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Broad Roads in a Thin Country

Infrastructure Concessions in Chile

Lessons learned from Chile's highly successful experience in introducing private capital into the transport infrastructure sector.

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Summary findings

To increase investment in infrastructure, in the early 1990s Chile's government introduced private capital into the transport infrastructure sector, covering roads and highways, bridges, tunnels, and airports. The chosen mechanism: a concession scheme through which private firms would finance and build a given project and then operate the infrastructure for a set number of years, recovering their investment by collecting tolls from users.

Among lessons learned from the experience:

- As much as possible, avoid concessioning roads for which there are convenient alternative freeways nearby.
- Choose the right variable for awarding a concession. Avoid mechanisms that (by promoting large payments to the state or short-term concession periods) encourage high tolls, and if you choose to award a concession to the firm charging the lowest tolls, place a floor and ceiling on possible bids. The floor is to guarantee the concession's financial viability; the ceiling is to prevent inefficient traffic diversions. Ties at either end should be resolved by a second variable, such as the level of transfers between the state and the firm.
- Allow downward toll flexibility so that the concessionaire can react to unexpectedly low traffic flows, especially for certain types of vehicles.
- Pay special attention to the tendering mechanism and to the general incentive structure. There are limits the pure least-present-value-of-revenue (LPVR) auctio but income guarantees do enhance liquidity. In fact, a minimum-income guarantee through an LPVR auction an instrument for credit enhancement, not income support. Alternatively, some form of financial innovati should be encouraged to make debt service commitme more flexible.
- If concessions are tendered by traditional method and income guarantees will be given, cover only a fraction of the concessionaire's expected income strear to reduce the state's financial exposure and to improve the incentives to the concessionaire.
- Make the contracts as complete as possible but allow for later modifications or renegotiations, and include a well-designed dispute resolution mechanism.

This paper — a product of Governance, Regulation, and Finance, World Bank Institute — is part of a larger effort in tl institute to increase understanding of infrastructure regulation. Copies of the paper are available free from the World Ban 1818 H Street NW, Washington, DC 20433. Please contact Gabriela Chenet-Smith, room J3-147, telephone 202-47. 6370, fax 202-676-9874, email address gchenet@worldbank.org. Policy Research Working Papers are also posted on tl Web at www.worldbank.org/research/workingpapers. Andrés Gómez-Lobo may be contacted at agomezlo@deco facea.uchile.cl. January 2000. (51 pages)

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BROAD ROADS IN A THIN COUNTRY
Infrastructure Concessions in Chile

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1 Introduction

Chile has experienced rapid economic growth for more than a decade. Demand for basic infrastructure services has grown in tandem with the economic expansion, quickly outstripping the supply capacity of existing assets. As a result, important infrastructure deficits have appeared. If not eliminated, these deficits could create serious bottlenecks that could hamper further economic growth in the future.

Besides being a potential obstacle to growth, deficits in basic infrastructure may also lead to greater economic and social inequality. Lack of infrastructure may leave certain segments of the population isolated and unable to enjoy the benefits that economic development brings to the rest of society.

The need to increase investment in infrastructure was recognised early on this decade. However, the required resources—if they were to come from the public purse—would naturally crowd out other public expenditure programmes, especially social welfare spending. Therefore, in the early 90's a policy decision was taken to introduce private capital in the transport infrastructure sector, covering roads and highways, bridges, tunnels and airports. The chosen mechanism was a concession scheme, whereby a private firm would finance and build a given project and then operate the infrastructure for a set number of years. The concessionaire would recover its investment by the collection of tolls from users.

The concession programme would thus alleviate the budgetary restrictions of the government, allowing more public resources to be devoted to social spending. However, introducing private capital in the infrastructure sector does not eliminate the need for government intervention. As will be discussed below, there is an important role for the State to design, monitor and regulate the contracts for the duration of the concessions. In Chile, these activities have been the responsibility of the Ministry of Public Works (MOP).

The purpose of this paper is to review the Chilean private infrastructure programme and to present some lessons for other countries embarking on a similar route. The focus is mainly on roads and highways, although a tunnel and some airport facilities have also been concessioned.

The Chilean experience is interesting for several reasons. First, for its size and scope. Over 2,000 kilometres of roads have been concessioned for a value of US$3.3 billion. If airport projects are considered, the value of the total infrastructure concessioned is over US$3.6 billion. Furthermore, the programme will generate, in present value terms, net revenues amounting to between US$130 million to US$150 million for government coffers. These figures ignore, however, the potential liabilities assumed by the State in relation to the granting of minimum income guarantees.

Second, unlike the experience in Mexico, the programme in Chile has been mostly successful. Although it is too early to know for sure, the projects that are already in service have not confronted any major setbacks in terms of traffic levels, construction delays, cost overruns or other problems. This is not to say that problems have not been encountered. In fact, government minimum income guarantees for low traffic levels have been triggered in the case of one concession. In other cases,

conflicts have arisen regarding compensations for geological costs and expropriation delays, *ex-post* changes to projects, and excessive government demands for additional investments. The tendering of one recent concession failed to attract bidders. However, for the most part these problems have been successfully dealt with by the mechanisms established in the concession contracts and the concessions law, and have not stalled nor compromised the concession programme as a whole.

Even in early 1999, in spite of the international financial turmoil, one consortium was able to place dollar denominated bonds in the North American market for a nominal value of US$213 million. Also, in 1999, another company issued peso inflation linked bonds equivalent to US$150 in the domestic pensions fund market. These figures imply that the programme still generates confidence among investors.

Part of this success may be due to the stable macroeconomic situation of the last few years.[1] However, it is fair to say that part of the success of the programme is also due to its design and implementation which, it may be added, benefited from the lessons learned from Mexico and other international experiences.

Third, the programme has been the motivation and testing ground for some interesting innovations in tendering mechanisms used to award projects. These innovations may help overcome some of the problems that have plagued road concessions around the world. A case in point is the Least Present Value of Revenue (LPVR) auction developed by three Chilean academics originally contracted by the Ministry of Public Works.[2] The properties of the LPVR auction—as well as the experience from its use in the tendering of two concessions—will be described in greater detail below.

Other innovations include the use of a multi-variable tendering procedure to reduce the perverse incentives that lead to bidders presenting unrealistically low bids in the hope of winning and then renegotiating the concession contract *ex-post*. Also, the design of an exchange rate guarantee using the logic of the LPVR auction in one recent concession may be of interest to other countries.

The paper is organised as follows. First, some background information concerning the magnitude of the infrastructure deficit is presented. It shows the urgency that confronted the Chilean authorities to increase infrastructure investment, which eventually led to the implementation of the concession programme. Second, a description of the main characteristics of the Chilean toll road programme is presented, followed by a summary of the projects tendered so far. The following sections focus on

[1] Chile was relatively unaffected by the regional crisis sparked by the financial troubles in Mexico in December 1994. The current year may provide a more severe test for the concession programme. Due to the international financial and economic situation, growth projections for 1999 have been drastically reduced to between 1-2%.

[2] See Engel, Fischer and Galetovic (1996, 1997a, 1997b, 1997c, 1997d, 1998) [from now on EFG] and the discussion below. These academics were originally hired as consultants by MOP. In that role, Alvaro Gonzalez from the Ministry suggested they study—among other issues—the properties of a least total revenue tendering mechanism, which is a special case of the LPVR auction that they later developed. As part of their work for the Ministry—and later independently—they were the first to recognise some of the economic problems faced by traditional franchising methods and to propose novel solutions.

some special issues related to road concessions and its application in Chile. Finally, the paper ends with some conclusions and lessons that can be extracted from the Chilean experience.

2 Infrastructure deficit

Between 1980 and 1994 the vehicle stock in Chile increased from 746,782 to 1,499,904. It is now expected to reach over 2 million vehicles by the year 2000. In Santiago, the number of vehicles per capita almost doubled in less than two decades (see Table 2.1).

Table 2.1: Average number of vehicles per thousand residents, Greater Santiago

Year	Vehicles per 100 residents
1977	5.8
1991	9.1
1995	11.9

Source: Trip Origin and Destination Survey, 1991. The 1995 figure is an estimate by the Ministry of Public Works.

The problems created by the increase in the vehicle stock were compounded by the poor condition of the road network. During the eighties, maintenance investment reached only 30% of the amount required. The portion allocated to the paved network was even lower. Estimates showed that by the middle of the decade close to 50% of the road network was in poor condition (see Table 2.2).

Table 2.2: Conditions of the road network (km)

	Good	Fair	Poor	Total
Concrete	1,611	1,726	498	3,835
Asphalt	5,157	2,157	1,802	9,116
Gravel	4,191	22,244	5,803	32,238
Dirt	1,027	15,405	17,802	34,234
Total	11,986	25,905	41,532	79,423
	(15%)	(33%)	(52%)	(100%)

Source: Ministry of Public Works.

As a consequence of these trends, there has been a marked negative impact on average traffic speeds and road accident rates. In Santiago, average traffic speeds are almost half of what they were in the late seventies (Table 2.3). Accident rates in 1996 were more than double their level in 1985 (Table 2.4).

Table 2.3: Average traffic speeds in Greater Santiago

Year	Average traffic speed at a given hour (Km/ Hour)
1977	37.4
1991	24.6
1995	20.0

Source: Ministry of Public Works

Table 2.4: Accidents on Chilean highways

Year	Highway accidents (per 100,000 people)
1985	8.7
1990	11.9
1994	18.3
1995	21.8

Source: Ministry of Public Works

With respect to airports, the situation was even more dramatic. Economic growth sharply increased demand for air transport. Passenger traffic, national and international alike, has grown at rates of up to 20% a year (see Table 2.5). In 1995, the total number of passengers that used airports was 3.5 times greater than 10 years earlier. This situation has created a high degree of saturation in the use of airport infrastructure, requiring urgent expansion in the capacity of most of the country's terminals.

Table 2.5: Air transport traffic, 1991-96

Year	Domestic passengers (thousands)	International passengers (thousands)	Freight (tons)
1991	1,856	1,260	126,205
1992	2,428	1,382	134,371
1993	2,990	1,609	144,363
1994	3,569	2,000	180,704
1995	4,024	2,342	188,305
1996	4,750	2,610	204,000

Source: Dirección General de Aeronáutica Civil

One estimate has put the economic cost of inadequate infrastructure—including waste water treatment—at more than US$1.5 billion annually (see Table 2.6).[3] In addition, Chile has the strategic ambition—within the framework offered by Mercosur—of becoming the gateway for Latin American trade with Southeast Asia, Australia and New Zealand. However, this would require an additional endowment of more than 900 million dollars in infrastructure.

In 1995, MOP estimated that total infrastructure investment needs until the year 2000 would reach more than US$11 billion (Table 2.7). As a rule of thumb, the international experience indicates that infrastructure investment should reach between 3.5% and 5.5% of GDP. In Chile, 3.5% of GDP is equivalent to around US$1.8 billion. This last figure can be taken as a lower bound on the annual

[3] The estimates presented in Table 2.6 were determined by the Chilean Chamber of Commerce, which had obvious vested interests in overstating the existing deficit. Therefore, these figures must be taken with a grain of salt. However, most analysts would agree with the general observation that there were significant costs related to the growing infrastructure deficit at the time.

investment requirements. However, it is well above the current budgetary capacity of the Ministry of Public Works, which has an annual budget of close to US$800 million. Although MOP's budget has been increasing by approximately 10% annually and is expected to continue to rise in the future, an important part of new resources will be devoted to the maintenance of the already existing infrastructure. Without the concession programme it would have been extremely difficult to tackle the infrastructure deficit using public funds alone.

Table 2.6: Costs of the infrastructure deficit

Type of loss	Annual loss (US$ million)
Traffic delays	433
Fruit damaged in surface transit	108
Highway delays and vehicle wear	465
Port delays	42
Accident, injuries and damage	130
Gastrointestinal illnesses	106
Other health effects	216

Source: Chilean Chamber of Construction, 1995.

Table 2.7: Infrastructure investment needs, 1995- 2000

Sector	Investment (millions of US$)
Inter-city roads and Highways	4,250
Urban Roads	2,000
Water Treatment	1,480
Potable Water Supply	950
Equipment	810
Sea Ports	450
Railroads	470
Irrigation	370
Control of Rainwater	195
Airports	100
Total	**11,075**

Source: Ministry of Public Works

3 Overview of the concession programme

The primary legal basis for the concessions is the Concessions Law (DFL N°164 of 1991), although the tendering documents, and other laws and decrees, are also important elements of the legal framework.

3.1 Tendering procedures

There are several stages in the tendering process. First, the project must be defined. Prior to 1994, projects were tendered without full engineering studies and technical designs. Bidders were required to undertake these studies as part of their technical proposals. This approach has the virtue of speed—government delays over the preparation of studies did not hold back the concession programme—and may create an opportunity for private firms to be innovative in designs and technical solutions. However, it has the drawback that bidders must invest a considerable amount of resources in preparing their bids. Besides the social waste created by the duplication of studies, the high cost involved reduces the number of firms that participate in each tendering process.

Furthermore, it has now become evident that tendering projects without thorough preparation is an invitation to future conflicts, both with the concessionaire as well as the affected community. Many additional investments and design changes have been required in these earlier projects as a result of insufficient design preparation and lack of consultation.

In an effort to induce more competition and reduce the probability of *ex-post* conflicts, since 1994 each concession has been tendered with detailed design and engineering studies. Besides reducing the ambiguities related to the project definition, these studies allow MOP to estimate the investment, maintenance and operation costs of the project. The resulting 'Official Cost Estimate' is included in the bidding documents and is a crucial parameter for determining several variables of the contract. However, it must be emphasised that the real *ex-post* cost of the project is borne by the concessionaire and may well differ from this official *ex-ante* estimate. Except for expropriation delays and—in the case of a tunnel concession—geological risk, the concessionaire bears the full construction cost risk.

Projects can also be proposed by the private sector. An interested party can present the relevant studies to MOP, who then evaluates the social convenience of the project. If the Ministry agrees to tender a concession, the firm that originated the project is given an advantage in the bid evaluation stage. Alternatively, MOP may compensate the firm for the costs of the studies undertaken. To date, one concession—the access road to Santiago's international airport—was an idea originally formulated by the private sector.

Once the project is defined, a pre-qualifying round for bidders is held to screen for financial and technical capacity. The authorities actively encourage the participation of foreign as well as domestic firms. Tenders are then requested from pre-qualified firms.

Tenders must include a technical as well as an economic bid. Technical Bids are opened first and evaluated by the Technical Bid Evaluation Commission. This commission disqualifies those bids not satisfying the minimum technical requirements established in the tendering documents. After the Evaluation Commission announces the results of the technical round, it opens the Economic Bids of those firms that were successful in passing the technical stage. The concession is awarded to the bidder who tenders the most advantageous Economic Offer, in accordance with criteria set forth in the tender documents.

The winning consortium must form a company whose sole purpose is to construct and operate the concession. This company can only operate one concession, and its exclusive economic activity must be the concession. If a consortium wins more than one project, it must create several concession companies. As will be seen further below, isolating the concession firm in this way can be useful to avoid certain problems that can sometimes plague the bidding process for a franchise. It is also a pre-requisite for project finance or security purposes.

There are restrictions on the capital structure of the concession companies. Sponsors (the members of the consortium) must provide for the equity capital of the concession company for an amount equal to at least 30% of the estimated official cost of the project. The rest can be credits provided by domestic as well as international financial institutions.

On average, the duration of the initial design and awarding stage has been 16 months (Coordinación General de Concesiones, 1998).

3.2 Tendering variables

The potential variables that determine the Economic Offer, which are used to award the concession, can be any one or combination of the following variables:

- Tariff level;
- Subsidy required from the State;
- Duration of the concession;
- Income guarantee requested from the State;
- Revenue offered to the State for existing infrastructure;
- Total income from the concession;
- Degree of risk commitment that the bidder assumes during the construction stage;
- Quality of the technical offer;
- Revenues offered to the State, or reductions in tariffs offered to users, when the profits of the concessionaire reach a pre-established level;

The first concession to be tendered (El Melon Tunnel) was awarded using a weighted average of seven variables, including the toll level and payments offered to the State. In the end, these last two variables were the crucial factors in determining the outcome of the bidding process. The winning consortium

offered a high toll level (set at the upper bound of the allowed range) and a high payment to the government. With hindsight, there is little doubt that this tendering mechanism was not appropriate.[4] Besides the complexity of this scheme,[5] the resulting high tolls generated an important traffic diversion to the free alternative road over the mountain where the tunnel was situated. This served to lower the revenues of the concessionaire and resulted in an inefficient allocation of traffic between the tunnel and the mountain road.

The concessionaire has subsequently lowered tolls in order to increase traffic through the tunnel. However, to date, traffic allocation is still inefficient and negotiations are currently underway to reduce payments to the State in exchange for even lower tolls.

In some respects, the situation of the El Melon Tunnel is similar to the predicament of some Mexican toll roads[6]. In that country, projects were tendered based on the shortest concession duration offered by firms. For a given traffic flow, the shorter the concession duration, the higher tolls had to be set in order to finance the projects. However, the resulting high tolls produced important traffic diversions, aggravated by the fact that in Mexico alternative freeways to each concession were mandatory. This was one of the main causes behind the low financial performances of some Mexican concessions and the subsequent government bailout (Gómez-Ibañez (1999)).

After the El Melon Tunnel, the tendering mechanism for subsequent concessions was changed. It is now based on a lexicographic scheme whereby bidders first compete based on the lowest toll offered. However, tolls are restricted to within a band set by MOP. This band is set with reference to the possible impacts of toll levels on traffic diversion, the economy of the project and—in the case of the main Pan American highway (Route 5) concessions—the level of tolls in adjacent concession segments.

Ties at the floor or ceiling of the allowed band are resolved based on a second variable. In some early cases, this second variable was the length of the concession. Table 3.1 presents the example of the economic bids for the Route 5 Santiago-Los Vilos concession. The minimum tariff that could be offered was $1,000 (expressed in pesos of December 1994). Since two companies offered this minimum toll, the competition continued based on the duration of the concession. Trinela Ruta 5 won with an offer of 276 months. Had there been no tie for the toll level, the duration offered would have been irrelevant.

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[4] See EFG (1996, 1997a). At the time, MOP expected the tunnel to be unprofitable at the maximum tariff level and so was expecting that the project would be awarded to the firm that solicited the lowest subsidy. As it turned out, subsidies were negative. That is, the winning firm offered to transfer resources to the government rather than the other way around.

[5] EFG (1996, 1997a, 1997c) have stressed the importance of having simple tendering mechanisms. Otherwise, bidders may face difficulties in preparing reasonable bids, increasing the likelihood of mistakes in their offers. Complexity also increases the possibility of ambiguities in the tendering documents, the possibility of discretion on the part of the regulator or opportunistic behaviour on the part of concessionaire. These effects increase the likelihood of contract renegotiation.

[6] For a review of the Mexican experience see Gómez-Ibañez (1999).

Table 3.1 Bids for the Santiago-Los Vilos concession

Consortium	Toll offer expressed in pesos of 12/94	Duration of the concession offered (months)
Trinela Ruta 5	1,000	276
Ica-Tecsa	1,044	300
Infraestructura 2000 S.A.	1,074	300
Consorcio Obras Viales	1,000	285

Source: MOP.

The advantage of this scheme is that it gives MOP more control to set tolls. Therefore, potential inefficient traffic diversions associated with high levels of this variable are avoided. Conversely, low toll levels may also be undesirable if there are congestion problems on the highway.

3.2.1 Tendering mechanism and the financial viability of the concessions

As the programme continued, the authorities became concerned about the financial viability of firms that bid too low (that is the minimum tariff and a short concession period). Calculations by MOP showed that the winning bids in several concessions implied a high risk of future financial instability for the franchise holder.

There are several reasons why firms may pursue such an apparent loss-making strategy. First, when several projects are going to be concessioned, firms may be interested in giving a signal of low cost or aggressive behaviour to other bidders in order to discourage some competitors from participating in future contests.

Second, when construction firms are the principal consortium partner, the chief interest in the project may derive from the ensuing construction contracts rather than the subsequent operation of the concession.[7] In this context, they may bid below costs in order to secure the construction contracts, disregarding the long-term financial viability of the concession, possibly because they can later pass on these costs to other consortium partner or creditors.

Third, firms may behave opportunistically. They bid low, and once they win the franchise, pressure the regulator to renegotiate the conditions of the contract. This strategy would not work if the government could commit to not renegotiate *ex-post*. However, this is nearly impossible for governments to do. If the concession runs into financial problems in the future due, for example, to low revenue flows, the government will find it difficult to let the concession fail. There are political problems associated with this event, and there are also the costs and delays in re-tendering the project. Therefore, bidding low and renegotiating afterwards may be a viable strategy for a potential concessionaire (a phenomenon called "low balling").

[7] The issue of the potential perverse incentives of construction companies in road concessions is not well explored in the literature but some analysts mention this as a problem in several toll road programmes, including France and Mexico (see Gomez-Ibañez and Meyer (1993) and Gomez-Ibañez (1999)).

Finally, one cannot rule out optimisation mistakes on the part of bidders, possibly related to uncertainty (winner's curse), or the complexity of tendering mechanisms.[8]

Whatever the underlying cause, from a social point of view, low-bids that risk the financial stability of the concession should be avoided. Otherwise, the competitive bidding process does not guarantee that the most efficient firm wins the franchise. In addition, if subsequent financial distress forces a re-negotiation, the *ex-post* economic conditions of the concession (tolls, subsidies, etc.) may not be as beneficial to society as they could be. Furthermore, the fact that a government is seen to renegotiate contracts may be a very dangerous signal to give to future bidders.

As a reaction to the low bidding problem, MOP changed the tendering mechanism slightly, starting with the Route 5 Temuco-Rio Bueno project. This change may prove to be an effective method of avoiding the negative effects of unrealistic bids. The method works as follows (see Figure 3.1). The toll band is set as before. The floor of the ban is set sufficiently high to guarantee a certain revenue stream to the concessionaire. In addition, the duration of the contract is also fixed in the tendering documents.

Recalling that the concession company is a single-purpose firm that has to be capitalised by the sponsoring firms, setting this minimum toll level and the duration of the contract effectively puts a floor on the expected earnings of the company. Therefore, the risk of future financial distress for the concession firm—which would force the government to renegotiate the contract—is minimised.

What happens if two or more firms bid the minimum value? Then the winner is chosen as the consortium of *sponsors* that offers the highest transfer directly to the government. Because this transfer does not affect the income or capital structure of the concession firm, sponsors can bid as much as they like without jeopardising the financial stability of the concession. If investors make a mistake and bid too much, the consequent loss will show up in the sponsor's financial returns, not the concession company.

In effect, this bidding mechanism significantly reduced the chances of re-negotiation, without lowering the competitive pressure of the process. It is possible that sponsors may still try to renegotiate the contract *ex-post*, but they will not have one of their main bargaining chips at their disposal; namely, that the concession firm is effectively in financial distress.[9] It is unlikely that governments will feel pressured to renegotiate because the financial results of the (possibly international) sponsors are negative. If the concession firm is in good shape, and there are no risks

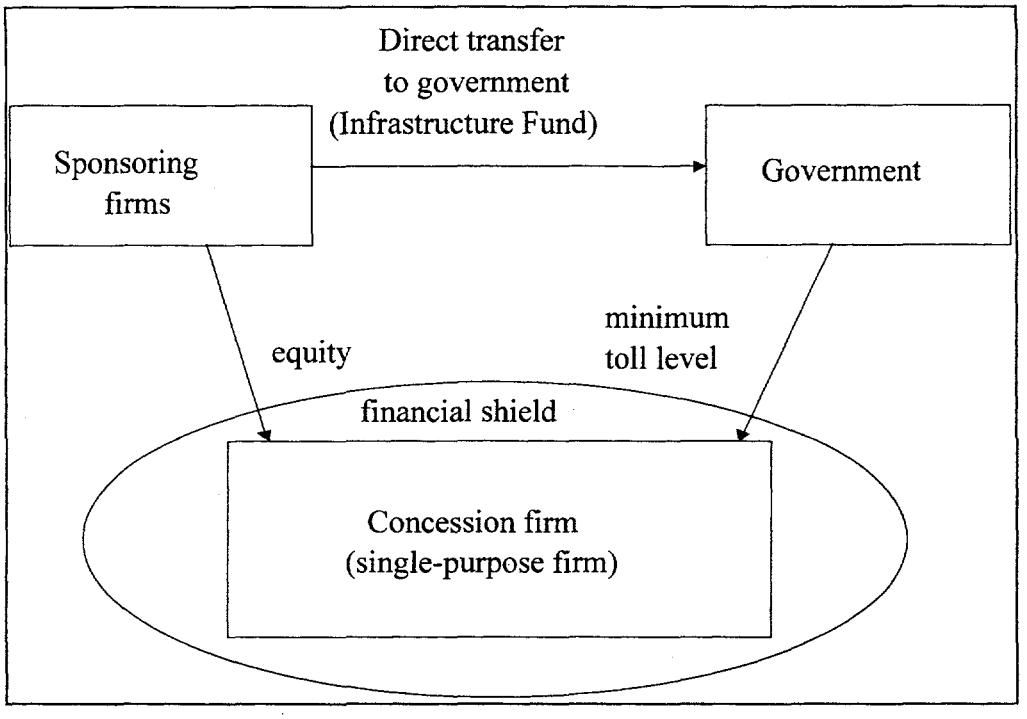
[8] EFG were the first to raise the issue of 'low balling' in the context of the Chilean road programme, as well as possible optimisation errors, winner's curse problems and other issues covered in this section, especially the socially detrimental effects of contract re-negotiation. However, the mechanism devised to overcome the problems resulting from low bids is due to MOP.

[9] Engel, Fisher and Galetovic in several of their articles point out that the LPVR auction may also reduce the occurrence of low-balling. Their argument rests on the assumption that the LPVR bid of the winning firm offers the government a credible threat to terminate the concession quickly and compensate the firm if it tries to renegotiate. This will be discussed further below in relation to the LPVR auction mechanism.

of disruption to its activities due to financial distress, governments should be able to resist re-negotiation pressures better.

This transfer mechanism from sponsors has served to generate close to US$150 million in the 4 concessions where it has been used. The proceeds are deposited in an Infrastructure Fund which is then used to cross-subsidise other projects or pay for minimum income guarantees.

Figure 3.1 Bidding mechanism to avoid 'low-balling'



3.2.2 Subsidies and transfers in projects

The government has offered direct subsidies on several occasions. These are used to fund projects that are not privately profitable at reasonable toll levels, or to equilibrate tolls along adjacent segments of road (as in the Route 5 concessions). The yearly value of subsidies is known and included in the tendering documents. In other cases, when concessions are very profitable, it is the firm that must make transfers to the State. These values are also included in the bidding documents.

In essence, MOP has taken the view of dissociating toll settings from the financial requirements of the concessionaires. Tolls are set according to traffic allocation criteria. Transfers and subsidies are then used to guarantee the financial equilibrium of the firm. This policy makes economic sense. If tolls are set exclusively to cover investment, maintenance and operating costs, then high tolls result when low traffic volumes are expected and low tolls result in high traffic and congested conditions. Exactly the opposite of what economic rationale would dictate for a pricing signal (Tirole (1997)).

It is important to note that these transfers and subsidies are different from the transfers and subsidies described earlier in relation to the tendering mechanism. Whereas the transfers/subsidies described in this section are yearly values that accrue to the concession company, and are known before the tendering of the project, the transfers described in the previous section are payments from sponsors that do not affect the concession company. It is possible (and has happened on one occasion) that a project receives a subsidy from the State, but due to a tie in the bidding stage, the concession is awarded according to a transfer from sponsors to the State.

3.2.3 Least Present Value of Revenue tendering mechanism

Finally, two projects (one unsuccessfully) have been tendered using a Least Present Value of Revenue mechanism. These will be described in greater detail below.

3.3 Construction and operation stage

Once the project has been awarded and the relevant documents signed and formalised, the construction stage begins. The concessionaire must post a guarantee bond at the beginning of this stage, which the government can make effective if the conditions of the contract are not met. The value of the initial bond is set in the tendering document, but usually varies between 2%-5% of the official cost estimate for each project. Once a significant amount of the construction has been undertaken (usually 40%), the value of the guarantee bond is lowered.

Right of way acquisitions are paid for by the concessionaire. The estimated value of these acquisitions is set in the bidding documents. Delays and cost over-run risks are borne by the State. The concessionaire is compensated for delays by a matching extension in the duration of the concession. There is also a compensation for the extra construction costs borne by the concessionaire as a result of delays in land expropriations (idle machinery, fixed costs, etc.). If right of way acquisitions turn out to be more expensive than originally planned, the State must provide the extra resources.

Right of way acquisition delays and cost over-runs have been the norm in the Chilean (as well as most other) concession programmes. Some practical difficulties have also been encountered in estimating the fair compensation that should be given to the concessionaire for the added construction costs due to these delays.

Once the infrastructure is in operation, the concessionaire must replace the construction guarantee bond with an operation guarantee bond, which must be valid (or periodically renewed) until one year after the concession ends. The value of the operational guarantee is in the same range as the construction guarantee.

Besides these guarantees, the concessionaire is subject to numerous other penalties and fines—including the possible termination of the concession—for failures to meet the safety, operational and quality standards set in the contract. A list of the faults that the concessionaire may incur and the corresponding financial penalties are set out in the bidding documents.

3.4 Toll indexing and safety premium

Tolls are differentiated by type of vehicle. The concessionaire is free to lower tolls provided that he does not price discriminate against users in the same category. The categories are:

- motorcycles;
- cars, vans and pick-up trucks;
- cars, vans and pick-up trucks with attachments;
- 2 axle buses;
- 2 axle trucks;
- buses with more than 2 axles;
- trucks with more than 2 axles.

Tolls are correspondingly higher for vehicles with 2 or more axles. Two axle vehicles pay a maximum of 1.8 times the normal car toll, while larger vehicles pay 3.2 times. Under certain conditions, namely when traffic diversion is not a problem, this charging structure is appropriate for an efficient pricing structure since it is well known that the deterioration of a highway is exponentially (to the 4^{th} power) related to axle weight.[10] However, differentiating tolls by vehicle type may increase tolling costs for the operator. Furthermore, it imposes an additional monitoring burden on the regulator.[11]

Tolls are adjusted yearly for inflation or when accumulated monthly inflation surpasses a pre-established level, usually 15%. There is also a premium tariff increase for the concessionaire when road safety improves. Many concessions also have a peak pricing mechanism whereby tariffs are raised during peak demand periods.

3.5 Duration of the concession and the subsequent transfer to public operation

The concession period varies from project to project. Some—in particular the airport infrastructure concessions—can be as short as 10 to 12 years (including the construction stage). The usual duration of the major highway concessions is 22 to 25 years, with the longest being 28 years (including the construction stage).

Not all concessions have a fixed period duration. In early 1998 the Santiago-Valparaíso-Viña del Mar inter-city highway project (Route 68) was tendered using the Least Present Value of Revenue

[10] This is based on the research of the American Association of State Highway Officials (AASHO). See Armitage (1980) for a useful discussion of the AASHO results.

[11] In contrast, in the United Kingdom toll roads programme vehicles are differentiated into two categories based on length. However, in this case, the use of shadow tolls instead of real tolls allows the use of simple and inexpensive traffic counting machines. These can only reliably differentiate vehicles by length. For a recount of the UK toll road experience see Highways Agency and Private Finance Panel (1997).

auction.[12] The bidder who offered the lowest revenue (in present value terms) in exchange for constructing, operating and maintaining the infrastructure won the competition. Initial tariffs were set in the contract and can later be modified by the government. The concession will terminate when enough traffic has used the infrastructure so that the concessionaire has received the revenue presented in his Economic Offer. Therefore, the exact month when the concession will end is uncertain.[13] Furthermore, the government has the option, after 12 years, of terminating the concession early and compensating the concessionaire according to a pre-established formula.

Another concession was recently tendered using the Least Present Value of Revenue mechanism (Costanera Norte). Unfortunately, only one bid was received for this project and it did not meet the conditions stipulated in the bidding documents. Consequently, this project was not awarded. In spite of this setback, it is probable that in the future, more projects will be tendered using this mechanism, so an increasing proportion of the concessions in Chile will be of variable length.

At the end of the concession period, the infrastructure reverts to public operation. An important issue arises at this stage with respect to the quality of the infrastructure. Although the operator has the obligation to maintain the infrastructure in good quality for the duration of the concession period, it is natural that towards the end of the concession the incentives for such additional expenditures and investments are blunted. Therefore, safeguards must be put in place in the contract in order to guarantee that the infrastructure will revert to the State in good condition.

In Chile this safeguard consists of an additional bond posted two years before the concession ends (that must be valid for at least three years). The value of this bond is similar to, and additional, to the operation stage bond already posted. Furthermore, at least one year before the concession ends, the Fiscal Inspector (the government's representative who monitors and oversee the concession) conducts an audit. He then presents the concessionaire with a list of maintenance and repair work that needs to be undertaken in order for the infrastructure to revert to public operation in the conditions established in the contract.

3.6 Tolls in Chile: a socially acceptable tradition

The concessionaire recoups his investment primarily through the income provided by tolls to users. However, as already mentioned, in some concessions these tolls are insufficient to cover the required investment and are complemented by direct subsidies from the State. In other cases, toll income more than suffices to finance the project and the concessionaire must make a payment to the State. When applicable, the amounts of these transfers are set before the bidding stage.

Unlike other countries, in Chile, alternative freeways are not required for toll roads to be built and—for the most part—existing projects do not have convenient free alternative routes. There are

[12] The properties of the LPVR auction and a detailed description of its use in the Santiago-Valparaíso-Viña del Mar concession is presented below.

[13] However, there is a maximum limit of 25 years to the concession.

historical reasons why this was possible. The first toll in Chile was built in 1963. Since then, more than a dozen tolls in the public highway system have been built and operated by MOP. Therefore, users are already accustomed to being charged for the use of certain highways. There is a social acceptance of these arrangements due to historical tradition.

Furthermore, many of the concession projects have been extensions and improvements to currently tolled roads. The tendering process has also served to lower some toll levels.[14] Therefore, users not only see an improvement in the infrastructure as a result of the concession programme, but in certain cases a decrease in the level of tolls too. In the case of previously untolled roads, users can compare the new charges with the traditional tolled public roads. This comparison shows that tolls are lower in the private sector as compared to the public sector, an indication of the competitive benefits of the franchising process. These reasons may explain in part why public opposition to a private toll road programme without freeway alternatives has been minimal in Chile.

That is not to say that there have been no legal challenges to the policy. The legal arguments are based on two rights guaranteed by the Constitution: the right to free movement within the national territory and the right to the use of private property. The first right may be considered violated when there is a tolled route without free alternatives. The second right may be limited when the only access to a certain property is by means of a toll road.

In this respect, it is interesting to examine the results of a legal report from March 1994.[15] The generality of the arguments make them relevant to other countries.

Regarding the principle of free transit, the report asserts that a toll only affects the cost, not the liberty to exercise the right to movement within the national territory. A fare or toll, as such, is only one component of the total cost of transport in motorised vehicles, just as fuel taxes or licences would be (to mention other costs of which the State is the beneficiary). The Constitution does not assure the right to gratuitously exercise the rights that are guaranteed. Therefore, no conflict was found between the right to free movement and the establishment of tolls without free alternatives.

In addition, it is not clear that a toll to fund a better, faster and safer road increases the overall cost of a trip. Savings in time, maintenance and accidents may well compensate for the extra costs imposed by the charge.

Regarding property rights, the Constitution also states that the law can establish limitations and obligations on property rights when this is in the general interests of the nation, national security, public health or the environment. Thus, a toll can be interpreted as an obligation allowed for by law, which affects those who travel by road, for the general interest and collective social good of having an appropriate road infrastructure.

[14] Individual tolls are lower in the private sector. However, since there will be more tolls than before, the total toll costs borne by users will depend on the origin-destination characteristics of trips.

[15] Judicial report by Attorney Monica Madariaga, commissioned by MOP

3.7 Minimum income guarantees

All but one concession contract tendered so far provides a minimum income guarantee to the concessionaire. This guarantee was introduced so that investors could secure the needed finance for the projects. Because of its importance to the concession programme, its fiscal implications, and the criticism it has received from various analysts, details of the guarantee mechanism are relegated to a special section below.

3.8 Extension or changes to existing contracts[16]

A concession contract must strike a balance between being credible, and thus providing potential operators with the security that they will not be 'expropriated' of their investment in the future, and being flexible, by allowing the concession to be modified if new and unexpected circumstances arise. A particular situation where this is important is the treatment of additions or modifications to a project once it had been awarded. It may become apparent *ex-post* that due to an initially faulty design, unaccounted for social impacts, or other unexpected circumstances, it might be socially desirable to modify or extend the infrastructure from what was originally contained in the concession contract.

A substantial number of contracts have been subject to *ex-post* complementary negotiations due to the need to change the original design or to provide for additional investments. One important cause of this has been the *ex-post* revelation of the demands of the numerous communities affected by a project. Although community participation—in the form of public meetings—and social, environmental and geographic impact assessments are routinely undertaken by MOP in the project design stage, it is never possible to predict the myriad of effects that a particular project may impose on neighbouring communities. Issues such as the placement of bus stops, pedestrian crossings, resistance to land expropriations and the effects of a project on the dynamics between hub and satellite towns and cities are very difficult to consider completely and satisfactorily at the design stage. There is also the possibility that *ex-post* the designs are sub-optimal from a technical or safety perspective.

One recommendation derived from the Chilean experience is that consultations and agreements with the affected communities are crucial and should be undertaken thoroughly before projects are tendered. This has been a 'learning by doing' process. MOP now tries to reach protocol agreements with the relevant local governments before projects are tendered. Another recommendation is that land expropriation procedures should be undertaken as early as possible, and ideally before projects are tendered.

However, it is inevitable that some issues will still arise after a contract has been tendered and pressure will be placed on the authorities to change or expand projects. If these issues present legitimate social concerns—as opposed to financial bailouts to the concessionaire—then it may be desirable to renegotiate the contract. In this case, it is better to have a framework for dealing with subsequent

[16] This section and the next are partly based on Jiles (1998).

negotiations rather than relying on ad-hoc procedures as issues arise. Otherwise, the risk perceived by potential concessionaires increases, as well as the loss in transparency and accountability of the tendering process.[17]

In order to provide the needed flexibility without compromising the interests of the concessionaire, there has been a progressive effort to include detailed procedures for the treatment of additional work in concession contracts. The government can demand additional work for up to a maximum of 20% of the initial official cost estimate of the project, and only up to two years before the concession ends. In the later concessions an additional restriction was added to the contract. It specifies that during the construction stage, additional work can only be demanded for up to 5% of the official cost estimate.

There are two further issues that need to be considered. First, how should the additional investment be valued? If the government can impose a low valuation, the concessionaire will suffer an economic loss. On the other hand, if the concessionaire can negotiate a high valuation of the extra investment, it will obtain excessive profits to the detriment of the State, and ultimately users or taxpayers. In recent concessions, any new investment demanded during the construction stage is valued according to a unitary pricing schedule contained in the tendering documents. Bidders implicitly accept these unitary costs when they participate in the franchising process. These official costs were introduced in the contract due to the difficulties encountered during negotiations to change some of the specifications of the initial concessions. In these earlier cases, bidders had to present detailed budgets for the project, including unit prices for all items.[18] However, since the project was awarded according to the Economic Offers—which were not required to be consistent with the investment budgets— bidders did not have an incentive to reveal their true costs.[19]

The construction phase lasts no more than a few years and therefore it may be reasonable to set unitary prices in the contract, especially when—as in Chile—they are indexed for inflation. However, setting prices far into the future may not be recommendable. Relative price variations and technological change will make prices set at the beginning of the concession period increasingly out of line with real costs. Therefore, the valuation of new investments required during the operational phase must be agreed between the Ministry of Public Works and the concessionaire. If they do not agree, differences must be settled by the Conciliatory Commission (described in the next section) based on technical reports produced by consultants from each party.

The second issue is how to compensate the concessionaire for the additional investments undertaken. There are several options:

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[17] EFG (1996, 1997a) present several arguments on why re-negotiation may be harmful to the public interest. The argument here is that these negative impacts are somewhat reduced if renegotiations are conducted within a clear and pre-established framework.

[18] Because MOP did not do the detailed engineering studies in these earlier concessions, it was not possible to have official unit prices.

[19] In fact, because of the specific revenue sharing scheme included in the early contracts, bidders had an incentive to overstate their investment budgets.

- increase tolls;
- increase the duration of the concession;
- direct payments by the State.

The Government and the concessionaire may not agree on the preferred compensation instrument, especially because of the different timing of cash flows implied by each alternative. Furthermore, due to the length of the political cycle, a government may have an undue preference for extending the length of the concession rather than increasing tolls or direct payments to the concessionaire. These may create an excessive incentive to demand new investments since the current authorities would enjoy the political benefits of procuring extra infrastructure today but the costs would be borne by future users.

In order to avoid conflicts and to reduce the incentive problem mentioned above, the most recent concessions place explicit restrictions on the compensation mechanism. For example, in the Río Bueno-Puerto Montt concession, tariff increases during the life of the contract cannot exceed 25% while the increase in the duration of the concession cannot be longer than 120 months.[20] Furthermore, an explicit formula is included in the contract to calculate the required compensation. This is given by:

$$\sum_{i=k+1}^{N+S} \frac{Y_t - T_t}{(1+r)^{i-k}} = I_k + \sum_{i=k+1}^{N+S} \frac{C_t}{(1+r)^{i-k}}$$

where

I_k = Additional investment in period k

N = Initial duration of the concession

S = Extension of the contract

Y_t = Additional income due to the increase in tariffs, where

$$Y_t = \begin{cases} \rho_t P_t Q_t + G_t & t = k+1,\ldots,N \\ (1+\rho_t) P_t Q_t + G_t & t = N+1,\ldots,N+S \end{cases}$$

and

P_t = Tolls prior to compensation

Q_t = Projected traffic levels associated with the new investment at initial toll levels

ρ_t = Percentage increase in tolls

G_t = Direct payments by the State

C_t = Operational and maintenance costs associated with the new investment

T_t = Taxes due on the additional toll income

r = Discount rate

[20] In the case of a variable length concession, such as the Santiago-Valparaíso-Viña del Mar Highway, these conditions are correspondingly different.

The additional operational and maintenance costs, the projected traffic levels and the discount rate must be based on an expert's report. If disagreements arise over these parameters, the Conciliatory Commission must be convened. However, the tender documents are usually more explicit on how to estimate the discount rate and they place an upper limit on the risk premium that the concessionaire can receive.

In order to avoid imposing additional traffic risks on the concessionaire, there is a payment at the end of the concession to compensate for the difference between the projected traffic levels used in the above calculations and the real traffic level observed. This compensation is calculated as:

$$R_{N+S} = \sum_{i=k+1}^{N+S} \frac{Y_t - T_t - \left(\hat{Y}_t - \hat{T}_t\right)}{(1+r)^{1-k}} * (1+r)^{N+S-k}$$

where the "^" symbol indicates the *ex-post* real value observed of the variable. There is no compensation, however, for operational and maintenance costs that differ from the original estimates. Otherwise, the concessionaire would have an incentive to inflate these costs in order to receive extra compensation at the end of the concession period. However, these costs are usually small in comparison to investments. Differences between the expert's estimate used to calculate the compensation and real *ex-post* costs will probably not have a significant affect on the profitability of the concession.

3.9 Dispute settlement mechanisms

As the concession programme has evolved, there has been a progressive effort to reduce contractual ambiguities and make contracts as complete as possible. The treatment of additional investments presented above is an example. However, controversies are bound to arise anyway. In the case of additional investments, for example, there are some parameters which are still left undetermined and may be the source of future conflicts. In addition, many other issues may lead to controversies.

Therefore, it is important to have an efficient and effective dispute settlement mechanism. Due to the costs and time involved, recourse to the judicial system should be the last resort and thus limited to the most important and acrimonious conflicts.

The main dispute settlement mechanism in the Chilean concessions is the Conciliatory Commission. This commission has three members, one nominated by the concessionaire, one by the authorities and the third by mutual accord. Members of the commission must be nominated at the beginning of the concession before any controversies have arisen. The commission is established when one of the parties raises a demand. In the case of the State, contracts stipulate an explicit and limited set of circumstances whereby it can raise a demand to the Commission. The concessionaire has more flexibility in this respect.

The Commission's initial task is to conciliate the diverging positions. If agreement is not reached, the concessionaire, and only the concessionaire, has the choice of either taking the matter to the judicial system or requesting the establishment of the Arbitration Commission. This last Commission is formed by the same members as the Conciliatory Commission and its decision is binding and not subject to appeal in the courts.

To date, several Conciliatory Commissions have been established (see Table 3.1). In the case of El Melon Tunnel, the controversy related to the geological cost over-run guarantee offered by the State in that concession. In particular, there was a dispute as to the required level of compensation owed to the concessionaire. The final agreement resulted in a transfer that was an average of the government's and the concessionaire's position.

Other commissions have been established for the Nogales-Puchuncavi Road, Route 5 Rio Bueno to Puerto Montt, La Madera Road and the Access Road to the AMB international airport. In this last case, the controversy is related to the valuation of additional landscaping investments demanded by the government and the compensation for the modification of parking charges that had to be introduced after significant protests from airport workers forced the government to change the original charging policy.

The Chilean dispute settlement mechanism may be improved on several fronts. First, most conflicts have taken longer to resolve than originally planned, reducing the efficiency of the mechanism. Establishing time limits for a dispute settlement, or paying commission members a fixed fee rather than an hourly fee, as is currently done, may help to speed up these processes. Second, concession contracts do not specify a time limit for raising conflicts to the commission. Therefore, complaints may be lodged by a concessionaire many months after the occurrence of the offending event, after which it is nearly impossible for the State to collect the required information to argue its case or to negotiate a reasonable settlement.

Another problem relates to the transition from the Conciliatory Commission to the Arbitration Commission. The members of both of these commissions are the same. Each party to a conflict will have an opportunity to gauge the commission member's attitudes and opinions regarding the issue under dispute during the conciliatory stage. This benefits the concessionaire who has the sole right to decide—if agreement is not reached during the first stage—whether to pursue the issue in the judicial system or through the Arbitration Commission. The concessionaire may then have the incentive to take the matter to the Courts only when it perceives that the majority of commission members have a position less favourable to its own and vice versa. Hence, the dispute settlement mechanism may not be fair to the State.

Finally, the dispute mechanism currently lacks clear rules and procedures for arriving at a settlement. The outcome of the El Melon Tunnel and the La Madera Road cases point to an 'average' solution to disputes. If parties anticipate that this will be the case, they have an incentive to exaggerate their *ex-ante* position in order to benefit from this *ex-post* averaging. This may increase the frequency of disputes and make them harder to reconcile during the conciliatory stage. Constraining the Arbitration

Commission to use 'swing arbitration'—where they have to choose between the positions of one of the parties but not an intermediate one—may be recommendable. This is the approach taken in Chile to deal with price setting disputes in the utility industries.

Table 3.3 Dispute settlement cases and their outcomes

Concession	Problems	Process	Outcome
El Melon Tunnel	Dispute over the interpretation of the geological risk insurance that was given by the State. The firm argues that compensation should be US$15 million while MOP argues it should only be US$ 7 million	Conciliatory Commission	The Commission recommended a US$ 10 million payment The recommendation was accepted by both parties
La Madera Road	Dispute regarding the inclusion or exclusion of 2 kms. of road in the concession. MOP argues that the stretch of road is part of the concession and thus the firm is responsible for its maintenance. The firm argues otherwise.	Conciliatory Commission was unable to produce an agreement and the case was taken to the Arbitration Commission	The Arbitration Commission determined that the 2 km in question are part of the concession but MOP must compensate the firm for 50% of maintenance and other costs
Access Road to AMB Airport	Dispute regarding additional landscaping investments demanded by the State and the status of parking charges	Conciliatory Commission	In process
Route 5, Rio Bueno to Puerto Montt	Dispute over a US$ 100,000 fine applied to the concessionaire for its delay in cancelling an expropriation payment due to the State	Conciliatory Commission	In process
Nogales-Puchuncavi Road	Dispute over the original design of the project and its modifications, a catastrophe insurance claim and cost over-runs in land expropriations	Conciliatory Commission was unable to produce an agreement and the case was taken to the Arbitration Commission	In process

4 The concessions program to date

The bulk of the concession programme, in terms of investment volumes and kilometres of road, has been the different segments of the main north-south Pan American highway, Route 5 (see Table 4.1). Of the 2,052 kilometres awarded so far, 75% corresponds to the Route 5 projects. In value, these projects account for 70% of the total volume to be invested.

Table 4.1: Projects awarded, 1992-1998

Sector	Project	Investment (US$ millions)	Length (km)	Year concession awarded	Year expected to be in partial or full operation	Duration (years)
Inter-city	El Melon Tunnel	42	6	1992	In operation	23
	La Madera Road	34	110	1994	In operation	25
	North Access to Concepción	230	89	1994	In operation	28
	Santiago-San Antonio Highway	140	104	1995	In operation	23
	Nogales-Puchuncaví Road	12	27	1995	In operation	22
	Route 5, Talca-Chillán	183	192	1995	In operation	10
	Route 5, Santiago-Los Vilos	272	218	1996	1999	23
	Santiago-Los Andes Highway	146	96	1996	2000	28
	Route 5, Los Vilos-La Serena	265	228	1996	2000	25
	Route 5, Chillán-Collipulli	224	160	1997	2001	22
	Route 5, Temuco-Rio Bueno	203	172	1997	2001	25
	Route 5, Rio Bueno-Puerto Montt	210	136	1997	2001	25
	Route 5, Collipulli-Temuco	241	163	1997	2002	25
	Santiago-Valparaíso-Viña del Mar Highway	400	130	1998	2002	Variable length
	Route 5, Santiago-Talca	750	266	1998	2002	25
	Total	**3352**	**2052**			
Urban	Access to AMB airport	13	2.2	1995	In operation	12
	Total	**13**	**2.2**			
Airports	Diego Aracena, Iquique	6	---	1996	In operation	12
	El Tepual, Puerto Montt	6	---	1996	In operation	12
	La Florida, La Serena	3	---	1997	In operation	10
	El Loa, Calama	3	---	1997	1999	12
	AMB, Santiago	220	---	1997	1999	15
	Carriel Sur, Concepcion	20	---	1998	2000	16
	Total	**258**	---			
	TOTAL	**3610**	**2054**			

Source: MOP

Table 4.2: Project tolls and other relevant parameters, 1992-1998

Sector	Project	Estimated average daily traffic 1996 (veh/day)	Tolls for cars (US$ at tolls and exchange rate of 12/96)	Tolls per km. (US¢/km)	Transfers to the State (US$ millions)[a]	Subsidies from the State (US$ millions)[b]
Inter-city	El Melon Tunnel	6,300	8.37	119.52	4.36 per year	---
	La Madera Road	1,200	4.98	4.15	---	5.23 total
	North Access to Concepción	3,000	4.77	6.35	---	---
	Santiago-San Antonio Highway	6,000	2.21	2.13	20 payments of 6.13	---
	Nogales-Puchuncaví Road	1,000	1.49	5.52	---	---
	Route 5, Talca-Chillán	9000	2.41	2.49	$12.45*(1.05)^{(T-4)}$	---
	Route 5, Santiago-Los Vilos	9200	2.74	2.58	10.90 (T=4) $9.34*(1.05)^{(T-4)}$ (T>4)	---
	Santiago-Los Andes Highway	5,200	3.56	4.95	$0.62*(1.05)^{(T-6)}$	---
	Route 5, Los Vilos-La Serena	2,500	3.12	2.73	---	$10.90*(1.05)^{(T-5)}$
	Route 5, Chillán-Collipulli	5,900	2.74	3.18	---	$4.67*(1.05)^{(T-5)}$
	Route 5, Temuco-Rio Bueno[c]	3500	2.74	2.75	2.01 (T=5)	$7.78*(1.05)^{(T-5)}$
	Route 5, Rio Bueno-Puerto Montt[c]	5,800	2.74	2.28	8.14 (T=5)	$9.34*(1.05)^{(T-5)}$
	Route 5, Collipulli-Temuco[d]	5,700	2.74	2.89	18.22 (T=5) $3.11*(1.05)^{(T-5)}$	---
	Santiago-Valparaíso-Viña del Mar Highway	12,600	4.27	3.89	---	---
	Route 5, Santiago-Talca[d]	18,000	2.73	2.87	124.5 (T=5) $10.9*(1.05)^{(T-5)}$	
Urban	Access to AMB airport	11,700	0.50	29.13	---	---
Airports	Diego Aracena, Iquique	1,070	3.41	---	---	---
	El Tepual, Puerto Montt	1,006	6.05	---	---	---
	La Florida, La Serena	1,478	3.13	---	---	---
	El Loa, Calama	2,650	5.62	---	---	---
	AMB, Santiago	600	1.44 [e]	---	---	---
	Carriel Sur, Concepcion	3,500	7.42 [f]	---	---	---

Source: MOP

[a] The 'T' in some of the transfer/subsidy formulas stands for the concession year. The transfers in this column include those contained in the original tendering documents as part of the profitability enhancement of the concession as originally designed by MOP plus transfers as a result of the bidding competition.

[b] The 'T' in some of the transfer/subsidy formulas stands for the concession year.

[c] In this concession, subsidies were included in the bidding documents. However, because several firms presented an offer at the minimum toll level, the contract was awarded to the company whose sponsors offered the highest payment to the State. Therefore, this company has subsidies and transfers. However, the subsidies accrue to the concession company, while the transfers must be paid by sponsors directly.

[d] In this case there were transfers to the government already built-in to the original design. In addition, the concession was awarded to the company whose sponsors offered the highest payment to the State.

[e] Toll at 30/6/97.

[f] Toll at 31/8/98.

Table 4.3: Winning consortiums and partners

Sector	Project	Consortium name	Partners	Origin
Inter-city	El Melon Tunnel	Túnel el Melón S.A.	Endesa Delta S.A. Agroman S.A.	Chile Chile Spain
	La Madera Road	Camino de la Madera S.A.	Empresa Constructora Belfi Asesoría e Inversiones CMB S.A. Las Américas AFI S.A.	Chile Chile Chile
	North Access to Concepción	Trinela S.A.	Tribasa Chile S.A. Const. de Ingenieria Neut Latour S.A.	Mexico Chile
	Santiago-San Antonio Highway	Autopista El Sol S.A.	Endesa S.A. Besalco S.A Empresa Const. Fe Grande S.A. Larrain Vial S.A.	Chile Chile Chile Chile
	Nogales-Puchuncaví Road	Camino Nogales-Puchuncavi S.A	Cruz Blanca S.A. Empresa Constr. Delta S.A.	Chile Chile
	Route 5, Talca-Chillán	Ruta 5 Tramo Talca Chillán S.A.	Cruz Blanca Ferrovial Ltda.	Chile Spain
	Route 5, Santiago-Los Vilos	Tribasa-Inela S.A.	Tribasa Conosur Inela	Mexico
	Santiago-Los Andes Highway	Autopista Los Libertadores S.A.	Inecsa 2000 S.A. [formed by Infraestructura 2000 y Endesa] Ecsa Capitales	Chile Chile
	Route 5, Los Vilos-La Serena	Sacyr Chile S.A.	Sacyr Chile S.A.	Spain
	Route 5, Chillán-Collipulli	Tribasa Conosur S.A.	Tribasa	Mexico
	Route 5, Temuco-Rio Bueno	Ecovías 5 S.A.	Ferrovial Ltda. Delta S.A. CB Infraestructura	Spain Chile Chile
	Route 5, Rio Bueno-Puerto Montt	Sacyr Chile S.A.	Sacyr	Spain
	Route 5, Collipulli-Temuco	Favías S.A.	Ferrovial Agromar	Spain Spain
	Santiago-Valparaíso-Viña del Mar Highway	Rutas del Pacifico S.A.	Sacyr	Spain

	Route 5, Santiago-Talca	Autopistas del Maipo S.A.	Ferrovial Agroman Banco Santander	Spain Spain Spain
Urban	Access to AMB airport	Aerovías S.A.	Ingecol S.A. Sica Ltda.	Chile Chile
Airports	Diego Aracena, Iquique	Chucumata S.A.	Empresa Constr. Belfi S.A. Lan Chile S.A. Deconsa S.A.	Chile Chile Chile
	El Tepual, Puerto Montt	Concesionaria El Tepual S.A.	Gestión en Ingeniería IDC Senexo Cosalco Inversiones e Inmobiliaria Viento Claro Socimer Chile	Chile Chile Chile Chile Chile
	La Florida, La Serena	Gestión e Ingeniería IDC S.A.	Gestión en Ingeniería IDC Senexo Cosalco Inversiones e Inmobiliaria Viento Claro	Chile Chile Chile Chile
	El Loa, Calama	Gestión e Ingeniería IDC S.A.	Gestión en Ingeniería IDC Senexo Cosalco Inversiones e Inmobiliaria Viento Claro	Chile Chile Chile Chile
	AMB, Santiago	SCL, Terminal Aéreo de Santiago	Agroman Aeropuertos de Vancouver	Spain Canada
	Carriel Sur, Concepcion	Aero Sur S.A.	Ingecol Sica Mendez Junior Brundl	Chile Chile Brazil Chile

Source: MOP

As can be seen from Table 4.1, only one concession has a variable duration. As mentioned earlier, the Santiago-Valparaíso-Viña del Mar highway is the only project to have been tendered successfully using the Least Present Value of Revenue method. The last segment of the Route 5 highway, Santiago-Talca, was tendered after the Santiago-Valaparaíso-Viña del Mar highway. However, MOP used a fixed period concession mechanism to award this project.

Table 4.2 shows some economic parameters of each concession. Average tolls per kilometre vary between US$0.02 to US$0.03 for Route 5 projects. Other road projects are shorter and generally have a higher toll per kilometre. It can also be seen that the government has used transfers and subsidies extensively. This was necessary in order to produce reasonable and consistent toll rates across concessions. Also, as mentioned earlier, in the most recent concessions, when two or more companies offered the minimum toll, ties were resolved according to the highest payment offered to the State. In many cases, ties did occur and therefore there are several concessions that were awarded according to this rule. These transfers are paid (by sponsors, not the concession firm) the first year of full operation of the infrastructure and constitute an extra one-time payment to the State, which is then deposited in an Infrastructure Fund.

The aggregate net transfers from the above subsidies and payments are favourable to the State. For example, if one considers only the payments implied by the data in Table 4.2, the net present value (at a 12% discount rate) is close to US$130 million. Furthermore, if one considers the perpetual income and payments from the periodic re-tendering of the concessions, then the net present value increases to US$150 million. In this sense, the programme has had a favourable impact on the fiscal balance sheet.[21]

There has been over US$250 million in foreign equity investment related to the programme. Most of this foreign investment has come from Spain and Mexico. Table 4.3 shows the consortiums that have won each project and the origin of partner companies. Most of the successful companies have been Chilean, with the exception of several Spanish and Mexican firms and—in the case of the latest concession tendered—a Brazilian firm. One Canadian firm is also part of the consortium that was recently awarded the AMB Airport concession.

Other international firms that have been involved in one of the unsuccessful bidding consortiums include: Fluor Daniels of the USA, Dragados, FCC, Cubiertas y Entrecanales from Spain, ICA, GMD from Mexico, Transroute, GTM, and Bouygues from France, Strirling from the United Kingdom, and Bilfinger Berger and De Zublin from Germany.

[21] However, this does not consider the potential liabilities created by the minimum income guarantees that will be discussed below.

5 Uncertainty, opportunistic behaviour and government guarantees[22]

Uncertainty is an important issue in any concession contract, especially if it lasts for decades. In the case of roads and tunnels, the biggest source of uncertainty is future traffic levels. In turn, these traffic variations directly impact the revenue stream of the concessionaire.

As noted in EFG (1996, 1997a), traffic levels are notoriously difficult to predict. They cite the case of some public Chilean toll roads where yearly traffic growth rates varied from as high as 21.5% to as low as 2.9% between the 1987 and 1995. Furthermore, these variations occurred in a period of relative political and economic stability, and where the highways in question had been tolled for decades. With this volatility in the best of times, predicting traffic flows far into the future, or in more unstable settings, is clearly an imprecise endeavour.

There are many experiences where initial traffic projections turned out to be optimistic. In Mexico for example, *ex-post* traffic levels were on average only 68% of the level initially estimated (and guaranteed) by the government.[23] Only in 5 of 32 concessions were traffic levels above the initial projections, and in 16 they were below 50% of these estimates. In the case of the M1 project in Hungary, traffic levels were below 50% of initial projections, and in the case of the Dulles Greenway project in Virginia, USA, initial traffic levels were about a third of expected levels (Fishbein and Babbar (1996)). *Ex-post* traffic levels above original estimates are also common.

Besides the usual difficulties encountered in estimating traffic growth trends, when tolls are first introduced there is the added difficulty of gauging the reaction to the toll among users or, in more technical jargon, the price elasticity of demand. Traffic engineers have developed very sophisticated tools for estimating these elasticities, even when users have never confronted real tolls for the use of the infrastructure. However, these estimates may not be very reliable, not just because of data problems or the inference difficulties encountered with such estimates. There may be some cases where a toll road presents a strategic opportunity for some organised groups.[24]

In Chile, of the projects currently in full service, the one that has faced the most difficulties is the El Melon Tunnel, partly because in this particular case there is a very good substitute. The tunnel has to compete with the old route that goes over the mountain, and which increases travel time by about thirty to ninety minutes depending on the vehicle's size and weight. Due to the tendering

[22] In the case of Chile, EFG were the first to recognise the importance of uncertainty—especially traffic risk—for private toll roads. Some of their ideas are presented in this and the next sections. However, readers are encouraged to consult their articles (see also Tirole (1997)) for a fuller account of some of these topics.

[23] This summary and data from the Mexican experience are taken from Gómez-Ibañez (1999). See also Gómez-Ibañez y Meyer (1993) for an analysis of other world experiences, including the early Mexican experience.

[24] Whereas a bus or trucking lobby may have reacted passively to an increase in fuel prices in the past—perhaps because it was perceived that they had no power to influence that decision—they may have more negotiating power to pressure a concessionaire to lower the toll of a newly constructed road. Their power resides in their ability to boycott the road if there are good free alternative routes.

mechanism described earlier, tolls were set at inefficiently high levels, producing important traffic diversions. This was especially so for trucks and buses who—organised around their respective trade associations—formally boycotted the tunnel until the concessionaire was forced to reduced tolls.

One recommendation then for reducing the above problem, and to reduce traffic risk in general, would be to avoid building toll roads where convenient free alternative freeways are available, unless the saturation of the existing freeway implies that there is little risk of traffic diversion. A second recommendation is to allow downward toll flexibility in order for the concessionaire to adjust quickly to lower than expected traffic flows.

The benefits of downward pricing flexibility can be illustrated by two examples in Chile. In the North Access to Concepcion, the concessionaire reduced tolls for 2 or more axled vehicles at the end of 1998. Traffic in this category increased by 40%. In the case of La Madera Road, the concessionaire offered a free fuel coupon (valued approximately at US$7 and representing a reduction of less than 50% of the toll) for trucks with more than two axles that travelled without cargo. Traffic in this category increased by 100%.

In Chile, most projects enjoy a near monopoly as far as road traffic is concerned. Also, tolls are set as maximum values, which can be reduced if the concessionaire so wishes. In spite of this, it became evident early in the concession process that if firms were made to assume all traffic risks they would not be able to secure the needed finance. Financial institutions were not willing to fund projects unless the government provided some form of guarantee.

In addition to traffic risk, a concessionaire faces what may be called "regulatory or policy" risk.[25] Infrastructure investments have the characteristics of being sunk, in the sense that once they are built they cannot be dismantled or sold and the resources transferred to an alternative economic use. This opens the possibility of opportunistic behaviour by the government. For example, once a road is built a government could unilaterally demand a decrease in toll levels.[26] The concessionaire cannot threaten to "close the shop" and transfer the assets to another economic activity. The road—once built—is an irreversible investment. Knowing that they may be subject to such *ex-post* expropriatory behaviour, private investors might not be willing to invest in the programme.

In Chile, *ex-post* tariff changes by the government are not the most important factor contributing to "regulatory or policy" risk. Tolls, and their indexing formula, were set in the concession contract and the concessionaire has legal protection against such unilateral changes. However, it was much more difficult to guarantee that the government would not change its transport policy. As discussed above, in Chile alternative freeways are not required for toll roads to be built, and for the most part, existing projects do not have convenient free alternative routes. However, nothing prevents the

[25] This was also noted earlier by EFG (1996, 1997a).

[26] The failure of governments to increase tariffs according to previously agreed levels, or unilaterally decreasing tariffs, is quite common. It has happened in Hungary, Argentina, Thailand and France, to mention a few cases.

government from building such alternative routes in the future, thus siphoning off some of the traffic from the concession. It would be nearly impossible for a government to commit—even when it truly wanted to—to ensuring that no such policy change would occur.

The traditional solution to overcome the obstacles that traffic and regulatory risk pose for a concession programme is to give government income, traffic or debt guarantees. The guarantee scheme adopted in Chile is discussed next.

5.1 Minimum Income Guarantees

There are variations to the minimum income guarantee scheme across concessions. The first two concessions (El Melon Tunnel and the Madera Road) have actual physical traffic volume guarantees. Subsequent concession contracts express the guarantee as a minimum income level. If different types of traffic (cars, buses and trucks) pay different tolls, then it may make a difference which approach is taken.[27] Since the original objective of the guarantee scheme in Chile was to facilitate concessionaires' access to the financial market, a minimum income guarantee seemed preferable.

Before the bidding stage, MOP sets the total income level it will guarantee for the duration of the concession. This is set to a level equivalent to 70% of the estimated official cost of the project. Except for the first concessions tendered, MOP now gives bidders the flexibility to choose the time profile of the yearly guarantee within a band contained in the Bidding Documents. The bands are set with reference to the expected growth in traffic levels and usually have a maximum of 80% to 85% of expected yearly income as a ceiling.

Bidders choose yearly income guarantees subject to the constraint that the present value of the chosen guarantee is equal to the total set by MOP. In other words, each bidder chooses the yearly minimum income guarantee (within the band set by MOP), MIC_t, subject to

$$\sum_{t=1}^{T} \frac{MIC_t}{(1+\rho)^t} = 0.70 \times (I + OC + MC)$$

where

ρ = the discount rate (set in the bidding documents).

$(I + OC + MC)$ = the official net present value of the concession. This corresponds to the initial estimate by MOP of the investment, operating expenditure and maintenance cost over the life of the concession.

If in a given year income levels fall below the minimum income set for that year, the government pays the concessionaire the shortfall in revenues.

[27] If the contract guarantees a minimum total traffic level, then changes in the composition of traffic will affect income flows but would be irrelevant to the guarantee scheme.

It is interesting to note that most bidders have opted for a time profile of income guarantees that is heavily weighted to the present. That is, they chose the maximum of the band for the first period of the concession and then drop to the lower end of the band for the remainder. Bidders seem to be more concerned about short-term rather than long term traffic uncertainty. Alternatively, this may be a result of the debt structure of these firms. To date, domestic commercial banks have provided most of the funds and these credits are usually of relatively short maturity. In order to extend these credits, banks may have forced firms to bid high guarantee levels in the early part of a concession.[28]

The 70% parameter of the minimum income guarantee was chosen based on the average gearing ratios of concession firms. Debt is approximately 70% of assets in these companies. Therefore, implicitly the minimum income guarantee is designed so that revenues are sufficient to cover debt repayment. In essence, the scheme is a debt guarantee that benefits creditors.[29] The decision to apply this guarantee was based on an assessment that without it, lending institutions would not finance the infrastructure projects.

5.2 The Revenue Sharing Scheme

As a counter balance to the minimum income guarantee, a concessionaire must share 50% of the revenues obtained if traffic levels are consistently above estimated levels. This revenue sharing rule is triggered when the *accumulated* revenues pass a threshold level set at the beginning of the concession. The threshold level is set as that level of revenues beyond which the concessionaire would earn a rate of return on invested capital above 15%. It is estimated based on expected investment levels and costs at the time the project is tendered. Formally, the revenue sharing mechanism is triggered in the first month (S) after the following conditions holds:

$$\sum_{i=1}^{m} \frac{IN_i}{(1+\rho)^{i-1}} = RSTL$$

where

IN_i = the income level in month i.

ρ = the discount rate of 1.1715% (equivalent to an annualised rate of 15%).

$RSTL$ = Revenue sharing threshold level set before the concession is tendered.

Once in effect, the concessionaire must give the government:

$$RS_t = 0.5 * IN_t \qquad \text{for } t = S,....,M$$

[28] Eduardo Engel has noted that another possible explanation for this phenomenon is that the discount rate set by MOP for discounting the guarantees was too high. If this is true then investors have the incentive to cash in on the guarantee as early as possible.

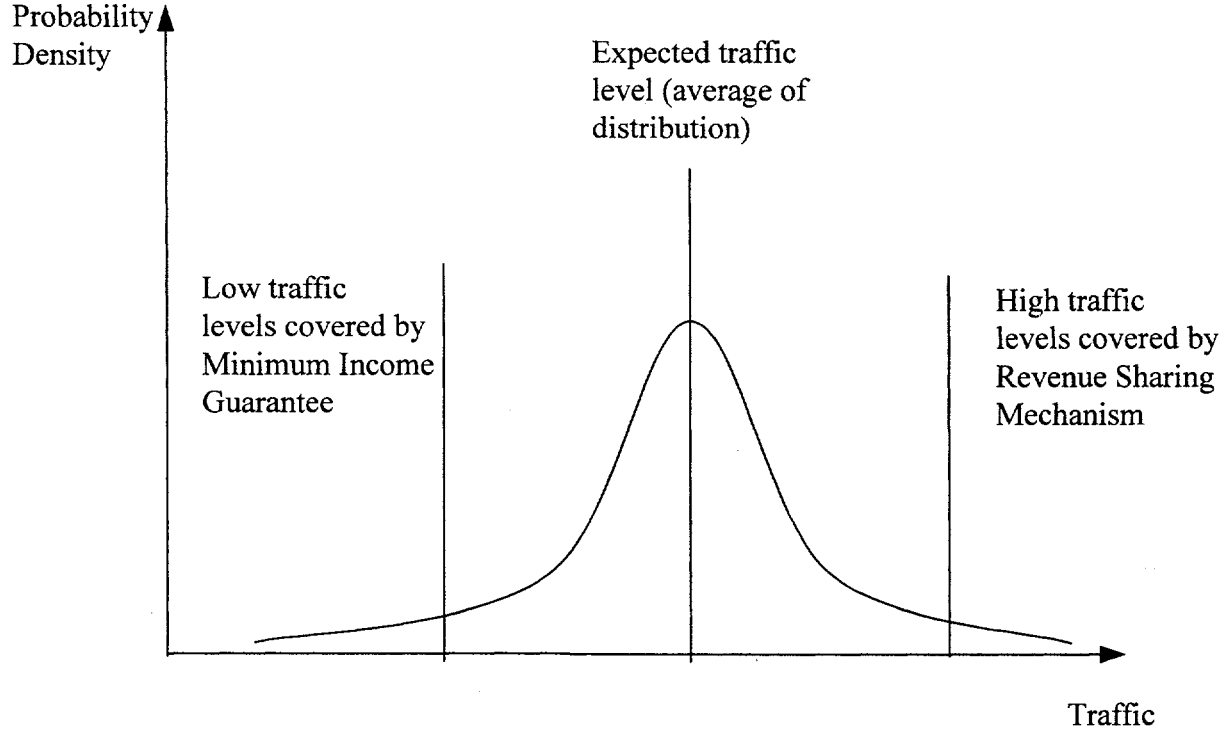
[29] Eduardo Engel has pointed out that since the amount of revenue guaranteed is a function of the official—as opposed to *ex-post* real—costs of the project, firms have an incentive to pressure the authorities to overestimate these costs. If costs are overestimated, part of the revenue guarantee will cover equity capital as well.

The first concessions had a different revenue sharing mechanism. The El Melon Tunnel, for example, has a yearly maximum traffic ceiling which is symmetric to the minimum traffic guarantee set for this concession. If traffic volumes are above this maximum level, the concessionaire must share 30% of its additional income that year with the government. The Access Road to the AMB airport has a similar mechanism, but it is based on a yearly income threshold rather than traffic volume.

Most of the other early concessions, however, have a profit sharing scheme based on a complicated calculation of yearly profits. This earlier scheme has been criticised by EFG(1997a) for being overly complex and thus making it more difficult for firms to evaluate the projects and prepare bids. In addition, profits are not easily measurable, making the process less transparent and requiring sophisticated monitoring by the authorities. Furthermore, the original profit sharing mechanism may have given bidders an incentive to over-invest, an effect analogous to the Averech-Johnson effect in the utility regulation literature (Averech and Johnson (1962)).

Minimum income guarantees and the revenue sharing mechanism serve to reduce income variance, as illustrated by the diagram below (Figure 5.1). For simplicity, assume that traffic uncertainty can be characterised by a simple probabilistic density function. The minimum income guarantee truncates this distribution by removing the risk for the concessionaire associated with very low effective traffic levels, while the revenue sharing mechanism removes the events associated with very high traffic levels.

Figure 5.1 Traffic probability density and variance reduction



However, it is important to note that in the latest concessions both effects are not symmetric. Income guarantees are based on yearly traffic levels while revenue sharing depends on accumulated traffic levels. One consequence of this asymmetry is that while income guarantees could be made effective any year that traffic levels fall significantly, revenue sharing will not occur until far into the future. From a public finance point of view then, there is a bias to the guarantee side of the scheme during the early stages of the programme.

The original idea of the revenue or profit sharing schemes was to compensate for the free income guarantees that were being provided to the concessionaire. Minimum income guarantees and the corresponding revenue sharing scheme have been optional. In the case of the two concessions tendered by a Least Present Value of Revenue scheme there was no revenue sharing rule. Instead, the concessionaire had to pay a yearly fee if he chose to have the minimum income guarantee. In other words, the revenue sharing scheme was replaced by a direct price ('premium') for the income insurance. For example, in the Santiago-Valaparaiso-Viña del Mar concession, there was a yearly charge equivalent to 0.75% of the outstanding value of the guarantees.

5.3 Income guarantees in practice

Table 5.1 shows traffic levels, income levels and guarantee levels for the different concessions in operation to date. Due to the changing nature of the guarantee design described above, some projects have an income guarantee mechanism while others have a traffic guarantee mechanism.[30]

In most cases, traffic or income levels are well above the guaranteed levels. The exception is the Nogales-Puchuncavi Road. Minimum income guarantees were triggered in 1997 and 1998. This situation is due to the unusual history of this project. When it was tendered, bidders had to choose between three construction options, each of which had a corresponding income guarantee schedule. The winning bidder chose the most expensive option, which had the highest level of guarantees. However, it was unlikely that traffic demand would respond significantly to the quality improvement implied by that option. Therefore, although traffic levels have been similar to those originally projected, income guarantee levels are relatively higher than in other concessions. As traffic grows during the next few years, the payments of minimum income guarantees in this particular concession are expected to cease.

In the case of the Access Road to the AMB Airport (the international airport in Santiago) traffic levels were so high in 1998, that they triggered a revenue sharing clause. That year, 30% of all income above 77,143 UF was transferred to the government. Something similar happened for the El Melon Tunnel, which had to pay 2,838 UF in 1997.

The net result for 1998 is a payment of 1,083 UF on behalf of the government for minimum income or traffic guarantees, or about US$35,000.

[30] There are a few more projects currently in partial or provisional operation. However, since the minimum income or traffic guarantees are only applicable when a concession is in full operation these projects are not included in Table 5.1.

The case of El Melon Tunnel deserves some comment. As mentioned earlier, the concessionaire has faced some financial problems due to traffic diversion. However, this would seem to contradict the figures in Table 5.1, which show a very high usage level for this project since 1997. In fact, a revenue sharing clause was activated in 1997. This paradox is explained by the peculiar nature of the traffic guarantee in this concession. It guarantees the total traffic levels using the tunnel *plus* the alternative route over the mountain. Therefore, a high traffic volume is consistent with low usage of the tunnel. This minimum traffic guarantee has not provided a real protection to the concessionaire. Needless to say, this is the only concession with such a mechanism.

Table 5.1 Income, traffic and guarantees for projects in full operation

Project	Year	Income (UF)	Minimum Income Guarantee (UF)	Traffic (vehicles or passengers)	Minimum Traffic Guarantee	Payments by government[a] (UF)
El Melon Tunel	1997	164,475	---	1,102,137	762,000	-2,838
	1998	174,720	---	1,251,648	769,500	---
Nogales-Puchuncavi Road	1997	5,927	7,125	---	---	1,198
	1998	39,306	42,100	594,322	---	2,794
Santiago-San Antonio Highway	1997	355,402	---	3,913,131	---	---
	1998	523,387	453,440	6,486,136	---	---
Access to AMB airport	1997	70,365	---	4,137,640	---	---
	1998	82,846	40,818	4,594,894	---	-1,711
La Madera Road	1997	66,257	---	369,356	221,000	---
	1998	73,846	---	414,182	228,000	---
Airport Diego Aracena of Iquique	1997	26,797	16,315	240,429	---	---
	1998	39,982	16,968	340,018	---	---
Airport El Tepual of Puerto Montt	1997	17,536	---	89,579	---	---
	1998	51,731	21,734	246,373	--	---

Notes: The Unidad de Fomento (UF) is an indexed monetary unit used in contracts. In December 1998, it corresponded to $14,685.39 in Chilean pesos, or US$ 31.00 at the prevailing exchange rate. For airport concessions the number of users corresponds to passengers, while for roads and highways it is the number of vehicles. Some concessions were not in full operation and therefore the minimum income or traffic guarantee was not applicable.

[a] Negative payments indicate a transfer from the concessionaire to the government as a result of a revenue sharing clause. The figures in the column do not include subsidies or transfers determined at the beginning of the concession. They are only due to minimum income guarantees or revenue sharing arrangements.

5.4 The fiscal consequences of minimum income guarantees

As stated earlier, income guarantees were necessary in order to attract private investment to the sector. By reducing traffic and policy risk, they also serve to lower the risk premium used by firms in evaluating the project.

However, many authors have pointed out the potential risks associated with these guarantees.[31] As seen in the previous section, the government is already paying some amount of guarantees. If current traffic trends do not change, these payments are expected to disappear in the near future. However, from a fiscal perspective, the real danger is a simultaneous downturn in usage across a multitude of concessions. If traffic levels across different concessions are highly correlated—as they would be if they are sensitive to the general economic business cycle—then a recession could trigger these guarantees over a wide range of contracts, forcing up fiscal expenditure just when government finances are least able to afford it.

Compounding the above problem is the fact that these contingent liabilities are generally not treated as such by current fiscal accounting practices. In most cases, no budgetary provisions are made for the eventuality that the government will have to pay the guarantees. From a budgetary perspective, guarantees are ignored until they are made effective, after which payments are recorded as current expenditure.

Due to its importance, MOP commissioned a study to address the fiscal issues related to the minimum income guarantees. The basic objective of the study was to determine the value of these contingent liabilities and whether budgetary provisions were necessary to cover expected future payments. Using MOP's traffic forecast models, Monte Carlo analysis found that the 70% guarantee level is sufficiently low so that only a very unlikely event would simultaneously trigger a substantial number of guarantees. Therefore, provisions were not considered to be necessary at that moment. However, ongoing research is being undertaken to implement the contingent liability valuation method for MOP and to continuously monitor the fiscal risks associated with the minimum income guarantees.

Furthermore, as noted earlier, the programme in Chile has so far generated a positive cash flow to the government. The proceeds deposited in the Investment Fund provide some form of provision for future minimum income guarantee payments.

Another problem with income guarantees is that if they are designed—as in Chile—to be a debt guarantee, then creditors may have a reduced incentive to monitor the operations of the concession firm. EFG (1997a) also argue that income guarantees remove one of the main advantages of private infrastructure provision, namely the effective screening by the private sector of 'white elephant' projects. These are projects that are not socially justified based on

[31] See Mody and Patro (1996), Engel, Fisher and Galetovic (1997c) and other studies in Irwin, Klein, Perry and Thobani (1997).

expected demand projections but are still promoted for political, prestige or special interest reasons. If guarantees are given, private investors may not scrutinise the viability of the project as carefully as they would otherwise. This argument would indicate that—if guarantees are to be given—they should cover less than 100% of the investment and operating cost of the project. In Chile, because income representing only up to 70% of the value of investments is insured, and this is approximately equal to the value of debt, equity investments effectively have little or no guarantees and therefore sponsoring firms have full incentives to evaluate the project correctly.

5.5 Least Present Value of Revenue mechanism

Engel, Fisher and Galetovic argue in a series of articles that many of the problems that plague road concessions—and which give rise to the pressure faced by governments to give guarantees—are due to the fixed term nature of the traditional franchising contracts.[32] One of their main insights has been to note that the economic uncertainty posed by traffic risk can be substantially reduced by a state contingent contract (ie. a contract whose duration is a function of the future demand level encountered).

As was mentioned earlier, income uncertainty may force governments to grant income guarantees in order to implement a successful concession programme. Income uncertainty will also increase the risk premium required by equity investors. EFG (1996) estimate that in Chile the added risk premium imposed by fixed term concession contracts may be 33% of investment costs on average (ranging from 16% to 67%).

Uncertainty may also lead to what is called the 'winner's curse'. With uncertainty, bidders form an opinion ('estimate') of the future evolution of a key variable, such as the traffic flow. Even if this estimate is unbiased on average, each will have a slightly different outlook on the future. In this situation, if bidders bid naively the winner is the agent who is most optimistic—and therefore biased—with respect to the future. The winner will therefore find that the concession is *ex-post* unprofitable. On the other hand, if bidders are aware of this phenomenon, taking this factor into account when formulating their bids may make them conservative in their bidding strategy. They will compensate the risk of the winner's curse by increasing their bids, with the consequence that tolls will be higher than what would have been possible otherwise.

Perhaps the most important consequence of the demand uncertainty created by fixed term contracts is the higher probability that the contract will need to be renegotiated *ex-post*. In fact, Engel, Fisher and Galetovic show that with a fixed term contract a concessionaire will make losses under some states of nature (ie. low demand outcomes). Once a concessionaire is in financial distress it may be very difficult for a government to resist a re-negotiation process. There are countless experiences around the world where unsuccessful road concessions have

[32] See EFG (1996, 1997a, 1997b, 1997c, 1997d, 1998) and Tirole (1997).

been bailed out by governments, the case of Mexico being a recent example. Besides the detrimental effect to tax-payers and road users, franchise renegotiations should be avoided due to the signal it sends to bidders of future contracts. If bidders know that contracts can be renegotiated, the winner may be the firm with the highest comparative advantage in renegotiations, rather than the most efficient and productive firm.[33]

In order to avoid some of the problems posed by fixed term concessions, Engel, Fisher and Galetovic propose the 'Least Present Value of Revenue' auction (LPVR).[34] The bidding variable—instead of toll levels or some other conventional variable—is the present value of revenue throughout the life of the concession that firms are willing to accept to undertake the project. The firm that bids the lowest present value of revenue wins. The duration of the concession is then flexible and depends on the effective traffic levels encountered. Once the concessionaire has received—in present value terms—the amount that he bid, the concession ends and the infrastructure reverts to public ownership. If real traffic levels are lower than expected, the duration of the concession is extended automatically, while if traffic is higher than expected the opposite occurs. Therefore, income uncertainty due to traffic variations is to a large extent eliminated for the concessionaire.

Besides reducing income uncertainty, the LPVR auction has other advantages. It reduces the problems and potential conflicts related to the early termination of a concession. In a thirty year contract, it is difficult to predict what will happen far into the future. In many cases, excessive traffic growth or other events call for an expansion of the original project. In spite of the special provision for these events included in some contracts, it would be optimal to cancel the original contract and re-tender the concession with the extended projects, rather than negotiate the additional investments with the existing concessionaire. However, the difficulty lies in calculating the compensation that must be given to the concessionaire in order to terminate the contract. The forgone future income stream must be estimated, giving rise to potentially contentious and protracted conflicts and legal battles. The LPVR auction reduces this problem substantially by just giving the concessionaire the difference between what he originally bid and what he has earned already.[35] This may increase the credibility of a government threat to terminate the contract if the concessionaire attempts to opportunistically renegotiate the contract, thereby reducing the potential problems related to "low balling."

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[33] As mentioned earlier, in Chile many concessions have been renegotiated. However, the cause has been the need to change original designs or to provide for additional investments, rather than to bail out concessionaires in financial distress. As noted by EFG (1997a), this may still send a harmful signal to potential bidders.

[34] The idea of tendering a contract using a minimum least total revenue mechanism was first suggested by Alvaro Gonzalez of MOP. This is a special case of the LPVR auction, specifically, when revenue flows are not discounted.

[35] There is a small adjustment to this simple procedure due to the maintenance and operating costs that the concessionaire saves by early termination of the contract. In the case of roads these are relatively minor expenditures compared to construction costs and can in principle be estimated by audits or another mechanism. However, in sectors other than roads, where operating and maintenance expenditures are a significant proportion of investments, the LPVR auction may not be as useful.

More generally, the LPVR auction generates a public signal of the value that the concessionaire places on the contract. This facilitates the monitoring by third parties of *ex-post* negotiations and possible compensations to the concessionaire, making the process more accountable and transparent.

Another important characteristic of the LPVR mechanism is that tolls can be adjusted without having to negotiate new terms with the concessionaire. If tolls are deemed too high or low, the authorities could change them without affecting the concessionaire's expected income stream and without engaging in a potentially protracted negotiation process. As stressed in EFG (1997a), this flexibility may be important in urban road concessions where it may be very difficult to determine the optimal tariff *ex-ante*, especially during congestion periods.

The LPVR mechanism also has its drawbacks. It may lower the incentive of concessionaires to make demand enhancing investments, such as quality improvements. The increase in demand from these expenditures results in an earlier termination for the contract, with little benefit to the concessionaire.[36] However, there are other remedies for this problem (see Tirole (1997)). Perhaps a more important difficulty is that the LPVR auction does not resolve possible cash flow problems that a concessionaire may face when traffic levels drops. This issue will be discussed below in relation to the Costanera Norte project.

In Chile, two projects have been tendered using the LPVR mechanism. Because of the novelty of the mechanism involved, these cases will be briefly reviewed next. First, however, it must be said that—knowingly or not—the UK was the first to apply a variable length concession with an LPVR flavour in the Severn Trent and Dartford Bridge concessions.[37] The social benefits of such a franchise can now be seen by the fact that—due to the high traffic levels—the concession for the Severn Trent Bridge will finish many years earlier than originally envisaged.

5.5.1 The Santiago-Valparaíso-Viña del Mar concession[38]

The Santiago-Valparaíso-Viña del Mar highway, also known as Route 68, is one of the main links between Santiago (the capital) and the coast. The project contemplated the construction of three tunnels and the extension or improvement of much of the 130 kilometres of existing infrastructure.

It was estimated that there was a high probability that by 2010, a substantial expansion of the route would be needed again to accommodate higher traffic levels. Therefore, the use of a LPVR

[36] Early termination of the contract would save the concessionaire the additional maintenance and operation costs that would have been incurred during the original period. But these are usually small.

[37] We thank Eduardo Engel for having pointed this out to us. See also Fishbein and Babbar (1996) for a description of the Dartford Crossing. See Marshall (1989) for a description of the financial structure of the Second Severn Trent Crossing. From this later article it is clear that the agents involved in the United Kingdom had a clear understanding of the benefits of a variable length concession in terms of reducing revenue uncertainty.

[38] See Hinojosa (1998).

mechanism seemed particularly useful in this case in order to have the option of terminating the concession early and tendering a new project.

Although the project was tendered using the LPVR mechanism, there is a ceiling of 25 years on the duration of the concession.[39] Five consortiums presented a bid, but only four passed the technical evaluation stage. The financial bids for each of the qualified firms are shown in Table 5.2. The consortium Rutas del Pacifico won the competition with a Total Revenue of the Concession (TRC) bid of US$381 million. The official cost of the project according to MOP was US$340 million in net present value terms.

Table 5.2 Total revenues bid for the Santiago-Valparaiso-Viña del Mar concession

Firm	Total Revenue of the Concession Bid (US$ Millions)
CICASA Chile	452
ECORUTAS	389
Rutas del Pacifico	381
Autopistas de Peajes SA	442

The concession ends the month that the following condition is met (unless the concession has already lasted 25 years, in which case it ends automatically):

$$PVI_m \geq TRC$$

where

TRC = Total revenue of the concession of the winning firm, or 11,938,207 UF (US$ 381 million) in this case.

PVI_m = Present value of monthly income of the concessionaire, which is calculated as:

$$PVI_m = \sum_{i=1}^{m} \frac{IN_i}{\prod_{j=1}^{i} (1+r_j)^{\frac{1}{12}}}$$

with

IN_i = revenues in month i expressed in Unidades de Fomento (UF) and including any payment of minimum income guarantees if applicable.

r_j = discount rate for month j.

Crucial to the above calculation is the rate used to discount future income flows.[40] MOP gave bidders a choice of a variable or fixed real interest rate. The fixed rate was set in the bidding

[39] Based on official cost and traffic estimates, the concession is expected to last approximately 17 years.

[40] It is important for the authorities correctly set the value of the discount rate so that it reflects the true cost of capital of bidders. On this issue see Gonzalez, Hinojosa and Muñoz (1999) and the original EFG articles.

documents as a risk free rate of 6.5% plus a risk premium of 4%, giving a total real rate of 10.5%. The variable rate was set as the monthly average real risk free rate of the financial system in month *j*, plus a 4% risk premium. Table 5.3 shows that only one bidder declared a preference for the variable rate, while the winner opted for a fixed rate.

Table 5.3 Type of discount rate chosen by each bidder

Firm	Type of discount rate
CICASA Chile	fixed
ECORUTAS	variable
Rutas del Pacifico	fixed
Autopistas de Peajes SA	fixed

As was mentioned earlier, minimum income guarantees were offered as an option at a price of 0.75% of the value of the outstanding guarantees. It is interesting to note that two of the four bidders—including the winner—did not request the guarantees (see Table 5.4). This is suggestive of the advantages of the LPVR auction in lowering income uncertainty and therefore reducing the need to grant guarantees.

Table 5.4 Minimum income guarantee requests

Firm	Request of minimum income guarantee
CICASA Chile	yes
ECORUTAS	yes
Rutas del Pacifico	no
Autopistas de Peajes SA	no

Finally, the government has the option of terminating the concession early after 12 years if it considers that traffic growth justifies the development of a new project. If the concession is terminated early in month *m*, the concessionaire will be compensated according to the following formula:

$$COMP = \left(TRC - PVI_{m-1} - \sum_{i=m}^{s} \frac{C_i}{(1+r)^{\left(\frac{i-1}{12}\right)}} \right) * \Delta$$

where

$COMP$ = future value of the required compensation in Unidades de Fomento (UF).

C_i = estimated operating and maintenance cost in month i.

s = estimated end of the concession if early termination is not applied.

r = discount rate of 10.5%.

Δ = forward value factor given by,

$$\prod_{j=1}^{m} (1+t_j)^{\left(\frac{1}{12}\right)}$$

where t_j is the fixed or variable discount rate chosen by the concessionaire.

The simplicity of the above formula for terminating the contract is one of the important advantages of the LPVR mechanism. Potential disputes are limited to the relatively minor issue of estimating the present value of operating and maintenance costs

5.5.2 The Costanera Norte Concession

Late last year the first urban concession was tendered using the LPVR auction mechanism.[41] It considered the construction of a 39 kilometre east-west corridor to reduce Santiago's endemic congestion problems. It was also intended to be the project that would set the standard for electronic metering technology in the country. Most of the features of the Santiago-Valparaiso-Viña del Mar tendering mechanism described above were also included in the Costanera Norte project. However, one novel feature of the tendering was the inclusion of a foreign exchange guarantee, something that had not been necessary in previous concessions.

The Costanera Norte is a very complex project. Institutionally, there are many government bodies with jurisdiction over some aspect of the concession. Moreover, being an urban project, numerous environmental, technical, and legal issues had to be resolved. Opposition from affected parties had also been greater than for previous concessions. After more than three years and several postponements, it was finally tendered late last year. Unfortunately, of the eight pre-qualified bidders only one—the French Bouygues-Transroute Consortium—presented an offer. Furthermore, this offer was disqualified because the guarantee bond offered by the bidder was below the level established in the bidding documents.

There are several explanations for the above result. The international financial crisis was probably a factor in explaining the low turnout. However, private sector sources also point to the risky nature of the project—with grassroots opposition, new untested electronic tolling and low income guarantees—as the reason behind their decision not to participate.

The bidding documents included an optional minimum income guarantee similar to the Santiago-Valparaiso-Viña del Mar highway. However, construction costs in the Costanera Norte project were perceived to be higher than the official estimate made by MOP. Therefore, the minimum income guarantees would cover debts equivalent to a lower share of the total cost of the project than the 70% target set by MOP. Industry sources indicated that the guarantees would only cover about 60% of their expected costs and therefore creditors would only be willing to finance this amount. Equity investors were not willing to provide the 40% difference.

There was an added commercial risk involved in this project. Electronic tolling was considered to be the only feasible charging method in the crowded urban setting of the Costanera Norte

[41] See EFG (1997a) for a proposal specifically designed for urban road concessions and some insights relating to the Costanera Norte project.

project. Since electronic tolling was untested in the country, there was uncertainty as to the success in collecting charges to users. The minimum income guarantees came into effect only if 'real' traffic flows decreased below the guaranteed level, independent of the success of the concessionaire in collecting the charges from motorists. The government eventually agreed to give some form of commercial risk guarantee. This took the form of an 85% toll collection guarantee. However, unlike the minimum income guarantees, these were not actual payments that the government would make to the concessionaire. Rather, a shortfall in collection success would be translated into a longer concession period, in an analogous fashion to the effect that lower traffic has under a LPVR contract.

Participants, however, were not convinced of the merits of this scheme for two reasons. One sticking point was that the collection guarantee only came into effect if the concessionaire has exhausted the legal options for collecting tolls through the judicial system. However, many firms were concerned that the number of non-payers may have swamped the capacity of Santiago's court system, thereby rendering the guarantee useless. Not many cases would reach the final stages where the guarantees could be invoked. However, from the governments point of view it was difficult to design the guarantee otherwise without creating a moral hazard problem related to toll collection.

Another objection posed by firms was the fact that a term extension did not solve the medium term liquidity problems that a concessionaire may face. The conventional income guarantee solves this problem because the government makes real transfers to the firm. However, an extension of the concession period does not. Therefore, although the 'asset' value of the contract (the LPVR) may be sufficiently high, cash flow problems may force the concessionaire into debt service problems and possibly liquidation if he cannot reschedule his debts with creditors during the interim period.

Both Klein (1997) and Tirole (1997) have noted the cash flow problem in relation to the LPVR method. In particular, Tirole argues that the LPVR method must be complemented by financial innovations that would give concessionaires more flexibility in their debt payments. Fixed maturity finance is not adequate for LPVR type arrangements.

This is not an argument against an LPVR auction method. EFG have proven that for a given level of guarantees an LPVR type arrangement is always preferable to a fixed duration contract. It is, however, a reason why minimum income guarantees may still be required when projects are tendered using an LPVR method.

Minimum income guarantees coupled with the LPVR tendering mechanism may be an interesting policy combination. In this context, guarantees act as a liquidity instrument rather than a guarantee to subsidise losses. If traffic falls below the guaranteed level, the government makes an income transfer to the firm. For the purpose of keeping track of the accumulated revenues, these guarantees count as income as if they were produced by real traffic. Therefore, the concession terminates earlier compared to the case when the LPVR mechanism is used

without guarantees. The concessionaire does not benefit from the government transfer. In NPV terms his income is the same. The government is repaid the 'loan' when the infrastructure—and the corresponding tolling income—reverts back earlier to public ownership.

Another interesting aspect of the Costanera Norte experience, which sheds some light on the potential for the LPVR auction mechanism, is that firms placed a very low value on cash flows beyond 30 years. The expected duration of the concession under baseline projections was 30 years.[42] Therefore, lower traffic flows or low collection levels would automatically extend the duration of the concession beyond that period. However, debriefing meetings held with potential participants indicated that they only evaluated the project using a 30 year horizon, therefore annulling the benefits of the LPVR mechanism in reducing income uncertainty. Apparently investors were not willing to consider potential cash flows that went beyond the horizon of most existing financial instruments in Chile and in international capital markets.

The above evidence is anecdotal and must be interpreted as such. However, if the above hypothesis is true, then the LPVR mechanism may not be feasible in all circumstances. In particular, for very long and risky concessions such as the Costanera Norte project the method may not be as promising compared to shorter concessions such as the Santiago-Valparaiso-Viña del Mar highway. Furthermore, there is still an issue surrounding possible cash flow problems related to debt service when an LPVR mechanism is used. It may be that the optimal solution could be for governments to complement this mechanism with an explicit liquidity guarantee as discussed above.[43] Alternatively, some form of financial innovation could be encouraged in order to provide for more flexible debt service commitments. This topic merits further research.

6 Financial issues and exchange rate guarantees

As stated in the introduction, one of the main motivations of the concession programme in Chile was to mobilise private sector finance for infrastructure investments. There were three potential sources of funds:

- the domestic banking system;
- domestic pension funds and insurance companies;
- foreign equity or financial investors .

To date, domestic banks have provided most of the credits for the construction stage. However, these credits are usually expensive and of short maturity. As the exposure of the domestic banking system to infrastructure investments increases, and as concessionaires attempt to

[42] Increasing tolls to shorten the concession was ruled out since it would probably create important traffic diversions. In addition, tolls have already been increased by over 50% in a previous revision of the project.

[43] It must be noted that this alternative would still create some of the fiscal problems related to public guarantees that were discussed above.

refinance their debts after the construction stage, there will be a growing need to tap other sources of finance, especially long-term finance.

The Chilean private pension system offers an attractive source of funds. These institutions could provide much needed long-term finance. However, pension funds are tightly regulated and in the initial stages of the programme these institutions were legally constrained from investing infrastructure projects. In particular, the lack of investment grade rating for bonds or other financial instruments issued by concession companies was an obstacle.

In order to facilitate investments from pension funds and insurance companies—as well as to expedite the participation of banks—legal changes to financial and infrastructure regulations were introduced between 1995 and 1996. These reforms, among other things, increased the lending allowances of commercial banks for infrastructure projects from 5% to 15% of capital and reserves. In addition, they opened the door for pension funds and insurance companies to invest in bonds without history. As a result of these reforms, a new long-term financial instrument—the Infrastructure Bond—was created.[44]

Table 6.1 Infrastructure Bonds emissions

Concession	Currency	Amount	Date of issuance	Rating[a]
AMB International Airport	US$ denominated bond	US$213 million	1999	AAA
Route 5, Talca-Chillan	Domestic denominated inflation linked bond	US$ 185 million	1999	AAA
Route 5, Santiago Los Vilos	Domestic denominated inflation linked bond	US$ 230 million	pending approval by financial regulator	A
Nogales Puchuncaví	Domestic denominated inflation linked bond	US$ 12 million	Advance stage of preparation	

Source: MOP

[a] Rating by Standard & Poor's.

To date, there have been two bond emissions, both in early 1999 (See Table 7.1). The consortium of the AMB International Airport in Santiago was successful in placing a dollar denominated bond in the North American market for US$213 million. These bonds were rated as AAA by Standard and Poor's. Another bond issue was successfully placed in the domestic market in February of this year. Pension funds were for the most part the purchasers of these domestic currency financial instruments. These bonds were also rated as AAA by Standard and Poor's.

[44] See Ministry of Public Works and Ministry of Finance (1998).

In spite of these innovations, there is a growing perception that the domestic financial market may not be sufficiently large to fund, by itself, the next wave of concessions. Therefore, there is a concerted effort to attract foreign credit for the new projects. In addition to providing more competition in the financial market, foreign funding could also force a decrease in premiums, thereby reducing the financial costs faced by concessionaires.

However, exchange rate risk poses an important obstacle for attracting foreign credits in the infrastructure industry. In the last concession tendered—the Costanera Norte project—the government for the first time considered giving an exchange rate guarantee. This consisted of denominating part of the minimum income guarantees in US$. Therefore, in the case of a devaluation, the real value of these guarantees increased. Once again, this mechanism only provided cover for their foreign currency denominated debt payments, therefore foreign equity investors still faced the risk of currency fluctuations. However, there was another mechanism whereby part of the LPVR would be denominated in US$. In this case, a devaluation would increase this value, extending the duration of the concession automatically. A revaluation of the currency would have the opposite effect.

An exchange rate guarantee has a similar problem to the minimum income guarantee. Both are likely to be triggered when government finances or balance of payment problems are at their worst. The interesting aspect of the LPVR exchange rate cover, as designed in the Costanera Norte project, is that it would not entail an actual payment by the government or users at the time of crisis. Therefore, although it provides an exchange rate protection to investors, it would not drain foreign reserves in times of crisis. This scheme would only have an affect on the duration of the concession, and then only if devaluations are not compensated by revaluations during this period.

The government is currently studying the development of a more comprehensive exchange rate guarantee in order to facilitate the foreign funding and re-financing of infrastructure projects.

7 Monitoring of contracts and regulatory institutions[45]

Up to the present moment, the Ministry of Public Works has acted as the regulatory institution that monitors the concession contracts. However, this might not be an optimal long-run institutional arrangement.

The design of regulatory and monitoring institutions is an immensely important topic in any franchising process. These contracts lock-in the government and private concessionaires in a relationship that lasts a very long time. It is illusory to think that the work is finished once a project is concessioned, or to think that the provisions of the contract are enough to regulate the firm.

[45] See EFG (1997a) for a longer discussion of these and other issues related to the regulation of toll roads.

In the first place, there is hardly any concession experience in the world --be it water, telecoms, electricity or roads-- that does not experience some form of *ex-post* re-negotiation of the original terms of the contract. In addition, political considerations will always get in the way when it comes to monitoring, applying fines, and terminating a contract when the concessionaire does not meet the stipulated contract conditions.

For these reasons, it is ideal to have a regulatory agency that:

- is politically independent from the executive power;
- is not a promoter of the concession programme;

Although far from the ideal described above, in September 1997 a special unit was created within the Concession Agency in MOP and specifically designed to monitor and regulate the concession contracts.

One of the first difficulties faced by this new enforcement unit was the lack of human resources required to monitor such a large concession programme. In addition, there was a need to generate the technical information required to enforce the quality standards of the infrastructure during the construction phase. Although construction companies undertake regular quality tests for the infrastructure, it was found that in certain cases this information is not passed on to MOP, nor to other partners in the concession consortium, in a regular and timely manner.

To solve both of the above problems, regular quality audits are now undertaken by third party engineering firms paid for by the concessionaire. This information is immediately distributed among the various interested parties.

8 The future

There are still over US$3 billion worth of projects to be tendered. Almost half of this amount is accounted for by the urban road projects, including the re-tendering of the Costanera Norte project.

In addition, MOP has been studying the possibility of extending the concession programme to new activities and areas. An interesting example currently being studied is the introduction of concession type contracts for the maintenance of parts of the existing road network. The private sector already undertakes maintenance activities under contract from MOP. However, these contracts usually cover specific tasks and have a short duration. A concession type maintenance arrangement would be longer and would try to exploit the full life cycle economies that could be achieved if an agent is responsible for the state of roads for a longer time period. For example, if a concessionaire has to maintain the quality of a piece of network for 5 years, he may find it convenient to invest in higher quality repairs than what MOP currently demands in maintenance

contracts in order to reduce subsequent costs. Also, a concessionaire may have superior knowledge regarding the state of the network and have a faster reaction in repairing roads after a harmful climatic event.

Introducing real tolls to fund these maintenance concessions is generally not feasible nor desirable. However, the use of shadow tolls seems a promising alternative.[46] In essence, shadow tolls are another way of providing State subsidies or funding for infrastructure projects. Instead of a lump-sum yearly fixed transfer—as in some of the existing Chilean toll roads—transfers are made based on the number of vehicle using the road. In other words, the State pays a 'toll' for each vehicle using the network but the user does not face this charge, hence the name 'shadow toll'. Nothing prevents linking the payments to other variables besides vehicle use. In a maintenance contract, shadow tolls could be linked to measurable quality characteristics of the road, in addition to vehicle use.[47]

The use of shadow tolls—by allowing a performance related payment to the contractor—improves the incentive properties of maintenance contracts, reducing the cost of maintaining the infrastructure in good condition. In addition, it would allow government maintenance expenditures to be less volatile through time. Instead of big lump-sum transfers when capital maintenance is required, the government would make more stable yearly payments based on the quality and use of the network. This would allow more projects to be funded with existing budgets, although provisions must be made for the future liabilities that the State assumes with this mechanism.

MOP is also studying the possibility of extending the concession programme to irrigation projects.

9 Conclusions

The intention of this paper has been to present an overview of the Chilean programme and some lessons that may be useful to other developing countries wishing to embark on a similar route.

Among the lessons extracted from the Chilean experience, we can summarise the following:

- It may be advisable to try to avoid as much as possible the concessioning of roads with convenient alternative freeways;

[46] Shadow tolls were developed in the United Kingdom and are currently being used in eight BOT type road projects. See Highways Agency and Private Finance Panel Executive (1998).

[47] Linking payments to vehicle use may still be desirable in maintenance contracts if traffic demand is sensitive to the quality of the road or if maintenance expenditure varies with traffic levels using the infrastructure. However, in order to give the right incentives, the measurable quality of the road should be central in the payment mechanism.

- Choosing the appropriate variable to award a concession is critical. Mechanisms that encourage high tolls (for example by promoting large payments to the State or short concession periods) should be avoided. Also, if a concession is awarded to the firm offering to charge the lowest toll level, a floor and a ceiling should be placed on the possible bids. The first should be set to guarantee the financial viability of the concession and the latter should be set to avoid inefficient traffic diversions. Ties between bidders at the top or bottom end of this band should be resolved by a second variable such as the level of transfers between the firm and the State.

- Downward toll flexibility should be allowed in order for the concessionaire to be able to react to unexpected low traffic flows, especially for particular categories of vehicles;

- Special attention should be placed in the tendering mechanism, as well as in the general incentive structure of the concession contract. Novel mechanisms, such as the LPVR auction, may help overcome many problems faced by traditional road franchises. As the case of the Santiago-Valaparaiso-Viña del Mar concession shows, this mechanism may provide a useful instrument for reducing traffic risk and obviate the need for the State to extend income guarantees. Likewise, tendering mechanisms developed in Chile can be used to reduce the possibility of bidders presenting dangerously low bids, and hence jeopardise the financial stability of the concession.

- Although the evidence is anecdotal, the case of the Costanera Norte tendering experience may point to certain limitations to the pure LPVR mechanism. In particular, there may be a limit to the value that investors place on the extension of a concession's duration if it goes beyond, say, 30 years. In addition, this mechanism does not address cash flow and liquidity problems that a concessionaire may face during an extended low traffic episode. However, there may be a role for income guarantees to provide liquidity enhancement in these circumstances. In fact, a minimum income guarantee within the context of an LPVR auction is a credit enhancement instrument rather than an income support tool. Given the clear advantages of an LPVR auction mechanism over traditional fixed duration contracts, the combination of this type of scheme with an explicit liquidity enhancement mechanism may be a promising policy option. Alternatively, some form of financial innovation could be encouraged in order to provide for more flexible debt service commitments.

- If concessions are tendered by traditional methods and income guarantees are going to be given, it is advisable for them to cover only a fraction of the expected income stream of the concessionaire. This lowers the financial exposure of the State as well as improves the incentives faced by the concessionaire.

- Finally, efforts should be made to make contracts as complete as possible. However, more likely than not, contracts will need to be modified or renegotiated *ex-post* in ways unforeseen when originally drafted. Therefore, it is advisable to have a framework for

dealing with these events, including an efficient and well designed dispute resolution mechanism, rather than face each one in an ad-hoc manner.

The main motivation for the programme in Chile was the need to boost investment in order to plug the growing infrastructure deficit after more than a decade of sustained economic growth. To this end, the programme in Chile has been a success. To date, nearly 50% of the road infrastructure deficit identified initially has already been covered by the concession scheme. The rest will be addressed by forthcoming projects funded both by the private as well as the public sector. In addition, the programme has generated, in present value terms, net revenues amounting to between US$130 million to US$150 million for government coffers.

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