URBAN TRANSPORT INFRASTRUCTURE CONCESSIONS IN CHILE[*]

Héctor Gutiérrez[**]

ABSTRACT

To avoid the development of a congestion problem in roads and streets, the supply of transport infrastructure should keep pace with its demand. However, this is not an easy task, because the required funds tend to grow faster than tax collection does, which poses a challenge to Society: how to finance the gap between necessities and availabilities while not forcing a decrease in other sectors' share in public budget, especially in social ones. For example, this paper argues that traffic management including the introduction of toll fees for the use of using congested streets or, in the extreme, the prohibition to use some cars in rush hours have limited potencial to respond to the challenge. It seems there is no real alternative to just supply the infrastructure needed.

In order to provide new or improved infrastructure, concessions have a potential to meet the challenge. On the one hand, the private sector may provide the money that the public sector does not have, and concession users pay for what they get in order to cover the investment (and a regressive subsidy is avoided). On the other hand, the private sector contributes with economic efficiency to enhance the provision of infrastructure, including new ideas, efficient investment and maintenance, and low toll fees. However, concessions pose an incentive compatibilitty problem which is not easy to solve. The paper elaborates on the Chilean way to solve the compatibility problem and recognizes the necessity to include bids for the lowest toll fees, to exclude government guarantees, and to reinforce property rights. The concession plan for Santiago is also presented.

SINTESIS

Para evitar el desarrollo de un problema de congestión en los caminos y calles, la oferta de infraestructura de transporte debe mantenserse al mismo nivel que la demanda. Sin embargo, ésta no es una tarea fácil, por cuanto los fondos que se necesitan tienden a aumentar más rápidamente que los ingresos tributarios, lo que plantea una desafío a la sociedad: como financiar la brecha entre las necesidades y las disponibilidades sin, a la vez, originar una disminución en la participación de otros sectores en el presupuesto público, especialmente el área social. Por ejemplo, este trabajo plantea que la administración del tráfico que incluye la introducción de peajes en el uso de las calles congestionadas o, en la situación más extrema, de prohibir el uso de parte de los automóviles en las horas de mayor movimiento tienen un potencial limitado para hacer

frente al desafío. Parece que no existe una alternativa real para proporcionar en forma justa la infraestructura que se requiere.

Con el propósito de ofrecer infraestructura nueva o mejorada, las concesiones tienen un potencial para responder al desafío. Por una parte, el sector privado puede proporcionar el dinero que el sector público no tiene, y los usuarios de las concesiones pagan por lo que reciben para solventar la inversión (y se evita un subsidio regresivo). Por otra parte, el sector privado contribuye con eficiencia económica para optimizar la oferta de infraestructura, incluyendo nuevas ideas, inversión y mantención eficiente y bajas tarifas de peaje. Sin embargo, las concesiones plantean un problema de compatibilidad de incentivos que no es fácil de resolver. El trabajo profundiza acerca de la forma chilena para resolver el problema de compatibilidad y reconoce la necesidad de incluir propuestas públicas para obtener tarifas de peaje más bajas, excluir las garantías estatales y reforzar los derechos de propiedad. También se incluye el plan de concesiones para la ciudad de Santiago.

URBAN TRANSPORT INFRASTRUCTURE
CONCESSIONS IN CHILE*

Héctor Gutiérrez

1. INTRODUCTION: THE CHALLENGE POSED BY TRANSPORT INFRASTRUCTURE[1]

It is a well known fact that income elasticities for travel demands are larger than one. A typical figure for Chile and probably other developing countries is 1.4 (considering the correlation between aggregated traffic and national GDP).[2] This implies that traffic demand grows faster than tax collection, because the latter has an income elasticity slightly over one, 1.05 in the Chilean case.

The typical 0.35 excess of income elasticity for travel demand relative to tax collection poses a problem to the public sector, when the improvement of already existing roads and streets and building new ones are traditionally financed from its budget: fund requirements grow faster than the fiscal budget does, implying, in turn, an increasingly growing share of the latter, which is explosive.

Every national and local government is well aware that sooner or later it will have to face a capital rationing: profitable projects will be delayed, and existing infrastructure is going to suffer the consequences of insufficient maintenance. The statement made by the Undersecretary of Transport on October 16th, 1994 supports this view: "This year (1994) a record of US$139 million will be invested to improve urban transportation in Santiago, including actions in lane infrastructure, streets and roads, updating traffic light controls and beginning Line 5 of the Metropolitan Underground Railway (which is, in fact, the third to be built), among others. In any

[1] Transport infrastructure mentioned only includes roads and streets.

[2] Most of the elasticities referred to were estimated in evaluating an interurban project called «La Dormida», a completely new expressway conceived as a solution to the congestion problem in the Santiago-Valparaíso-Con Con road network. Traffic elasticity was estimated using a cointegrated model between the aggregated traffic of the network and GDP, along with other explanatory variables; it is also deemed to be representative of urban traffic. The reference is Angel Cabrera *et al.* [1993]. See also the project report prepared by Arturo Millard *et al.* [1994] from IGS.

Private travel costs to be referred to are from the same references and they were estimated by IGS in a revealed preference setting with a multinomial probit model calibrated to the observed traffic in a network with alternative routes. Some adjustments are made to the extrapolation from the interurban to the urban case.

event, this is *absolutely insufficient* to offset the growth of the car stock." (italics added.)

Add now the growth rate of GDP in Chile to the analysis. The government's official forecast for the mid term is an annual rate of 5.8 percent, the Central Bank estimate it at 6.0 percent, and our Department of Economics, at a rate ranging from 6.0 to 6.5 percent. Take 6.0 percent as representative. This means that hourly wages would grow 4 percent per year, traffic demand would do so at about 8.4 percent and tax collection at 6.3 percent. But funds devoted to transport infrastructure should grow annually at 8.4 percent or so to only keep up with demand, without even solving any existing deficit originated in the past; this exceeds the annual growth rate of tax collection by more than 2 percent. (See Appendix 1 for a clarification on this.) Both the national and the local governments in Chile are hardly willing to increase their spending in the transport sector by 2 percent over the rate at which their funds grow each year, especially due to the priority given to the social sectors, where it is desired to increase spending faster than their budget grows.

Here there is an obvious challenge: How to provide the required funds without increasing the share of the transport sector in the fiscal budget. The usual answer in Chile and other developing countries has been a blind one: no answer to the challenge, with no increasing share and subsequently with a growing infrastructure deficit. Chilean authorities say that hundreds of million dollars are needed to solve past deficits. To this respect, see the diagnosis put forth by Gomez-Ibañez et al. (1992, pp 1-2).

The modern answer to the challenge is in updating a very old idea: concessions of both already existing transport infrastructure which need improvement and efficient maintenance, as well as new roads and streets.[3] In a concession, a private firm provides the funds required for the initial investment, and people using the new or improved infrastructure provide the cash to make the concession a profitable business, because a toll fee on a usage basis will be charged for that purpose. Accordingly, the private sector has a potential to fill in the gap between the funds required and funds the public sector intends to spend on transport infrastructure.

The government retains the ownership of the infrastructure to be improved or developed on a concession basis, though it has to set the terms of the contract so as to become a concessionaire and control its operation. More crucial, the government is to provide appropriate incentives so that a concession business is not perceived as an opportunity to make extra normal profits. In other words, a concession must have a design such that it controls agency problems, which could be present given

---

[3] In 1929, an avenue from near down-town to the South on Santiago of Chile was built under a private concession schewe; it was called Gran Avenida (Great Avenue) and a toll charge was allowed. In the year 1800, there were 69 private toll roads under operation in the USA, and over 2000, in 1845; see Daniel B. Klein & Gordon J. Fielding [1992]. Consequently, private concessions are in fact very old.

118

the different parties involved: the government itself, the firms interested in the concession, banks and other finance agencies making loans to the concessionaire, the constructor of the road or street improvement, and the public; the latter does not celebrate any contract and is potentially the most affected by any erroneous incentive mechanism that might be included in a concession. In fact, the solution to the incentive compatibility problem faced in a concession is probably the most difficult part of the modern answer to challenge to provide the infrastructure that fast growing traffic demands.

The plan of the paper is as follows. The next section describes alternative means to answer the challenge already posed; it arrives at the conclusion that traffic management in congested cities might alleviate the problem, though it does not have enough potential to solve it. Section 3 follows with a description of the incentive compatibility problem posed by a concession, and the way it has been dealt with in Chile. Section 4 presents the government's concession plan for Santiago. Concluding remarks are offered in section 5.

2. TRAFFIC MANAGEMENT: AN INCOMPLETE ANSWER TO THE CHALLENGE POSED BY TRANSPORT INFRASTRUCTURE

Traffic demand that grows at 8.4 percent per year systematically originates increasing travel costs even with a supply expanding at the same pace, due to the time value component. Value of time tends to increase 4 percent per year in Chile. However, the provision of new streets and the improvement of existing ones is not growing at 8.4 percent per year and an increasing congestion problem should be added to the diagnosis.

In Santiago and other Chilean cities travel costs are rising due to their time value component at a rate in the range from 1.3 percent to 3.0 percent per year and per travel, depending on the income level of the people traveling. For relatively rich people such as those living in the East Area of Santiago, time cost is about three times as much as the operating cost of cars used in the travels and originates the mentioned 3.0 percent annual increase (4 percent applied to 3/4 of the total cost). For relatively poor people such as those living in the Northern Area of Santiago, time cost is about half the money cost of a typical travel on public transport and accounts for the 1.3 percent annual increase cited (4 percent applied to 1/3 of the total cost). Thus, travel costs grow at least 8.4 percent per year (the traffic growth rate), plus 1.3 to 3.0 percent (the per travel growth rate), leading to a growth rate ranging from 9.7 to 11.4 percent per year; it is an "at least" annual growth rate, because any increase in congestion causes an additional rise in travel costs and it has not been added yet. It is a sort of "natural" growth rate of travel costs.

An at least 10 or 11 percent annual growth rate in travel costs in the aggregate is quite impressive, meaning that travel costs double at least every 7 years. It is not a surprise that the increases in fiscal spending on transport infrastructure is well below that required to stop congestion from increasing, so several socially profitable projects such as traffic light controls and new off level intersections are delayed, with an accumulation of such projects in the portfolio of appraised investments waiting to be financed.

At this point, difficulties to generate ideas for projects to decongest the cities are recognized, because scarce physical space to add additional traffic lanes to existing streets or to build new avenues limits the possibilities. Typically, these ideas which account for a major fraction of the part of the fiscal budget devoted to transport infrastructure will be reserved primarily for interurban roads. The result is fiscal spending favoring interurban projects and attaching an additional constraint on the challenge of supplying urban improvements at the same pace as travel costs increase in cities. The data gathered by Jara-Díaz et al. [1993, Table 2.3-23] for 1990-1991 confirms this: about 75 percent of fiscal spending on roads and streets is on the interurban side.

The consequences of the picture shown are easy to imagine: a development of a congestion problem, especially noticeable in cities where it already exists in the eyes of the public (even though experts would not consider it as alarming by comparison to that in Bangkok, Bogotá and Mexico City, as it is sometimes argued).

A summary for a city like Santiago or Valparaíso is as follows: economic activity grows 6.0 percent per year and traffic demand does so at 8.4 percent; travel costs grow naturally at an annual rate of 9.7 to 11.4 percent (depending on the income level of the people traveling), but the lack of a supply growing at the pace of the traffic demand originates a higher rate, with 12.0 percent as a typical figure in relatively poor urban areas and 14.1 percent in relatively rich ones. This implies, in turn, that travel costs double every 5 or 6 years, respectively, depending on income level.[4]

Explicitly or implicitly, government authorities seem to favor traffic management as a way to alleviate the problem of so high growth rates in travel costs in an increasingly congested city. Traffic management involves imposing regulations to control congestion and those mentioned by the authorities include: a)

---

[4] A skeptical reader might find it revealing that car sales in Chile grew 23 percent in the first semester of 1995 (as compared to the same semester in 1994). Other figures are: a GDP annual growth rate of 7.0 percent in the 1986-1994 period and a rate of 10.3 percent for the registered traffic at toll plazas near Santiago over the same period; these two growth rates suggest an aggregated income elasticity for traffic demand in the order of [10.3/7.0=] 1.47. Since December 1985 to April 1993, real wages and salaries grew 25.6 percent with an annual growth rate of 3.2 percent (on average); from April 1993 to December 1994, real hourly wages grew 8.3 percent with an annual growth rate of 4.9 percent; the hourly wage is linked to time value so as to make decisions on travel frequency, transport mode and the route to use.

Tolls for the use of congested streets, b) Prohibition to use owned motor vehicles on some working days, and c) Improvement of public transport.

2.1. Tolls for the use of congested streets

Within the portfolio of ideas, government authorities, at least since 1989, have been considering the possibility of charging a toll fee for the use of arterial streets in Santiago and possibly other cities with congestion problems. However, and even though tolls have their own merit on efficiency grounds, the point this paper wants to make is that street tolls are not a definitive solution; they have a potential to alleviate the problem, though not to solve it.

The merit of tolls is to internalize congestion externalities, in a well known theoretical solution to an old economic problem of common property, but it is difficult to implement them in practice. It seems that the difficulties posed by a fee charged for usage are not solved that easily and they have delayed the implementation of the toll solution for years. For example, the simple method of using a seal to cross a predetermined area of the city is far from being an optimal solution, because it charges a fixed fee independently of usage (for those choosing to buy the seal). Currently, a study to define technical matters such as how to automatically charge for usage and then avoid the creation of additional congestion in the process has been outsourced to a private consulting firm. But it is hard to believe that a practical solution will be implemented in what remains of this century.

From another perspective, a rapid analysis leads to the conclusion that —independently from the efficiency argument in favor of tolls— its effect on controlling congestion is quite limited and, hence, it is not a complete answer to the challenge under analysis here. For example, consider the case of a congested avenue in Santiago which is used by people from the richest part of the city, the East Area. If a toll fee is implemented on a usage basis, the cost of each travel increases (notice that with the seal solution such an increase would not affect *each* travel). The marginal cost increase discourages the use of congested streets. The higher the response, the greater the demand price elasticity for travels, and the higher the marginal charge. But the demand for travels tends to be price inelastic, and hence a weak response should be expected.

Exaggerating a bit, assume that the price elasticity mentioned above is (minus) one. Assume now a US$0.35 toll fee is charged, equal to the current fare charged by a bus; it is hard to imagine a toll fee higher than that reference level to use *existing* infrastructure. The typical travel cost is currently (1995) no less than US$1.25 for East Area dwellers traveling 5 kilometers, including the time value component. On the whole, this leads to a decrease in traffic no greater than 22 percent, which is indeed quite remarkable. However, traffic has an expected annual

growth rate of 8.4 percent and after 3 years the pre-toll congestion level would be reached once again.

Thus, when a toll fee is imposed, it brings congestion down and the immediate effect is noticeable. But the natural increase in traffic after 3 years or even less restores congestion to the previously existing pre-toll level. The problem will be only postponed. This is the main reason why tolling the use of congested streets is an incomplete answer to the challenge posed by transport infrastructure, besides the fact that it can be implemented only once for a constant toll fee level.

The calculation made for a congested street used by relatively poor people, such as those from Santiago's North Area, is not so distressing. The same US$0.35 toll fee considered above is a greater fraction of the typical travel cost of about US$0.53 for people using public transport; considering people who use cars at a travel cost of US$0.70, the toll will reduce traffic initially by 33 percent, and the congestion problem is then delayed 5 years (instead of 2 or 3, in a relatively wealthy area).

Here we could say that toll revenues might relax the fiscal fund constraint, which can be seen positively. This alleviation however, runs along the same lines as financing infrastructure through private concessions, and the discussion of this point is put off until the next section. In any event, tolls should be considered only on the basis of their efficiency merits as regards internalizing congestion externalities and others imposed on third parties, so as to reduce congestion only up to its socially optimal level. Consequently, even though toll fees have some effect on alleviating congestion problems originating from the lack of funds to improve streets, caution should be exerted in resorting to them.

2.2. Prohibition to use the owned motor vehicle

Santiago is an air-polluted city, mainly on winter days. Although cars and other motor vehicles are not the chief pollutants, they do contribute to some extent. Consequently, restricting their use on one out of five working days is enforced in winter (as in the cases of Mexico City and Buenos Aires). The restriction applies to vehicles that are not equipped with a decontamination device and the result is that about 16 percent of motor vehicles are not used on each working day in winter. Moreover, when the contamination level surpasses a predefined level, the restriction applies to an extra 50 percent of vehicles. As air pollution caused by motor vehicles is stronger in a congested street, the prohibition neither applies at nights, on weekends or on holidays. Within the frame of the prohibition, it follows that every new motor vehicle must be equipped with a decontamination device.

Without questioning the prohibition as yet, it may be said that taxi and bus owners are the major supporters of the restriction. For example, consider the case

of an owner of a taxi equipped with a decontamination device and who is thus not affected by the prohibition. As the demand increases because some cars can not be used, and the supply of competitors decreases because the restriction also applies to some taxis and buses, there is an increase in price, in sales and consequently in profits. Even the owner of a taxi that is not equipped with a decontamination device has a gain with the prohibition: the increase in sales and the price on the four days that he is allowed to work (out of five working days per week) more than offsets the loss accrued from being idle on the fifth day; a working day per week is gained as a fringe benefit. Car owners' claims to extend the prohibition are more surprising. It seems that the advantage of a less congested city with a decreased travel cost outweighs the disadvantage of not using the owned car one out of five working days; notice that the disadvantage may not exist in the case of a car equipped with a decontamination device.

Nevertheless, the effects of the prohibition described above hold in the short run. Once there is an increase in profits due to owning a taxi or bus, the supply tends to increase until profits become normal again. The long run effect is then a larger stock of taxis and buses. Of course, a claim to extend the prohibition to more than one day a week is not to be delayed. Even a claim to apply the restriction to vehicles equipped with a decontamination device and on off winter days is stated in undertones as it now happens, a view some government authorities seem to favor (as is the case of the Undersecretary of Transport). And the incentive to own a second car and to replace it prematurely in order to circumvent the prohibition also tend to increase the car stock.

All these claims reveal that in the public's perception the chief effect of the prohibition is to reduce congestion; the effect on health is less easily internalized, probably because vehicles are not heavy polluters in Santiago. This takes the analysis to another ground. As the prohibition reduces congestion in streets —a side effect of an attempted solution to a problem of air pollution— there follows a brief analysis of the extension of the prohibition, as a solution to congestion and as an answer to the challenge posed by transport infrastructure.

Suppose that the restriction to use motor vehicles forces an additional 16 percent of them out of the streets every working day during rush hours. Thus, the extension of the prohibition increases the current 1995 effect by two times. Following the steps in the preceding subsection, an immediate and noticeable effect on congestion would result. But considering the typical growth of traffic demand, in about two years the congestion level prevailing at the time of the extension would be reached again, because traffic will grow by 18 percent over that period. Thus, an extension of the prohibition to use owned vehicles has a limited potential to meet the challenge involved in keeping the provision of infrastructure growing at the same pace as traffic demand increases. It can only delay the problem for not more than two years.

Overall, the prohibition should be considered only if it were an efficient means to control the air pollution problem. In this respect, the quantitative rationing included sounds somewhat inefficient, since price rationing is usually the efficient way to restrict undesired consumption. The toll solution should then be favored. Thus, even though the prohibition might have some effect in reducing congestion problems originated from the lack of funds to improve streets, it should be used only on the basis of its decontamination merit, if any.

2.3. Improvement of public transport

Since buses have advantages in per passenger used physical space over cars, a social cost-benefit analysis might lead to a gain for bus lanes alone in crowded streets as the Chilean experience has shown. And there seems to exist a very thin line from lanes for buses alone to buses for every lane, to capitalize on economies of scale in using scarce physical space in order to transport people. The government is currently considering streets reserved for buses and in Santiago an "experiment" started on July 20th, 1995, eight years after it was first evaluated. Nine additional cases are under consideration.

For many years, transport experts have considered this solution to congestion and the one most mentioned is that of segregated streets but with executive bus lines so as to commute with the underground railway. The line of reasoning is that new buses would have to be equipped with increased amenities in relation to those which now exist, such as, for instance, air conditioning, and passengers seated only, in order to be attractive to people who are currently using cars. If they are appealing, they would then impose a not so high cost on car owners, thus making it possible to prohibit owned cars on congested streets, which explains the official caution with respect to this sort of solution. However, neither the segregated streets under consideration, nor the experiment recently started, are on avenues from the richest part of the city, the most natural candidates to show a greater impact with a prohibition.

The potential to reduce congestion through this rather extreme measure is interesting. Probably, a first step to be implemented regarding streets that are more heavily crowded by cars would be to create incentives to start a business of a high quality bus line, not favored as yet by the market (as has been proposed sotto voce by the Las Condes City Mayor in Santiago's East Area), and then to evaluate the next step to be taken to implement the prohibition. But the public's reaction against it might be strong, so it could be eventually shelved, and its social justification could also fail on cost-benefit grounds, the most likely scenario. In any event, this method to reduce congestion is actually an incipient idea, as revealed by the experimental character given to the first segregated street. In addition, its applicability in the more affluent part of Santiago is far more limited. Hence, it is hard to imagine streets for buses alone as an integral solution to a congested city.

3. URBAN CONCESSIONS: A PROMISING ANSWER TO THE CHALLENGE POSED BY TRANSPORT INFRASTRUCTURE

3.1. Merits of private concessions

Private concessions have three main advantages over the traditional way to approach the challenge posed by transport infrastructure and over traffic management solutions. These are: a) Distributive equity, b) Economic efficiency, and c) The correct order in which to implement charges to users.

3.1.1. Distributive equity

From the point of view of equity, concessions have the merit to compel users to directly provide the funds to cover investment in infrastructure. Thus, toll fees charged on a usage basis eliminate the need for public funding, which then might have an alternative use. Moreover, concessions do away with crossed transfers among people and only the beneficiaries of each infrastructure improved have to cover its costs. All of this allows a better targeting of public expenditure, improving its potential to favor poor people. These advantages should not be overlooked and are the most valued by governments when they attempt to meet a development challenge with equity.

For example, to improve a road used by skiers or an avenue used primarily by rich people faces a well-founded twofold criticism, when financing originates from the fiscal budget. On the one hand, funds have an alternative use in social sectors, a priority that nobody questions. On the other, people living in other regions might claim that priority is being given to projects in order to finance them with a budget they helped to raise without any benefit accrued to them, a criticism which is levied against the expansion of the Santiago underground railway. Of course, criticisms no longer hold when the private sector finances projects and the future beneficiaries have to pay for them. The Chilean way to avoid financing such projects by forcing a negative result in the social evaluation of the project is no solution at all, unless it is considered for concession.

3.1.2. Economic efficiency

Distributive equity is achieved by resorting to toll fees, but economic efficiency is attained through incentives included in a concession scheme. In fact, projects financed with public debt and tolls administered by the State seemingly combine distributive equity and economic efficiency, as would be the case of the toll solution

125

to congested streets; but this overlooks the importance of incentives. Accordingly, although the analysis of the State's productive role is contaminated by ideological thinking, evidence in favor of a State as a regulator instead of a direct producer increasingly accumulates. See, for example, the World Bank's World Development Report 1994 devoted to the issue of infrastructure for development (referred to as WB's WDR [1994]). In fact, information theory and the recognition of inflexibilities associated with a State needing self-controls in productive activities are aimed at understanding why the State should favor a regulatory role and delegate productive actions to the private sector. The provision of infrastructure is no exception.

Infrastructure for transport concessions are examples of a State delegating the productive role, with a private sector taking up the responsibility for a good investment process, satisfactory maintenance and the associated risk. It is not difficult to see how poorly the State performs when it comes to maintain roads and streets, as has been documented in WB's WDR [1994], and in Schliessler and Bull [1992], an ECLAC report.

Consequently, the toll solution with potential to raise funds to finance infrastructure falls short in that it does not provide correct incentives to do things well, as past experiences show. By the same token, ECLAC's proposal to create specialized funds administered by decentralized agencies, with money coming from indirect taxation on motor fuel, also poses a similar shortcoming (and is also a second best solution even in the improbable case that the funding agencies function well). Moreover, congestion toll fees are impossible to charge through this earmarked solution, and the recommendation of the World Bank —in its WDR [1994, p. 50]— is to avoid doing so, illustrating the point with the failure of the Colombian road fund which was in operation for more than 20 years.

Infrastructure for transport concessions also holds a promise of new ideas, since government agencies tend to choose the most obvious ones. In fact, an open door to new concession ideas is an integral part of a concession scheme and in Chile innovation has been the keynote as all government proposals were improved by the concessionaires, whenever innovations were allowed. More on this is mentioned below.

Even though concessions are not an ideal solution, because they face the unsolved problem of charging only a marginal fee in an industry with high fixed costs, the alternative is a blind answer to the challenge posed to the transport infrastructure. Therefore, it is preferable to charge fees equal to long run marginal costs —those required to finance investment and operating costs— instead of not doing anything at all, as Gomez-Ibañez et al. [1992, pp. iii and 13] have convincingly pointed out.

3.1.3. The correct order in which to implement charges to users

Public opposition to the toll solution for congested streets is not a surprise. From the users' perspective, the use of *existing* streets and roads should be granted toll free, because they are there and were built with taxes which have been already paid. On this basis, the public's reaction against increases in interurban tolls —even in those cases when they only aim at recovering the real value lost due to inflation— and their complaints for the evident lack of maintenance, can be understood. What people appreciate most is the *improvement* of existing infrastructure and the construction of new one, because they perceive a noticeable gain from such actions.

Accordingly, the promise to devote toll revenues to future improvements to benefit payers themselves seems to be in the wrong order and that intention has not changed (almost, I suppose) any opinion regarding the toll solution for congested streets. The correct order is first the construction and subsequently, and only then, a toll charge, as it is with the purchasing of goods and services. The contrast between the acceptance of the correct order consulted in a referendum called by the Las Condes City Council, and the opposition to the wrong order proposed by the central government as a regulatory framework speaks for itself. See Gomez-Ibanez [1992] for details on the underlying political economy and references to the US experience in this respect.

Here, it is again the idea that traffic management has potential to only alleviate congestion problems. The integral solution is to include improved and new public works on both the interurban and the urban side in the present, instead of raising funds on the basis of a promise of future projects and instead of restricting traffic by means of regulations in order to postpone congestion problems.

3.2. Private concession problems and solutions

To solve the incentive compatibility problem in a concession is the most difficult part of the modern answer to the challenge posed by transport infrastructure. The agency problems —in chronological order of actions needed to formulate a concession business— are as follows: a) Correct incentives to generate concession ideas, b) Correct incentives to avoid corruption, excessive toll fees, and transfer of business risk to the State and to concession users, c) Correct incentives for the public to be considered in every concession contract to be celebrated, d) Correct incentives in concessions considered as the operation rather than the construction of infrastructure businesses, along with the development of a private financial system capable of providing the finance needed, e) Correct incentives to

self-control sovereign risk of revenue appropriation, and f) Correct incentives to face the need for an increased infrastructure capacity during the concession period.[5]

3.2.1. Correct incentives to generate concession ideas

Government agencies have a sensitive role in the development of a concession program. In addition to the regulatory framework for each individual concession with correct incentives to achieve its social role, Ministries and Municipalities make decisions on specific concessions to be included in the program. Therefore, it is crucial to pave the road for new concession ideas. In an ideal scenario, public agencies generate innovative concessions, but with the cooperation of the private sector, because —as it is often the case— consulting firms are also actively involved in analyzing how adequate the existing infrastructure is and have the potential to develop innovative concession ideas. In the Chilean case, the road has been paved and a structured mechanism on the submission of proposals is at the core of the concession system.

Once an external new idea is submitted and justified through a cost-benefit analysis, a patent is granted, as has been the case. Such a patent has market value, because the patent owner has an advantage in the process of obtaining the concession business. Private proposals have not been included so far in the list of concessions granted except for a small one to evaluate the current incentives to the generation of ideas; but a direct award in cash at the time a successful idea is given in concession would be better than additional points in the score obtained by the consortium owning the patent when it comes to choose the concessionaire (which could be rather arbitrary and could entail the risk that the 10 percent additional points that are given at present are an excessive reward in order to encourage competition).

---

[5] Due to space restrictions, some agency problems are not reviewed. For example, we omit the discussion of the so-called "two road problem", in which an alternative road to the one considered for concession is toll free, a trait shared by Mexican and Spanish concessions, which might require tolling the alternative road or limiting competition to some extent. See Gomez-Ibanez *et al.* [1992, pp. 12, 16-17 & 21], and WB's WDR [1994, p. 99]. We also omit the problem of identifying a toll fee structure to be included in a concession bid for the lowest level, not the structure (with room for congestion fees), and the role of two part tariffs to reduce the gap between long and short run social costs. See the proposal included in Labbé *et al.* [1993, pp. 31-40 and 91-111] and the recommendation to avoid toll fees proportional to the savings in travel costs made by concession users as it is implemented in Chile. A third issue omitted is related to the role played by technical proposals in a bidding game and their connection with economic proposals, and how to leave room for technical innovations, which is a goal in a concession program. See the proposed role in Labbé *et al.* [1993, pp. 8-9 & 53-58], including the proposal to reward losers, to some extent, in a bidding game in order to encourage competition. Other topics omitted in relation to the incentive compatibility problem are: the role of subsidies in concessions with relatively low traffic levels, the role of salvage values especially crucial in new highways and avenues and connected with defining the concession period, the role in sharing geological overcost risk between the State and the concessionaire as, for example, in the case of tunnels, and the role of financial equity requirements to concessionaires. See Cabrera *et al.* [1993].

128

3.2.2. Correct incentives to avoid corruption, excessive toll fees and transfer of business risk to the State and to concession users

An obvious part of the solution to the incentive compatibility problem is through bids to choose concessionaires, because the possibility of corruption is considerably lesser when there is a transparent bidding process. Furthermore, bids create incentives to arrive at the smallest toll fee level due to the competition which arises to become a concessionaire when the variable bidden is the toll fee level itself. Chilean experience with bids is wide and this mechanism to control corruption and achieve low prices is used even when it is a matter of leasing a photocopying machine, by both the public and the private sectors.

The example provided by Australian authorities in a direct negotiation with an Australian-Japanese joint venture for the concession of a tunnel running under Sydney harbor is a typical case that should be avoided. As reported by G. Mills [1991], in that particular case almost every risk is not borne by the concessionaire, a very favorable outcome of the direct negotiation that favored the private consortium. The Chilean Concession Law prohibits direct negotiation, discouraging the transfer of every business risk to the State and/or to concession users. Furthermore, direct negotiation should be avoided at every stage in a concession process.

By the same token, the mechanism used by transit authorities in California is not recommended. As reported by Y. Cohen [1991], the process of selecting concessionaires included a pre-selection of 10 consortiums which were set up by firms (400 in all) interested in doing business with the State; each interested consortium submitted a project idea. The selection was based on a ranking based on a score assigned depending on the degree of attainment of nine targets, most of them qualitative (such as, compatibility with the California goal on energy conservation and the degree of technical innovation). Each idea selected had then to be developed further in order to choose four (out of eight detailed proposals received at this stage); the four projects were considered for independent financial evaluation and none of them was on the preliminary list of high priority projects. At a later stage, toll fees will be freely charged by each concessionaire, but self-limited by the fact that any amount in excess over a previously negotiated "reasonable return" that could originate belongs to either the State or the creditors. Even though the structure of toll fees is also negotiated with the State —primarily those aimed at managing congestion— the toll fee level rests heavily on the resulting construction costs and on the return negotiated.

There is a sequence of first the construction of the infrastructure and then a transfer of the facilities to the consortium for their operation. This has a potentially important agency problem, because there are no clear incentives to build at a minimum cost and to set minimum toll fees. The "reasonable" (nominal) return given in California to the four concessionaires ranged from 17 percent to 21.25

percent, as reported by Klein and Fielding [1992, Table I]. When converted to real returns, they are all higher than the expected real return obtained by consortiums involved in Chilean concessions and which range from 8 to 12 percent (though official figures are not available in Chile, they are computed secretly and then discussed in hushed voices by the losers of each bidding game). Accordingly, the returns assigned to Californian concessionaires as the outcome of direct negotiations seem too high, as compared to the Chilean case, especially when contrasting the limited exposure to business risk in California and the almost full bearing of business risk in Chile. All the foregoing speaks for itself.

The proposal forwarded by Gomez-Ibanez et al. [1992, pp. vi-viii and 35-42] to the Chilean Ministry of Public Works is not to be recommended either, for the same reason. Essentially, it considers toll fees to achieve a return on investment in a fashion similar to that in which electricity tariffs are fixed in Chile and in the Californian (and Puerto Rican) system for concessions as well. It also considers the possibility of decreasing fees in a system called "RPI minus X" (in which fees are fixed every five years and adjusted automatically each year to a Retail Price Index, the RPI factor, minus X percent per year, as a goal to improve productivity in the provision of transport services); this price-cap method originated in the U.K. in order to regulate telecommunications. Apart from the non trivial problem of identifying the return to be obtained and its periodical updating, there seem to be very limited, if any, incentives to build at minimum cost.

In fact, searching for a hypothetical efficient concession firm as a benchmark, in order not to exaggerate the toll fees associated with the return to be assigned is cumbersome, controversial and not as easy as in the case of the Chilean electricity, which is already a conflicting issue. On the one hand, when a concession program starts, there are no other firms in the same business to be used as a benchmark. On the other hand, to identify a "typical" risk premium and even an "obvious" risk free rate in order to calculate a "reasonable" return are just as debatable as any academic paper. See WB's WDR [1994, pp. 68-71] for additional insights on this.

The simplest and most accurate way to solve the problem of setting toll fees is to call a bid for them, which leads to minimum fees. As it is the chief and ideally the only variable in the bidding game, the problems associated with direct negotiation vanish, combining correct incentives to minimize both construction and operating costs and the target to maximize profits (including the corresponding business risk).

3.2.3. Correct incentives for the public to be considered in every concession contract celebrated

Another rather obvious part of the solution to the incentive compatibility problem is that the public paying the toll fees be considered in some manner in the

concession contract to be celebrated. Concession users have both high enough coordination costs as well as incentives to free-ride so as not to even state their point of view. For example, a bidding for the maximum transfer to the government would result in excessive toll fees, which maximizes profits made by a concessionaire with some monopoly power, instead of those which are required to cover costs, though making the necessary allowance for business risk. This is a sort of collusion between the State and a private firm against the people who are supposedly going to be favored by the concession. Obvious as it may be, the concession of a tunnel called «El Melón» on Chile's principal interurban trunk was bidden for the highest transfer to the government. This method to raise additional funds to supplement the fiscal budget has been abandoned and every agency offering a concession business is also exerting caution so as to consider concession users, as should be.

3.2.4. Correct incentives in concessions considered as the operation rather than the construction of infrastructure businesses, along with the development of a private financial system capable of providing the finance needed

The desired outcome in a concession program is the operation of either an improved or newly built infrastructure. Thus, a concession is not a business to be set aside, at a too early stage, immediately after profits are obtained from its construction. It is not to be renegotiated either, because construction costs were higher than those supposedly expected and the initially offered toll fees (instrumental to winning the auction) are then allegedly insufficient to recover the increased costs. The Cuernavaca to Acapulco highway concession in Mexico seems to fit this pattern, as the facilities were built at an additional cost of US$1 billion, as mentioned in WB's WDR [1994, p. 99].

For example, there is a need to solve the agency problem which is discussed below. A construction firm sees an opportunity to make a normal business with a concession and then decides to lead a consortium in order to participate in the bidding process. Soon the firm realizes that the key to win the bid is through a very low toll fee structure: by offering a lower than the required one to recover construction costs with revenues from the operation, it bars any possible competition. With the bid resolved on that basis, construction starts and some methods to inflate cost are used, by forming a subsidiary which acts as a front and subcontracts the construction from its mother company. When the construction ends, extra normal profit results, though with an insolvent subsidiary, which actually signed the concession contract. The fact that the concessionaire is going bankrupt is unimportant, because profits have already been made. Moreover, it would be even better to start a renegotiation process with the government to salvage the concession, since an additional business to operate the concession could be made as

131

a fringe benefit. How can the concession program avoid this opportunistic behavior?

Of course, the above example is somewhat exaggerated, as there is someone who is bound to lose, though having the incentives to protect himself against the loss. The potential loser is the finance agency who grants a loan beyond control, then a collateral would be required so as to rule out the possibility of such an opportunistic behavior. But what about the government pledging a guarantee or easing the financing with loans from State-owned banks? In this new scenario, the required collateral to the loan would be greatly lowered, with a greater probability of either the State making the loss directly (when bankruptcy is allowed), or concession users (through increased toll fees, the most likely outcome, as the Mexican case has shown). See WB's WDR [1994, pp. 97-100]. Thus, the strategy of promoting the success of a concession program through easy financial terms with guarantees or loans from the State invites agency problems. In Spain, and not by accident, the granting of government guarantees to foreign loans was abandoned (after three concession failures), and the coverage of exchange risk eliminated (which implied a fiscal spending of about US$3.7 billion as up to 1992).[6]

The correct strategy to promote the success of a concession program seems to be that of requiring guarantees that the construction stage will be started and finished on schedule, and to leave the financing problem to the consortium, without committing the State with any loan or guarantee. To require guarantees that the construction is really started on time and to include fines for excessive delays in ending the construction, basically aim at solving financing difficulties before the concession is granted, and also to avoid the case of a concessionaire that delays the construction and attempts to obtain operating revenues before the construction is finished, a mechanism used in Argentine when this country's concession program started. In any case, this does not mean that nothing should be done. In fact, the financing of a concession faces problems that could well be lessened by the regulatory framework.

In point of fact, making loans to a concessionaire could be seen as a too risky business by the financial system, possibly due to a lack of profundity in the national banking system, inefficient operation or closed access to international financing. Though this is not Chile's case, which has a financial system that has proved to operate reasonably well, the setting up of a syndicated loan or a project financing scheme for a concession business is not an easy task in developing countries. Notice

---

[6] The Spanish case was documented by Carlos Martín P. at a Seminar held in Santiago on January 12th, 1993. Mr. Martín was then the *Delegado del Gobierno en las Sociedades Concesionarias de Autopistas de Peajes*. He also reported that problems in Spain are concentrated in concessions led by constructors, and that a way to limit such a leadership was being searched for.

that the higher the risk perceived in a loan to a concessionaire-to-be, the higher the interest charged. All of this results in a larger toll fee level required to cover investment costs to *everyone* participating in a bidding process. Thus, improvements in the regulatory environment to decrease loan risks are in order. Following with the example, one thing to be avoided is that consortiums should be required to have sufficient financial equity to guaranty full repayment of loans; this would restrict competition to only large firms.

The ideal scenario is that the operating revenues of a concession be used as a collateral for loans, which enables firms that are not so large to participate in the bidding process, in much the same manner as loans are obtained in the case of typical businesses that produce goods and services. The ideal scenario also includes permitting institutions which have the need to invest large long-term amounts of money to participate in the financing process. Insurance companies, investment funds and pension funds are the natural candidates.

These actions aimed at improving the profile of loans and lowering their risk are not easy to implement, because the property of the infrastructure to be built is not transferred to the concessionaire and remains public. This also poses a problem with respect to taxing a concessionaire's profits as the usual allowance for asset depreciation is affected. All of this, in turn, requires special legal provisions enabling the creditor —in the case of a concessionaire's bankruptcy— to take control of the concession business, in a way as similar as possible to normal cases, and to promote the profundity of the financial system.

It is stimulating that in Chile no government guarantees are given to loans obtained by concessionaires and that concessions are perceived as the operation of the facilities instead of their construction. Only one concession out of five already granted in Chile was won by a consortium led by a constructor, a Mexican one,[7] and most consortiums that lost bidding games were not. In addition, the initial regulatory framework is being improved not only to allow concession revenues to be used as legal collateral to loans, but also to enable Insurance Companies, Pension Funds and other financial institutions to participate in concession consortiums and their financing.

The remaining thing to be questioned is the practice of giving some explicit and implicit government guarantees to concession businesses. For example, it has become a normal practice to guaranty revenues at a minimum level. This has been used heavily in both Mexico and Australia. Though it was probably a good idea without using operating revenues as a collateral for loans when the Chilean

---

[7] As a result of the bidding game, the Mexican winner declared a required investment 50 percent above the one reported by the runner-up. This peculiarity is suspicious indeed and time will reveal its connotation.

concession program started, it no longer is with the improvements that are under consideration at present.[*]

3.2.5. Correct incentives to self-control sovereign risk of revenue appropriation

Once a concession is granted, the terms of the contract to regulate the following stages, including those for construction and operation are agreed on. The infrastructure to be built and the toll fees to be charged are written into the contract, and also the minimum operating conditions of the infrastructure together with requirements that the construction, maintenance and toll fee collection should not contribute excessively to congestion. As years go by, however, the people in charge can change and a different view regarding concessions could emerge.

For example, an outcome might be a lower construction cost than the one initially expected by the government agency offering the concession business. In this hypothetical scenario, new authorities could deem the toll fees included in the already signed contract to be "too high", because lower ones than those previously agreed on are sufficient for a reasonable return to investment. Hence an argument aimed at lowering fees could develop for the sake of concession users.

As a second example, consider the case when traffic development turns out to be substantially better than that initially forecasted by all parties. Thus, an event which years ago was considered improbable happened. This could originate the view that the concessionaire is getting "too large" a return, even though this outcome was within the scope of the rules of the game when the concession business was bidden. Here it could be argued, for the sake of concession users, that toll fees "should be" lowered.

Another example arises when long term interest rates decrease in the market, possibly due to improvements in the national financial system or due to a decrease in country risk (as was the case of Chile in 1995). In this case, the conclusion could

---

[*] Revenue guarantee is being used to limit losses but in combination with a profit-sharing mechanism whenever the latter exceeds a predetermined level; the latter form of limiting profits is also used in Puerto Rico. Thus, Chilean concessions are including a put option on traffic development to cut the lower tail of the statistical distribution of returns, and as a way to limit the upper tail to some extent as well.

The intuition is that minimum revenues are so far set at a low enough growth rate of traffic demand (in the range from 5 percent to 6 percent instead of the typical 8.4 percent that is expected) to generate a put option of small value (to the concessionaire), and a traffic forecast conservative enough to make the result of the government's share in profits a probable event (for returns in excess of 15%). (Mexico has guaranteed revenues growing at 8 percent, in a less favorable environment for growth.) Thus, the intuition is a government gain as a whole. Years to come will reveal how sound this intuition is. Moreover, the intuition regarding this way of altering risk and upper and lower tails of the statistical distribution of returns is probably neutral, due to the typical logic of making risky decisions with its upside potential, downward risk.

be arrived at that a new auction for the same concession business bidden in the past would lead to lower toll fees. Hence, it could be judged that current financial conditions permit a decrease in toll fees, to a lower level than what the concession contract had established several years before for the duration of the concession (including the current year and those remaining). Again it could be argued, for the sake of the public, that toll fees "should be" lowered.

Even a judgement on how things were done in the past could arise without involving a favorable conclusion, as in the case of the Melón Tunnel concession mentioned above, or an alleged need to introduce unanticipated congestion fees. Again, a case could be built as regards revising concession contracts.

Of course, the four examples given of government appropriation of quasirents do not apply symmetrically, when the conclusions are the very opposite. If construction costs are higher than initially expected, or traffic grows at a lower rate than initially forecasted, or long term interest rates increase instead of decreasing, or the judgment on how things were done in the past permit concluding that the contract signed is favorable to concession users, nobody in the government agency is going to demand an increase in toll fees. It could be only said that this is the business risk the concessionaire agreed to take on. This asymmetrical behavior is often called sovereign risk, because every contract with the State faces the possibility of a new law to unilaterally change the terms of a contract signed earlier. Notice that sovereign risk could be present even when there does not exist a case to question signed contracts, because only the existence of the possibility of revenue appropriation suffices.

Sovereign risk is well known and every consortium engaged in a concession bidding includes a premium in the toll fees to be offered to cover such a risk. Thus, the greater sovereign risk, the larger the toll fee structure offered by every consortium interested in becoming a concessionaire. Therefore, a way of controlling sovereign risk is in order. Otherwise, the entire success of the concession program is at risk, owing to excessive toll fees in every concession granted.

The thing to do to self-control sovereign risk is to reinforce property rights of concessionaires. Here, a statement of intentions is not enough and every concession contract should include clauses to protect concessionaire rights. In addition, this will also save the case, when a licit reason to amend signed contracts such as the one to be referred to is brought up, or when the government concludes that something should be done to lower excessive toll fees as those in the above examples. The point is that a need to change toll fees or any other contract clause should not be an excuse to appropriate concession revenues. Government's time inconsistent behavior is to be avoided.

Contracts should include a detailed procedure so as to calculate the amount of the compensation to be granted to the concessionaire, to prematurely terminate a concession. Thus, if the government wants to amend a contract, it is far better to terminate a deficient contract than to begin a direct negotiation to improve it; here it is necessary to recall the disqualifying defects of direct negotiations. More on this will be mentioned later on, especially on how to establish compensation clauses in concession contracts, as a way of protecting concessionaire rights.

Chilean authorities also share this viewpoint of reinforcing property rights as a requirement for the success of a concession program. However, intentions to include detailed clauses in contracts have failed, for lack of adequate legislation. Nevertheless, the need to amend signed contracts has not arisen in Chile so far, chiefly because none of the concessions granted has completed its construction (except one, to be inaugurated two days before the Seminar, which this paper is submitted to, will be held), in order to evaluate how well or poorly concessionaire rights are protected.

3.2.6. Correct incentives to face the need for an increased infrastructure capacity during the concession period

When a granted concession is its working stage, toll fees are charged and a government agency controls and evaluates its operation. Furthermore, from time to time *ex post* evaluations are probably made, including an analysis as to adequacy of existing infrastructure for current and future traffic levels.

As the idea that originated the concession currently in operation may be far in time, the traffic development might be similar or not to the initially projected one, because there is always a forecast error. So it need not come as a surprise that current traffic and the updated forecast for the coming years are different to the ones expected several years before. At this point, it is worth bearing in mind the fast growth of traffic demand. Therefore, and perhaps even in the case of small departures from the initial forecast, a need for new improvements of the infrastructure operating under a concession contract can be looked into.

If the new infrastructure had been anticipated at the time of the formulation of the concession business, it would have been a good idea to have included contingent clauses in the concession contract, binding the concessionaire to expand its capacity. To expand capacity should be a contingent activity, because traffic could develop faster than initially expected and then the investment would be required earlier than forecasted. Thus, a contingent clause to trigger capacity expansions avoids direct negotiations to amend a signed contract and allows the building of the additional

infrastructure in the optimal time. Traffic level is the natural candidate for the contingent clause.

By the same token, if traffic develops slower than initially expected, the contingent clause allows to delay investments until the optimal time to invest arrives. However, traffic could develop slow enough so as to postpone the expansion until the final years of the concession period. In this situation, the concessionaire is obtaining a poor return on investments already made and the requirement of additional investment could make matters worse, because there is not enough time to recover it with revenues that are to stop soon. As this event is within the possibilities when bidding for the concession business, it is better to have an exit to such an unfavorable event, and contingent clauses to trigger the capacity expansion should expire, say, when the concession period has exceeded half of the agreed concession period. This should be understood as a way to limit the possibility of losses in a risky business and to induce lower toll fees.

However, contingent clauses to bring about capacity expansions on roads and streets are not a perfect solution to anticipate future requirements. On the one hand, it is difficult to forecast every expansion that could be needed, for a traffic doubling every 8 or 9 years, for example, and which after 20 years is five times as large as the one on the first year. On the other hand, when a capacity expansion is delayed for several years and the automatic requirement to invest expires, the postponed need for the expansion could still exist. Thus, to make an allowance for an exit to a signed contract is in order.

The exit to a signed contract to improve existing infrastructure not anticipated several years in advance is probably the most difficult problem to be solved in a concession business. Of course, this does not involve using this as an excuse for revenue appropriation and the contingency is to be anticipated. It is the same point made earlier as regards allowing an exit to change toll fees currently considered too high or to amend a contract currently considered as not favorable to concession users.

The proposal is that every concession contract should have clauses to be prematurely terminated, with a detailed procedure to calculate the amount to be granted to a concessionaire in such a case. There is hardly any use in trying to anticipate every contingency under which to exercise a clause to terminate the contract, because there is always a government's sovereign decision than can be argued for. The important point is not the reason to do so, but the consequences. The indemnity should be computed in a rather automatic fashion, and so avoid a lawsuit. The fact that it is a difficult task —considering that contingent clauses are to be written into a contract— should not be an excuse. The Chilean Mining Law to expropriate concessions in mineral exploitation is a case to be borne in mind.

To avoid the possibility that the termination of a signed contract be seen as an expropriation instead of the purchase of a contract at its economic value, we propose a procedure which is based on a certainty equivalent approach because a risky business is to be terminated prematurely and converted into a lump sum certain. This can be approached by considering the traffic level structure for the last 36 months prior to the official notice to the concessionaire of the expropriation to be effected in due time, say, less than a year. We propose choosing the most favorable continuous 12 month traffic, in order to compute an annual cash flow to be considered as an equivalent certain of future annual revenues to be purchased. This annual cash flow leads to a present value calculated at a risk free rate, which is the amount sought for as an indemnity. The risk free rate is also contingent to current market conditions, such as the one implied by the market price of Central Bank debentures, for the term closest to the one considered in the calculation. The operating costs to be deducted from revenues are calculated on an historical basis by a certified public accountant, as a simple average linked to historical traffic corresponding to the 12 month period chosen as a reference. Notice that all the data to calculate the indemnity is collected in a rather automatic fashion, thereby minimizing conflicts. This avoids making a forecast of traffic revenues and costs which could be controversial, where costs could be open to disputes; the only adjustment to historical figures should be an updating of tax rates, if there had been any change in the law in the interim.

The above proposal to compute the indemnity has one flaw: the indemnity could be high enough to be deemed a factor discouraging the government to exercise its right to purchase a concession contract. This could happen because future revenues from an expropriation procedure are the greatest over the entire concession period. It must be borne in mind that traffic increases and so do revenues (see appendix 2). Therefore, two caveats are in order.

First of all, if minor increases in capacity are involved, it would be better to be entitled with the power to introduce changes in a concession contract. Consequently, if government authorities consider that there is the need to make additions to a concession after it has started to operate —as, for instance, traffic light controls, an updated signalling system, or any other improvement amounting to less than 20 percent of the initial investment already made— it is better not to terminate a contract, as it could be too costly. In any event, to permit an additional exit in cases involving minor investments should not be provided for at the full cost of a direct negotiation.

Probably, an automatic calculation to extend the concession period should be favored. For example, for each 10 percent of additional investment, the concession period is extended 5 percent of the months that it has already been under operation, without introducing any change to the toll fees specified in the contract. This could

solve the need to add minor investments in the operating stage of a concession. Even though some room for direct negotiation is included, it is rather restricted and the possibility of disagreement is lessened, on the one hand, due to the menace of a premature termination of the contract that the government is always entitled to and, on the other hand, because the concessionaire is not limited to merely making the minor investment under negotiation at his own risk (to change even a single word in the contract binds a concessionaire to add capacity to the concession).

Second, when a concession contract requires major changes, with investments amounting to more than, say, 20 percent of the initial investment, it is better not to allow an exit other than the solution of simply terminating the contract. To extend the concession period for a major investment is not recommended, because the advantages of a bidding process will be lost as a procedure to attain a minimum cost, and to change toll fees —as probably would be required— is to invite agency problems (especially because the latter is a negotiated change in the key variable to win concessions).

The problem to be solved through the premature termination of the contract is not an economic one, but one that falls within the political arena, because the amount to be granted as an indemnity could be difficult to justify in the eyes of the public: it could be well above the initial investment made years ago. It is not an economic problem, because the funds to purchase a concession contract are going to come from the new concession to be offered, which includes the infrastructure to be added and also the revenues to be purchased. This allows the indemnity to be charged as a part of the cost of a new business and even to be paid by the new concessionaire, after the new grant has been made. Thus, the government need not spend any money, and is able to keep political face in terms of the solution and avoid financial difficulties to the public sector. The only precaution needed is to establish a contract clause so as to pay the indemnity with some delay.

Unfortunately, intentions to include contingent clauses in Chilean concession contracts have failed, because there is no provision for them in the standing legislation. Thus, contingent clauses to program future capacity expansions, which can be more or less anticipated, to allow minor unanticipated investments, and to rule the purchase of contracts, are not currently included, as desired. Special laws are needed. Even though the need for contingent clauses seems not to have been crucial so far, future concessions —such as the one for the *La Dormida* Road— are calling for them.

3.3. Concessions as an opportunity to collect taxes

A practice to be avoided as a blight is to take advantage of the opportunity that toll fees are going to be charged through a concession, and not yield to the

temptation of an additional fee to supplement the fiscal budget. Even though the argument exists that the concessionaire is also exploiting infrastructure financed with previous investment not made by him and which must also be recovered, there are natural limits to toll fees, so that they might not be seen as an expropriation in the eyes of the public. The central idea is to always charge for the incremental project cost, because room should be left for users to make a gain. Thus, a toll fee should never exceed the savings made by users in travel costs. Otherwise, it will face the same rejection as the toll solution for congested cities that is applied on existing infrastructure. As a matter of practical political economy, at least at the beginning of a concession program, the acceptance of the whole idea by the public is put into risk by including a tax in the toll fees. For an opposite view on this, however, see Gómez-Ibánez *et al*. [1992, p. 18].

By the same token, the projects chosen to be given in concession have to be the only ones in which the toll fees needed to recover the costs are smaller than per travel cost saving. In fact, not every transport infrastructure project is feasible for concession, as is the case of those with less than 800 vehicles/day, as pointed out by Schliessler and Bull [1992, p. 87], especially because with such a traffic level about 20 percent of revenues should be devoted only to cover costs spent in toll plazas.

4.   THE CONCESSION PLAN FOR SANTIAGO

The whole Chilean concession program has been criticized, because only five concessions have been granted over the last four years, since the enactment of the Concession Law on August 28, 1991. However, critics overlook the fact that this is a very complex matter and that there is always the possibility of making big mistakes. Playing for time involves dangers —as was the case in Mexico and Argentina not so long ago— and everyone involved in the details of designing a law or business for concessions should be well aware of them; see WB's WDR [1994, p. 90]. For example, writing a draft for the first contract-to-be certainly takes no less than a full year, including all the steps to attain perfect consistency with the entire legal system. Add now the time needed to refine the laws such as those to bring about profundity in the national financial system, which is much more difficult and delicate than changing a particular law. The criticisms to the Chilean concession program in the sense that it is too sluggish are not shared at all.

However, with the experience of five signed concession contracts and with the law to reform the capital markets in the process of enactment at the time of writing this paper (hopefully in August, 1995, 31 months after it was announced), the time to evaluate what is expected has come. In this section the concession plan for Santiago is presented and then commented.

4.1. The portfolio of concession ideas for Santiago

Neither of the five concessions already granted, nor the one in the bidding process by August, 1995, are on the urban side, even though one of them includes substantial refinements to urban connections with interurban roads. Thus, one of the concessions to come into operation in the near future includes decisive advances to decongest some principal avenues in Santiago, though as a side effect to interurban concessions. None of the concessions was primarily motivated by urban congestion problems.
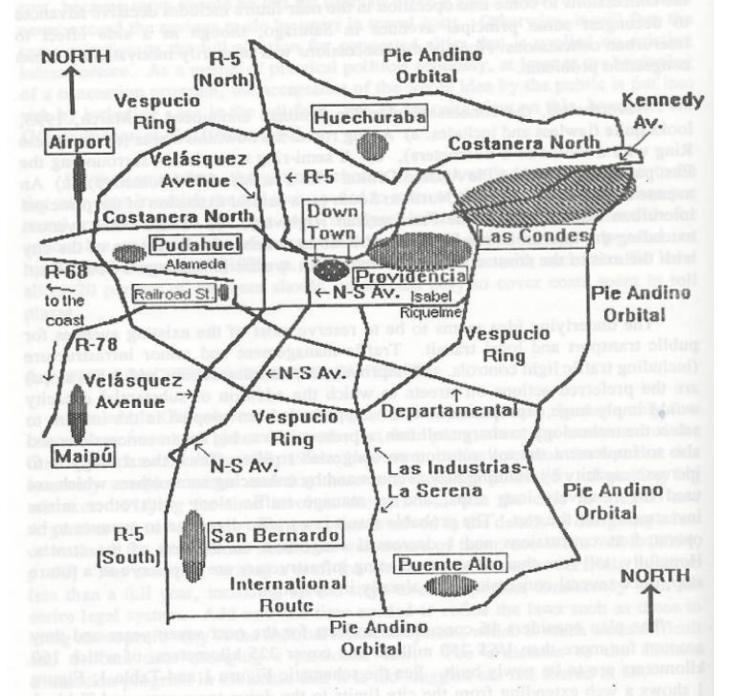
Nevertheless, the concession plan for Santiago announced in March, 1995, looks quite flawless and includes: a) A ring round the downtown area (the Vespucio Ring with a radius of 8 kilometers), b) A semi-ring or «orbital» surrounding the East part of the city (the Pie Andino Orbital with a radius of 20 kilometers), c) An avenue crossing the city from North to South (as a natural extension of the principal interurban trunk Route 5, the Panamerican Highway), d) Three other avenues extending the interurban roads R-78 and R-68 to connect the East Area of the city with the exit to the coast at the West, and e) An avenue in Santiago's South-East.

The underlying idea seems to be to reserve most of the existing avenues for public transport and local transit. Traffic management and minor infrastructure (including traffic light controls, and improvements on intersections and at bus stops) are the preferred actions on streets in which the addition of substantial capacity would imply huge expropriation costs. Steps have been adopted in the interim to select the technology to charge toll fees, a prerequisite to bid urban concessions and also to implement the toll solution on congested streets. Thus, the strategy is to increase capacity by building new avenues and by enhancing some others which are used for relatively long trips, and to manage traffic along with other minor investments for the rest. The probable result is a traffic diversion to avenues to be operated as concessions and a decreased congestion on the rest of the streets. Hopefully, toll fees charged to use existing infrastructure are in reserve as a future step, once several concessions are already in operation.

The plan considers 16 concession projects for the next seven years and they account for more than US$ 750 million and cover 325 kilometers, of which 160 kilometers are to be newly built. See the schematic Figure 1 and Table 1; Figure 1 shows a web extending from the city limits to the down-town area, and Table 1 shows the details. The promise was also made in March 1995 to deliver comparable plans in the course of the year for Valparaíso and Concepción, the next two urban concentrations in order of importance.

FIGURE 1

THE CONCESSION PLAN FOR SANTIAGO

NORTH

R-5
(North)

Pie Andino
Orbital

Kennedy
Av.

Vespucio
Ring

Huechuraba

Airport

Costanera North

Velásquez
Avenue

← R-5

Costanera North

Down
Town

Las Condes

Pudahuel

Alameda

R-68

Providencia

to the
coast

Railroad St.

← N-S Av.

Isabel
Riquelme

Pie Andino
Orbital

R-78

Vespucio
Ring

Velásquez
Avenue →

←N-S Av.

Departamental

Vespucio
Ring

Maipú

N-S Av.

Las Industrias-
La Serena

Pie Andino
Orbital

R-5
[South]

San Bernardo

Puente Alto

NORTH

International
Route

Pie Andino
Orbital

Source: Prepared on the basis of a Press Conference given by the Public Works, Transport
and Telecommunications, and Housing and Urban Development Ministers. March, 1995.

142

TABLE 1

THE SIXTEEN CONCESSIONS INCLUDED IN THE PLAN FOR SANTIAGO

Concession idea		Invest-ment US$ millions	Length Km	Description	Characteristics
Given name	Official name				
PRIORITY 0 PROJECTS: to be granted in 1995 - 1996					
1 R-78, West	Ruta 78 Sector Malloco-General Velásquez	52.8	18.0	Four two-way lanes	One off level intersection
2 International Airport Access	Acceso Aeropuerto Comodoro Arturo Merino Benítez	6.8		Four two-way lanes	Private initiative. One off level intersection; one bridge
PRIORITY 1 PROJECTS: to be granted in 1996 - 1997					
3 Vespucio Ring	Avenida Circunvalación Américo Vespucio	56.2	43.5 Km (out of 64.6 Km)	Highway divided in six parts: four two-way lanes with a median	Private initiative: 9.6 Km (under construction). It includes local lanes
4 Costanera North, East	Costanera Norte Sector Lo Barnechea-Norte Sur	130.0	34.0	Expressway: six two-way lanes	Private initiative. It includes two tunnels
5 R-5, North	Ruta 5 Norte Sector Lampa-Río Mapocho	20.0	34.5	Four two-way lanes	Five off level intersections; it includes local lanes
6 N-S Av.	Avenida Norte Sur	3.5		Highway divided in three parts	It includes traffic light controls and five off level pedestrian ways
7 R-5, South	Ruta 5 Sur Sector C. Valdovinos-Río Maipo	18.7	14.7	Highway divided in three parts: from 4 to 6 two-way lanes	Four off level intersections; it includes local lanes partially
8 Velásquez Av.	Avenida General Velásquez	42.5	23.3	Highway divided in four parts: from 4 to 6 two-way lanes	Two off level intersections; it includes local lanes partially

(continued on next page)

143

Concession idea		Invest-ment US$ millions	Length Km	Description	Characteristics
Given name	Official name				
9 Costanera North, West	Ruta 68 Sector Río Mapocho-Las Rejas	20.0	11.0	Expressway: Eight lanes	Four off level intersections
10 Kennedy Av.	Avenida Presidente Kennedy	13.6	13.7		It adds five off level intersections
PRIORITY 2 PROJECTS: to be granted in 1997 - 2000					
11 Pie Andino Orbital, East	Avenida Pie Andino Sector Las Condes Ruta 5 Sur	149.5	45.0	It starts with four two-way lanes	Nine off level intersections. Site expropriation adds US$77 million
12 Pie Andino Orbital, South	Camino Internacional G34 Sector Orbital-Ruta 5	16.8	17.5	It starts with four two-way lanes	Four off level intersections
13 R-78, East	Isabel Riquelme-Rodrigo de Araya	51.5		From 4 to 6 two-way lanes	
14 Las Industrias - La Serena	Eje Las Industrias-La Serena	43.6	18.0	From 4 to 6 two-way lanes	
15 R-68, East	Anillo Dorsal Sector Alameda-Las Rejas-Departamental	40.0	21.0	Six two-way lanes	
PRIORITY 3 PROJECT: after year 2000					
16 Pie Andino Orbital, North	Avenida Pie Andino Sector Las Condes - Ruta 5 Norte	85.9	31.0	It starts with four two-way lanes	Three off level intersections. Site expropriation costs not included
Total		751.4	325.2	Expropriations increase costs	

Source: Prepared on the basis of a Press Conference given by the Public Works, Transport and Telecommunications, and Housing and Urban Development Ministers. March, 1995.

4.2. Comments on the concession plan

A casual inspection of Figure 1 tests our imagination and the web hints that the challenge posed by transport infrastructure in Santiago has been seriously faced. What could be criticized then? Obviously, it is really hard for a bystander to suggest that a connection between two nodes in the network has been overlooked or that innovative ideas are missing.

For example, consider the case of the Vespucio Ring which accounts for 192,000 travels daily, the one with the highest demand out of the sixteen concession ideas, as documented by the Ministers. This Ring includes the addition "only" of lateral lanes for local traffic, reserving the existing four two-way lanes for rapid traffic and that are to be improved. This contrasts openly with each of the following three concession ideas ranked by order of traffic volume and which consider six two-way lanes, instead of four (Kennedy Av. accounts for 130,000 travels daily, and Costanera North and Velásquez Av. for 120,000 each).

A mild criticism might question why there are fewer lanes considered in the Vespucio Ring, with the probable answer that six two-way lanes are too costly due to expropriation costs. However, would six or even eight two-way lanes be profitable if elevated lanes are considered without having to bother about expropriating air?, or what about an elevated railroad resorting to the existing median between lanes? Of course, the last two questions are not easy to answer, but they do challenge our imagination. But this does not necessarily mean that the concession program for Santiago is not imaginative enough (as conceivably could be doubted in the case of the Vespucio Ring), and it illustrates the difficulties to make well-founded criticisms.

Of course, the plan for Santiago is up for enrichment with additional concession ideas put forth by private actors, as is the case of a project called East Radial intended to connect the Vespucio Ring with Route 5 North by means of one or two tunnels; this idea is currently in the process of its cost-benefit justification to grant the patent. Briefly stated, the concession plan for Santiago is promising, even though it is still under way and most of the ideas, as well as those that will eventually arise, are to be carefully evaluated.

However, concessions of streets and avenues such as the ones included in the plan along with others to be added in the interim are not the only way to meet the challenge posed by transport infrastructure. An overall answer should also explore solutions associated with the underground railway and urban railroads. This is the missing link, a rather important one.

In 1994 a third line of Santiago's Metropolitan Underground Railway was started, after a decade of (almost complete) passiveness. The option taken is to go from down-town to the South to serve middle class people mainly. Why not expand

it to the East, the most affluent part of the city? In this area of the city the time value is higher and what is justified for the South is probably also justified for the East. It seems that the argument against this view rests heavily on distributive effects, because there is a reluctance to finance infrastructure for well-to-do people from the fiscal budget; sharing this reluctance, what has to be done is to find a procedure to charge the cost to users, so as to do away with the argument. Of course, a concession of an underground railway is in order. Even though this leads to privatizing part of the Metropolitan Underground Railway --which probably would require a special law and also a feasibility study--, which is a challenge that has to be faced.

A second missing link and with a high potential is to include interurban railroads in the network, as is the case in several cities around the world, such as Buenos Aires, Madrid, Barcelona and Paris. This is a challenge that is difficult to face in this century, because the State-owned enterprise owning the railroad and also the right of use does not even have an inventory of its assets. But the time is ripe to start with an evaluation process to meet the expectations created by sporadic announcements that interurban railways are being seriously considered.

In short, the concession plan for Santiago holds a promise to decongest the city. The announced plan seems complete, though it lacks two links: the underground railway and the railroad concession alternatives.

5. CONCLUDING REMARKS

The transportation sector poses a challenge to the society: how to provide the infrastructure that fast growing traffic demands. This is not an easy task, because needs tend to grow faster than availabilities. For example, traffic management, such as the introduction of toll fees on congested streets or, at the extreme, to enact a law to force cars out of the streets have limited potential to respond to the challenge. It seems there is no real alternative in terms of providing the new infrastructure needed.

In order to provide new infrastructure, concessions have a potential to meet the challenge. On the one hand, the private sector provides the money that the public sector does not have, and concession users pay for what they get in order to cover the investment. On the other hand, the private sector contributes with economic efficiency to enhance the provision of infrastructure, including new ideas, efficient investment and maintenance, and low toll fees.

Concessions, however, pose an incentive compatibility problem which is not easy to solve, as experience has shown in the USA, Australia, Spain, Mexico and Argentina. Hence, a careful procedure for concessions should include bids for the lowest toll fees, absence of government guarantees, and reinforcement of property

rights. Concession contracts should also include contingent clauses, to allow expansions in capacity and even to purchase concession contracts by the governments, for the same purpose. In this respect, Chilean concessions are quite robust to the examination on how well or poorly the incentive compatibility problem is solved.

The concession plan for Santiago is a good example of the potential which the idea of responding to the challenge posed by transport infrastructure has. Although the proposed solution to the congestion problem in Santiago includes neither the underground railway nor railroad concessions, it is promising.

Here a clarification is made to the assumption in Section 1 that a traffic demand growing 8.4 percent per year requires funds to be devoted to transport infrastructure growing at the same rate per year, so that supply keeps pace with traffic demand. This is an assumption of constant return to scale in the provision of infrastructure.

To illustrate the point, on the one hand, consider Jansson's [1984, p. 219] view: it could be "observed that a four-lane road is less than twice as expensive to build as a two-lane road while its capacity will be more than double and this ... taken as evidence of economies of scale in the provision of road services." This means that spending on transport infrastructure need not grow at the same rate as traffic so that supply keeps pace with demand.

Jansson's [1984, p. 221] data on construction and maintenance costs leads to a scale factor of 0.46 for the Swedish case. This is rather crucial, because with such a scale factor it is enough to have 3.8 percent annual growth rate of funds devoted to transport infrastructure, for a supply growing at 8.4 percent per year, which is the same rate at which traffic demand grows; 3.8 percent is lower than 6.3 percent, the tax collection annual growth rate considered in Section 1. (Scale factors imply long run total costs following a rule of the type $C_1/C_0 = (T_1/T_0)^\alpha$, where C_1 and C_0 are the yearly equivalent per kilometer total costs corresponding to the traffic levels T_1 and T_0, respectively, and α the scale factor. For a scale factor of 0.46 and for a traffic growth rate of 8.4 percent, this rule implies in turn that long run total costs should grow [$1.084^{0.46} = 1.038 \rightarrow$] 3.8 percent per year in Chile, so that supply keeps pace with traffic demand.)

On the other hand, Gomez-Ibanez et al. [1992, pp. iii-iv and 15] mention that "there is little evidence of economies or diseconomies of scale in highway construction" and "most studies of highways show that they exhibit constant, or near constant, economies of scale in long run (construction) costs." See also Gomez-Ibanez [1992]. Constant returns to scale require funds to be devoted to transportation infrastructure growing 8.4 percent per year, which is the same rate at which traffic demand grows; 8.4 percent is larger than 6.3 percent, the tax collection annual growth rate.

Now consider the data available for the Chilean case. A scale factor in the range from 0.43 to 0.81 is inferred from Jara-Díaz et al.'s [1993, pp. 3.49-3.53] quadratic cost functions estimated for nine Chilean interurban road classes, considering construction, maintenance and rebuilding costs (but not land expropriation costs which could be a significant underestimation in the urban case). This finding is in line with the Swedish case. Quadratic cost functions allowed

professor Jara to make conclusions on economies of scope in the provision of infrastructure, because such functions include interactive terms between the four vehicle classes that use roads: cars and pick-ups, light trucks, heavy trucks, and buses. The four estimated long run total cost functions are of the following type:

$$Total\ Cost = Constant + \sum_{i=1}^{4} A_i\, Q_i + \sum_{i=1}^{4}\sum_{j=1}^{4} A_{ij}\, Q_i\, Q_j\ ,$$

where Q_i is the traffic level for each vehicle class. If each traffic level is defined as a departure from some reference level as the one considered representative for each road class, marginal costs of each vehicle class are A_i constants. But each marginal cost changes with its own traffic level and also with other vehicle traffic levels. So that the A_i's are marginal cost evaluated only for representative traffic levels.

Quadratic cost functions are tricky. For example, the above scale factors are the ones evaluated for the same traffic levels which were considered mean values in the study. But there is no guarantee that mean values are representative of either traffic currently observed on Chilean roads or future traffics. Moreover, due to the interactive terms, long run marginal costs may be decreasing with their own traffic level, but increasing with other vehicle traffic levels. Thus, to calculate scale factors from quadratic cost functions, an assumption of traffic development for each vehicle class is required.

As the simplest assumption is the same proportional change in traffic for each vehicle class, long run total costs were calculated from nine reported quadratic cost functions, considering two traffic levels. One considered the given representative traffic of each vehicle class. The other focused on the same representative traffics but increased by 8.4 percent. Then a set of nine paired total cost is obtained, and nine scale factors computed. The exercise was repeated proportionally changing the assumed representative traffic levels, considering 1/2, 3/2 and 2 times reference levels. The result is reported in Table 2.

Observe from Table 2 that scale factors for original representative traffic levels are in the range from 0.43 to 0.81, as mentioned above. The most intriguing case is the one for mountainous roads in the North, with a scale factor that becomes negative. Of course, it is not a credible result, because it implies that total costs decrease with traffic. This is because some interactive terms A_{ij} in the quadratic cost function are negative, particularly the four estimates for the A_{ii} constants; as these constants capture the quadratic effect on costs of a traffic increase, they contribute negatively and dominate. In Table 2, four cases marked with * out of nine are with the four A_{ii} constants negative and then affected by the same problem. Further, negative or very small scale factors are probably not a consequence of out of sample extrapolations.

149

TABLE 2
SCALE FACTORS INFERRED FROM NINE QUADRATIC COST FUNCTIONS

Road Class	Representative traffic levels scaled by:			
	0.5	1.0	1.5	2.0
North-Plane	0.75	0.68	0.53	0.31
North-Winding	0.57	0.64	0.63	0.57
North-Mountainous*	0.74	0.46	-0.04	-1.09
Central-Plane	0.34	0.81	1.16	1.39
Central-Winding	0.51	0.55	0.48	0.34
Central-Montainous*	0.36	0.43	0.40	0.32
South-Plane*	0.66	0.63	0.51	0.31
South-Winding	0.42	0.59	0.68	0.73
South-Mountainous*	0.38	0.43	0.37	0.24

Note: North refers to roads from the northern part of Chile, and so on.
Source: From Tables 3.4-1 and 3.4-2 in Jara-Díaz *et al.* [1993].

It seems that the estimates of the constants are not accurate. In fact, the reported t-statistics suggest that some of them are insignificant. Thus, it is safe to ignore the implausible implication of the quadratic terms. By contrast, all the A_i constants are accurately estimated. Finally, notice that ignoring quadratic terms leads to a linear function, with constant returns to scale. The latter is exactly the point argued by professor Gomez-Ibanez, and it is the viewpoint considered in Section 1.

As a remark, in professor Jara-Díaz [1993, p.3.47] study this view is also adopted, when calculating the funds needed for the interurban side and assuming "required new investments in roads ... are *proportional* to traffic growth" (italics added); also when concluding: "Thus, considering a traffic growth rate of 6 percent per year, the annual investment needed is 6 percent of the appraised stock of roads (evaluated as the funds required to rebuild and maintain all of them)."

Here it is pointed out why the economic value of a concession contract may be well above the investment made in the construction stage, when calculated in a year even close to its ending, as considered in section 3.2.6.

To see the point, consider the case of a concession business with a 14 percent required annual return, 7 percent above the risk free rate. For net revenues growing 8.4 percent per year, the net revenue expected for the last year is 4.6 times the one expected for the first year in a concession for 20 years; the expected net revenue for year 15 is 3.1 times the one for the first year. Thus, US$10 million expected net revenues for the first year and growing at 8.4 percent per year are expected to reach a value of US$31 million in year 15 and US$46 million in year 20. These operating revenues allow a one year investments of US$113 million, to obtain a return of 14 percent, the required yield. Notice that the first year net revenues are only 9 percent of the initial investment and a sort of capital loss is expected for the initial years of the concession. This involves that the last years of the concession should have net revenues large enough to offset initial capital loses: the year 15 net revenues are 27 percent of initial investment and the last year, 41 percent.

This also leads to the last 5 years of operation net revenues accounting for about US$133 million, calculated as present value in year 15. Thus, an expropriation of the concession in year 15 would merit an indemnity of US$133 million, for appropriation of the last 5 year net revenues. This amount to be paid in year 15 is larger than the initial investment of US$113 million. Notice also that the proposed procedure to calculate the indemnity based on the certainty equivalent approach gives US$137 million, which is the present value of a constant annual flow of year 15's US$31 million, for 5 years and discounted at the 7 percent risk free rate (pretty close to the exact figure of US$133 million).

In addition, suppose that the expropriation originated on the need to expand infrastructure capacity, because traffic has been growing faster than expected. Suppose also that traffic and net revenues have been growing annually at 10.3 percent, the growth rate Chilean traffic had in the 1986-1994 period. In year 15, the net revenues in the above example would be about US$44 million (instead of US$31 million, as initially expected) and net revenues for year 20 would be currently forecasted at US$71 million; the latter calculation would not be made to estimate the indemnity at year 15, but the present value of US$44 million for five years calculated at the 7 percent risk free rate; we would obtain an amount of US$197 million, which is 1.7 times the initial investment. Thus, the government will probably have a political problem in order to justify a larger than initially invested indemnity to purchase a concession contract.

The problem that originates on concession revenues growing at the pace of traffic demand could be lessened by considering decreasing toll fees. For example, and recalling the above numbers, toll fees decreasing 2 percent a year lead to the following: In the extreme case of net revenues growing 10.3 percent instead of the expected 8.4 percent per year, US$10 million net revenues in the first year are followed by US$31 million in year 15 (instead of US$44 million without decreasing toll fees), and then originate an indemnity amount of US$137 million in year 15 (instead of US$197 million). However, toll fees decreasing 2 percent per year lead to higher initial fees, which would be 15 percent larger in the first year.

REFERENCES

CABRERA, A., R. DE LA CUADRA and H. GUTIERREZ (1993): *Asesoría para el estudio del esquema de licitación, prospecto de inversión y bases de licitación del proyecto de concesión del camino de La Dormida*, technical report prepared by PROCONSULT (a Chilean consulting firm) to the Chilean Ministry of Public Works (December).

COHEN, Y. (1991): "Developments in Transport Policy: California Private Infrastructure Initiative," *Journal of Transport Economics and Policy* Vol. XXV, 299-302.

GOMEZ-IBANEZ, J.A. (1992): "The Political Economy of Highway Tolls and Congestion Pricing," *Transportation Quarterly* Vol. 46, 343-360.

GOMEZ-IBANEZ, J.A.; J.R. MEYER and F.C. NAVARRO (1992): *Chile's Highway Concession Programs. Final Report to the Asesoría Ministerial, Departamento de Concesiones de la D.G.O.P.*, *Ministry of Public Works, Republic of Chile*, John F. Kennedy School of Government, Harvard University.

JANSSON, J. (1984): *Transport System Optimization and Pricing*, John Wiley and Sons (Great Britain).

JARA-DIAZ, S. *et al.* (1993): *Desarrollo de un sistema de tarificación para transporte interurbano*, research report prepared by CITRA (a Chilean consulting firm) to the Chilean Ministry of Transport and Telecommunications.

KLEIN, D.B. and G.J. FIELDING (1992): "Private Toll Roads: Learning from the 19th Century," *Transportation Quarterly* Vol. 46, 321-341.

LABBE, F., H. GUTIERREZ, J. VIDELA, R. DE LA CUADRA and A. CABRERA (1993): *Metodologías y criterios de evaluación y priorización de poyectos viales interurbanos y urbanos ejecutados mediante concesión*, research report prepared by PROCONSULT and CIS (Chilean consulting firms) to the Chilean Ministry of Public Works.

MILLARD, A. *et al.* (1994): *Estudio del negocio de interconexión vial entre la Región Metropolitana y la Quinta Región a través de La Dormida*, project report prepared by IGS (a Chilean consulting firm) to the Chilean Ministry of Public Works.

MILLS, G. (1991): "Commercial Funding of Transport Infrastructure. Lessons from some Australian Cases," *Journal of Transport Economics and Policy* Vol. XXV, 279-298.

SCHLIESSLER A. and A. BULL (1992): *Caminos. Un enfoque para la gestión y conservación de redes viales*, published by The Economic Commission for Latin America and the Caribbean, ECLAC (Santiago).

153

WORLD BANK (1994): *World Development Report 1994. Infrastructure for Development,* Oxford University Press (New York).