to privatize via tolling but rather to privatize highways according to the "nontoll private highway" model, previously mentioned. This approach does require some continuing government involvement in the highway business, but as a "customer" rather than as the owner or producer. Private nontoll roads would receive their revenues from public access fees paid by the government per unit of usage (e.g., VMT) of the road. Usage would have to be monitored, much as television network rating agencies monitor television viewing, and the billing might be on a monthly or an annual basis. The formula defining the fee per VMT would be specified by the government before sale of the highway.

This form of privatization would be appropriate wherever the government did not want to toll a previously untolled facility, either because it would be economically inefficient to do so (e.g., uncongested roads) or because it would be socially undesirable (or politically impossible) to convert a freeway into a tollway.

Now consider the second approach to controlling the excess toll problem: government regulation of the toll. This is the method that would apply in the case in which the government did wish to privatize via the toll road model, either because the road is already tolled or because the government desires to

institute tolling on a previously free facility (for revenue generation or usage efficiency purposes, or both).

The traditional method of economic regulation of public utilities and transportation companies in this country would regulate the tolls on the basis of "fair rate of return" on (typically historical or "book") value of investment, or "operating ratio." The allowable return or ratio is calculated net of maintenance expenditures, thereby destroying the normal profit-maximization incentive to minimize production costs. Another problem results because the absolute profits allowed may be a direct function of the amount of capital invested in the highway by the owners.

In the long run this method of regulation distorts production and removes the incentives for production efficiency. It is also complicated and expensive to administer and subject to industry "capture" of the regulators and other abuses. Its justification is that, presumably, these losses in production efficiency are more than compensated by gains in overall allocative efficiency compared with what would occur in the absence of regulation (assuming laissez-faire private ownership). Applied to the private toll road problem, for example, this form of regulation would probably result in both lower tolls and better maintained roads than would occur without any regulation. Thus traditional regulation deals simultaneously with both of the problems that result from laissez-faire private ownership, though with no guarantee of an economically efficient result overall.

Therefore economic regulation as typically practiced in this country is an admittedly imperfect instrument from the economic efficiency perspective. However, that the government is currently the owner of the highway assets might make it politically and legally easier to improve on this traditional type of regulation in the case of highway privatization.

A formula for the maximum allowable toll could be prespecified and fixed as part of the terms of sale of the highway, known by all bidders in advance of the bidding. This formula could be based on such things as the highway traffic volume and speed flow, broad-based price indices such as the Consumer Price Index or the Producer Price Index, and determinants of average user value of time such as regional per capita income. The formula for the maximum allowable toll could be based on the efficient Pigouvian toll formula, including congestion costs, as described earlier.

This efficient toll is effectively independent of the absolute level of highway maintenance expenditures, which is why the profit-maximization incentive to minimize internal highway maintenance costs would be preserved under this regulatory system. The efficient toll depends on the marginal cost of highway quality maintenance with respect to usage volume, but this marginal cost is a technical or engineering-based parameter that could be estimated by an independent agent, such as an engineering firm or panel of highway engineering experts. Unlike the absolute level of maintenance expenditure, the marginal maintenance cost with respect to traffic volume is not a parameter that is subject to direct manipulation by the highway owner.

Because the toll formula as well as any highway maintenance requirements would be known by all bidders in advance of bidding for the highway, no highway owner could subsequently claim that the toll and maintenance requirements constitute a "taking" of private property without compensation by the government (which is the legal basis of "fair rate of return"–based regulation). As long as the government cannot unilaterally change the toll formula and maintenance requirements subsequent to sale of the highway, financial difficulty on the part of the highway company would not be related to any government "taking." Similarly, lower maintenance production costs leading to high profits for the owner would not give the government any legal basis to force the highway owner to reduce the tolls, and the incentive for the highway owner to minimize costs would thereby be preserved.

Thus the proposal to divorce the allowable toll from any direct link to rate of return or to maintenance expenditure would appear to solve the excessive toll problem without introducing the incentives for inefficient production usually found in traditional forms of government regulation of privately owned utilities.

Efficient Solutions to the Maintenance Problem

There are two basic approaches that the government could take to cause the privatized highway (toll or nontoll) to provide the desirable (i.e., efficient) level of highway quality over time without destroying the private owner's normal incentive to minimize the cost of producing highway maintenance. These two approaches are not mutually exclusive and indeed may well be viewed as complements of one another.

The first method, the "legalistic" approach, is simply for the government to require in the terms of sale of the highway that it be maintained to a certain level of physical quality. Various legal mechanisms exist to structure such a requirement, and they are not without precedent in major capital asset transactions. For example, the highway could be sold subject to an asset maintenance covenant, with the government holding a lien on the highway. (This would be not unlike the type of legal covenant often found in corporate bonds and debentures to protect the bondholders.) Or the government could retain the highway right-of-way and "sell" the highway by means of a perpetual lease, one of the terms of which could be asset maintenance.

These methods tend to be legalistic and adversarial, however, and they could be difficult and costly to enforce by themselves. For this reason it might make sense to supplement these legalistic mechanisms with a marketlike mechanism that gives the private highway owner a profit incentive to provide the correct maintenance.

The second basic approach is for the terms of sale of the highway to prespecify the formula of a Pigouvian subsidy or incentive fee to be provided by the government to the highway owner. In the case of a nontoll road, this incentive payment would simply be included in the definition of the public access fee to be paid by the government per VMT of usage of the road. In the case of a toll road, the incentive payment would be made by the government to the highway owner, per VMT of usage, over and above the revenues the owner collected from tolls. Such an incentive payment system would be defined and would work in the following manner.

The unregulated private highway company would voluntarily provide the economically efficient level of maintenance

(in order to maximize its own profits) if the MPB equalled the MSB. The basic idea of the incentive payment is to define this payment according to a formula that will cause the MPB to equal the MSB. For example, if the incentive payment per VMT is defined independent of the current level of highway quality, then the appropriate formula is

$$S = t + \frac{P}{\varepsilon} \tag{1}$$

where

- t = usage-sensitive highway user fees or taxes per VMT apart from tolls (e.g., gasoline taxes),
- P = total average user cost,
- ε = elasticity of demand for highway usage with respect to P, and
- S = payment per VMT by the government to the highway owner.

If highways were perfectly competitive then ε would be infinite and the second term in Equation 1 would vanish. But highways are not perfect substitutes for one another, and the ε perceived by the typical highway owner is likely to be around unity, perhaps even less. Thus, because P is typically on the order of 40 cents per VMT and highway user fees are currently only 1 or 2 cents per VMT, S is likely to be some 40 times the current level of government highway funding.

Providing such a large public access fee or subsidy would not transfer wealth to the highway company from the government (i.e., from the rest of society) because the bids for the purchase of the highway would be based on the knowledge of the level of S, capitalizing and thereby transferring to the government the huge profits implied by S. If the government invested the proceeds of the sale of the highways in a sort of "highway endowment fund," most or all of the annual access fees could, on average, be paid out of the earnings from this endowment, forever.

However, if the government does not wish to offer such a large public access fee as S, a slightly more complicated formula, which defines the incentive payment as a dynamic function of the cumulative changes in observed highway quality, could be used. This dynamic formula requires knowledge of the highway quality and of the elasticity of average total user cost (P) with respect to highway quality, but it would allow the incentive payment per VMT to be at a level near that of current government expenditures on highways.

It may be objected that the incentive payment approach would be difficult to implement because it requires that the government know or estimate the value of some unknown parameters, such as P or ε. In reality, the government must estimate these parameters anyway in order to follow an efficient maintenance policy, even if it owns the highway itself. Although governments may not currently explicitly estimate these parameters, their maintenance policy decisions imply implicit estimates of these parameters or the maintenance policy cannot be argued to be based on maximization of economic welfare. Forcing this process to be more explicit cannot harm the efficiency of the result.

CONCLUSION AND SUMMARY

In the first section were described the market "imperfections," which cause laissez-faire private highway provision to fail and which no doubt underlie much of the theoretical rationale and historical fact of government ownership of most highways throughout the world. The main dangers in this regard would be charging of excess tolls (in the case of unregulated private toll roads) and providing too little highway maintenance (in the case of both private nontoll roads and private toll roads).

In the second section the basic economic argument for privatization of ownership of existing highways in this country was presented. Noted were several reasons that might make a carefully executed program of highway privatization advantageous on economic efficiency grounds, provided the government could prevent various types of inefficient behavior that profit-maximizing private highway companies could be expected to display under a laissez-fare regime because of the imperfections described in the first section.

In the third section were described some perhaps novel but quite possibly workable ideas for highway privatization (either toll or nontoll) so that the main potential advantages of highway privatization might be preserved while preventing the problems of excessive tolling or suboptimal maintenance of highway quality that would otherwise stem from the imperfections of the highway market. This proposed type of governmental intervention would not destroy the normal private-sector incentive for production efficiency.

Finally, although this paper has been focused on privatization of existing highway capacity, the techniques and policies described in the third section could also be applied to privatization of the provision of new or additional highway capacity. For example, the government could specify how much new capacity is to be built and where it is to be built. The government could then auction off the rights to build and own that specified capacity, much as it auctions off petroleum leases. If the terms of sale are prespecified as described, the result should be efficient construction and maintenance of the new highway capacity.

In summary, it appears that the economic argument in favor of privatizing some highways in one way or another (toll or nontoll) can be encapsulated in three main points. First, it appears at least plausible that privatization could lead directly or indirectly to some highway maintenance production efficiency improvements (for both private nontoll roads and toll roads) and to some additional revenue generation and usage efficiency improvements (where the privatization is accompanied by tolling). Second, it is really impossible to either prove or disprove these assertions in the abstract; some real-world privatization experiments must be carried out to learn whether privatization can demonstrate more efficient or effective maintenance techniques and roadway pricing. Third, there would appear to be little downside risk from a policy of careful and selective privatization. The main dangers, that excessive tolls would be charged or that the roads would not be maintained to high enough standards of quality, should be avoidable by using the techniques described in the third section. If privatization does not appear to work well, it should be possible to modify or abandon the experiment with little or no irreparable damage, at least in the case of nontoll roads, because roads do

not wear out overnight, and it would be obvious if they were not being well maintained.

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Some Financial, Economic, and Social Policy Issues Associated with Toll Finance

GARY L. GITTINGS

Financial pressures are forcing state departments of transportation to consider alternative funding strategies, including an expanded roll for toll financing as a supplemental source of revenue to complement current user charges. It is timely and appropriate, therefore, to examine some important financial, economic, and social policy issues associated with tolls. The discussion is primarily directed toward the use of tolls for major reconstruction on federal-aid highways. Among the findings are that, despite the relative inefficiency of toll finance as a highway revenue mechanism, there are circumstances in which tolls may be economically justified. One example is when there are insufficient revenues from traditional highway user imposts and toll financing is used to make needed highway improvements many years in advance of when they otherwise could be made. However, federal policy, which mandates full repayment of all prior federal aid used on a potential toll facility, severely limits the usefulness of the toll mechanism for purposes of resurfacing, restoring, rehabilitating, and reconstructing highways. This policy has no economic justification. From a social equity perspective, toll financing has a potential advantage over current user taxes and fees because of the ability to more closely align the user charge with the benefit received or with the direct use made of the highway facility. The choices made about toll collection system design have significant implications for the capital and operating costs of toll collection. However, toll collection design decisions cannot rest on cost criteria alone, for the design will have implications for user access, traffic route choice, toll revenue, safety, and highway financing equity that also must be recognized.

During the last decade numerous state departments of transportation have come under extreme financial pressure because of the magnitude of the funds required to maintain and rehabilitate the existing highway network at a satisfactory level of service. In addition, new highway investments, although perhaps not demanded to the same degree as in past eras, nonetheless remain an important and necessary part of most states' highway programs. The states have responded to the fiscal pressures with a variety of strategies including shifting priorities, adopting new management techniques, increasing the rates of current revenue sources, and searching for new revenue sources. New priorities have caused a shift away from the long-range network expansion programs prevalent in the 1960s to programs that emphasize system preservation through maintenance, rehabilitation, and improved management of existing resources. New management techniques have been adopted in such diverse areas as pavement maintenance, construction, quality assurance, and fiscal planning and programming. In a number of states, the means by which highway needs traditionally were defined have changed to reflect more accurately the benefits that are achievable through a given improvement. Overall, emphasis has been placed on improving the management and cost-effectiveness of highway programs.

The Surface Transportation Assistance Act (STAA) of 1982 increased and modified the structure of highway user taxes to provide for a 50 percent increase in funding for the federal-aid highway program. To match the federal aid, many states implemented user tax and fee increases of their own, but, because funding demand continues to exceed supply, states have also been looking to new sources of funding, including an expanded role for toll financing of highway improvements. Wisconsin, for example, initiated a study before passage of the STAA on toll financing for Interstate "4R" (resurfacing, restoration, rehabilitation, and reconstruction) needs *(1)*. Although the 4R

Pennsylvania Transportation Institute, Pennsylvania State University, University Park, Pa. 16802.