

# Concessions and *road and rail transport* optimization

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The Latin American railways faced serious competition from another means of land transport for the first time in the 1930s, and one of the results of this was a significant loss of income from the transport of products of relatively high unit value. This income had covered their fixed costs in terms of management and infrastructure. The financial difficulties of the railway companies drove them to seek aid from the State sector, but in subsequent decades governments gradually lost interest in them because of their financial deficits and dwindling importance in the national economy. The services with the least volumes of freight and passengers were steadily eliminated, and rail services had already become quite sparse when governments decided to return the railways to the private sector as from the late 1970s. The growing tendency of railways to devote themselves to the transport of bulk cargo between a limited number of points means that in corridors without navigable waterways almost the only competition comes from heavy trucks. The subsidies for the transport of goods by such trucks have been reduced, but not impeded, by the granting of highway management concessions. Within a few years it will be technologically feasible to charge heavy trucks tolls that really reflect both the external costs of their operation and those deriving from the wear and tear on the infrastructure. In the meantime, rail and road transport could be placed on an equal footing in terms of competition by compensatory subsidies for the former. This would channel each type of traffic towards the means of transport that could move it at lowest cost. In order for the benefits to be received by the community in general rather than by the private-sector concessionaires of railways and highways, however, the policy on compensatory subsidies should be laid down before the award of the concessions.

# I

## Historical background

### 1. Rail tariffs before the emergence of competition from road transport

As far as land transport was concerned, until the appearance of the railways road transport had virtually no competition, although in some countries, including many European nations, canals and rivers were viable options, and in the Americas—in pre-Columbian and colonial times when, especially in the period of Spanish and Portuguese rule, much of economic and social development took place in the strips of land along the coast or in areas of mineral wealth—coastal shipping was often preferred to the primitive roads.

When the railways came on the scene, this represented a major technological leap forward: before the invention of the steam locomotive the human race had never had any form of self-propelled transport. The appearance of the railways brought with it a very significant reduction in transport costs, and indeed—except for very short-distance movements—road transport virtually disappeared in every corridor where there was a railway. This monopoly position of the railways attracted the attention of the incipient Ministries of the Economy, which began to subject the railway companies to rules which restricted their freedom of action regarding the tariffs they charged (Thomson, 1998). Even in cases where the railway companies continued to enjoy some degree of flexibility regarding their tariffs, they tended to levy relatively high charges for transporting products of comparatively high unit value, which was logical enough in commercial terms as long as the railways did not face significant competition. In 1886 an observer noted that “All the railways in the world have accepted differentiated tariffs, because otherwise low-value goods could not pay the high transport charges for long distances” (EFE, 1887). In 1932 the Chilean State Railways charged 36 cents per ton-kilometre for the transport of brandies, alcohols and liquors, 21 cents for wine, and only 15 cents for mineral water, although the cost of transporting each of these categories of beverages must have been very similar to that of the other categories.

By transporting products of higher unit value, the railway companies were able to finance not only the direct costs of the transport proper but also the fixed costs in respect of infrastructure, management, etc. It should be noted that the proportion of the sales value of the product accounted for by its transport was still very small in the case of goods of high market value, even though the absolute cost of the transport was much higher than that paid by lower-priced goods.

### 2. The impact of competition on rail transport charges, and its consequences

Generally speaking, the economic problems of the railway companies began with the appearance of competition from road transport, which was particularly interested in transporting precisely those products whose transport enabled the railway companies to cover their fixed costs as well as modernizing their operations and paying dividends which kept their shareholders interested. This phenomenon did not take place at the same time for all railways: for example, in the case of the line between Santiago and Valparaíso, where the volume of freight transported by road trebled between 1934 and 1937, it took place a long time ago (Huidobro, 1939), while there are other cases where it has still not occurred, as in the international rail links between Salta and Baquedano and between São Paulo and Santa Cruz de la Sierra, where there are still no good-quality highways. Table 1 shows this phenomenon in the case of the Chilean section of the railway from Arica to La Paz. During the years covered by the table (1992 to 1996), the paving of the highway between these two cities was completed, and this greatly increased the competition from road transport. The railway freight charges for all the products covered by the table went down in real terms, but those which went down most were the charges that were highest in 1992: i.e., the freight rates for products of relatively high unit value, such as motor vehicles and manufactured goods in containers.

This phenomenon largely explains why in many countries the railways were taken into the govern-

TABLE 1  
**Arica - La Paz Railway (Chilean section):  
 Relation between absolute value of freight charges  
 and relative changes in that value, 1992-1996**

Product	Freight charge for product, as a percentage of average freight charge, 1992	Change in real value of freight charge, 1992-1996 (%)
Wheat	91	-33
Diesel fuel	122	-45
Wheat flour	85	-20
Vehicles	270	-44
Manufactured products in containers	120	-58
Zinc	58	-21
Lead	60	-21
Paper and pulp products	95	-27

Source: Prepared by the author on the basis of data presented in EFE (several years).

ment sector between 1935 and 1965. Over that period it became evident that private enterprises could not attract sufficient capital to compete in the long term, and sometimes they could not even cover their operations in the short term, at least as long as they continued to maintain high-cost services such as branch lines. In some cases –as for example in Paraguay– railways had to stop running before the government realized that they had a socio-economic or strategic value that exceeded their financial deficit. Without the railways, great volumes of products of low value (and hence of low freight rates) would have serious difficulties in reaching the ports, the factories or the points of consumption. Likewise, the absence of railways would seriously complicate the travel of lower-income sectors of the population.

In government hands, however, the railways often suffered the adverse consequences of deficient management and administration, and in some cases, as in Argentina, they were subjected to politically motivated interference that severely compromised their economic efficiency. Their managers did not receive clear instructions from governments regarding the relative importance to be assigned to the provision of a social service, the promotion of economic development, or the need to cover their expenses from their income, thus tending to reduce the efficiency of their management still further. As they were not obliged to pay their way, however, they almost always managed to survive and, in a number of important cases, thanks to the injection of government

funds or government-backed loans, to modernize their operations in technological but not in institutional terms. There was a tendency to modernize in the aspects that most attracted the attention of voters, such as passenger coaches or locomotives, while relegating investment in the permanent way to the background.

As it was no longer necessary to cover all the expenses, and also because of the desire of governments to favour the development of particular geographical or economic sectors, many of the freight tariffs charged only tended to reflect the marginal costs of the transport (indeed, according to the managers of some recently privatized railways, sometimes they did not even cover these costs).

### 3. Governments decide to return railways to the private sector

By the mid-1980s, many governments, such as those of Argentina or Brazil, had begun to sharply reduce their investments in railways, and towards the end of that decade they began to ask themselves why they were channelling large amounts of resources to balance the accounts of railway enterprises whose role in the national economy seemed to be shrinking year by year. In Latin America, the first government to ask this question was that of Colombia, followed by Argentina and then most of the others, culminating in the privatization of the railways, normally by way of concessions. Sometimes, as had occurred thirty years before in Paraguay, as a result of their transfer from private to State management or their return to private ownership, railways stopped operating for a time, as happened in Guatemala and Costa Rica.

### 4. Commercial attitudes of private companies

The new private sector railway managers were not very interested in carrying freight at rates equal to or below their marginal costs, and they expected all the traffic transported to help at least to some extent to finance their fixed costs. Therefore, although the volumes transported have generally tended to rise with privatization, some types of freight have ceased to be transported by rail. A typical case is that of the Chilean railway company Ferronor, which has negotiated a contract for the bulk transport of five million tons of iron ore from the Los Colorados mine to the port of Huasco, while it has ceased to accept traffic of low volume and even lower profitability, such as cement

from La Calera to Copiapó or automobiles from Iquique to Barranqueros (Argentina).

When traffic ceases to be transported by rail it must either find another means of transport or simply cease to exist, with unfortunate consequences in both cases. If it moves to another means of transport, the economic costs may be higher than those of rail transport, while if it ceases to exist this will probably give rise to idle resources, at least in the short term.

It is important to note that the growing concentration of railway companies on the most profitable types of freight, which are generally those most suitable for transport by rail, means that long-distance buses and low-capacity trucks no longer compete with the trains. Increasingly, the companies or individuals which compete with the railway companies are those that operate heavy trucks.

#### 5. A concrete example of determination of the economic and social benefits of the railway

Let us take the case of Ferronor once again as an example. In 1986 the military government of the time, tired of having to pay for the deficit of this railway, decreed the elimination of almost the whole of the southernmost 850 kilometres of its main line (Thomson, 1997). It was decided to close the line rather than privatize it because at that time privatiza-

tion was not yet seen as a viable option in Chile or indeed in the rest of the world. The little traffic transported at that time over the stretch of line whose elimination was approved (between La Calera and Copiapó) consisted almost entirely of copper ore, because of an imbalance in the geographical distribution of the capacity for the concentration of the ore, on the one hand, and its refining, on the other.

At that moment, ECLAC was developing a methodology that would make it possible to compare the cost of the wear and tear on the roads caused by heavy vehicles, the tolls (if any) paid by those vehicles, and the various taxes involved, such as the fuel tax (ECLAC, 1987a). This methodology was applied to the hypothetical transport by road of the freight carried at that time by Ferronor over the stretch of line whose closure had been authorized, and it was determined that every ton-kilometre transported by road would represent a net cost to the government equivalent to approximately 0.41 US cents (US\$ 222 000 per month) at current prices.<sup>1</sup> In other words, if the subsidy needed to keep the railway going was less than that amount, then from the point of view of the community it would be better to pay it in order to avoid a greater cost in terms of wear and tear on the roads. A few months later, the government of the time decided to issue a second decree annulling the previous one.

## II

### Highway tolls and the cost of road infrastructure

#### 1. Wear and tear on the roads caused by heavy vehicles

It is generally acknowledged that the passage of heavy vehicles causes structural damage to roads which vary exponentially in line with the weight of the vehicles per axle. The value of the exponent varies, according to the circumstances, from 2.4 to 6.6: it is considered that the value is normally around 4.5 (Rolt, 1981). The default value in the World Bank's highway design and maintenance model (HDM model) is 4.0. This model identifies an "axle equivalent" as the destructive power of an axle bearing a

load of 18 000 pounds (equal to 8.165 tons) and uses this as the basic unit of analysis. Thus, a truck with two axles with axle loads of 5.0 and 6.0 tons respectively has an axle equivalent value of 0.36, assuming that the exponent has a value of 4.5. The same truck with loads of 7.5 tons on the front axle and 15.0 tons on the rear axle has an axle equivalent of 16.1, and if the rear axle load is increased by 2.5 tons the equiva-

<sup>1</sup> In 1992 Ferronor had favourable operating results, while in 1993 it had a deficit of US\$ 272 000 per month.

lent rises to 31.6. The axle equivalent fluctuates a little according to the quality of the pavement, and generally speaking a truck with a given axle equivalent value will do more damage to a low-quality highway than to a better-quality one.

## 2. The toll structure on Latin American highways

In some Latin American countries, such as Peru and Chile, the public authorities have for years or decades past been charging tolls for the use of some sections of the road system, especially main highways with relatively high standards of construction. More recently, the charging of tolls has been becoming more frequent due to the granting of concessions to private enterprises for the construction or reconstruction, maintenance and administration of highways.

As we have seen, a mere change in cargo distribution which results in the transfer of some weight from the less heavily loaded to the more heavily loaded axle of a two-axle truck, without altering the total gross weight of the vehicle, can significantly increase the axle equivalent value. For theoretically ideal cargo distributions, table 2 shows the axle equivalent values for three different types of trucks, loaded with two different amounts of cargo, and travelling in one case on an asphalt road and in the other on a concrete highway. Even with such ideal cargo distribution conditions, it is evident that the wear and tear caused to a highway is critically dependent on the axle load of the vehicles using it.

It should be noted, for example, that the axle equivalent value for a truck with a gross weight of 35 tons and four axles is 2.39 (asphalt) or 3.02 (concrete), whereas a truck of the same tonnage but with five axles has an axle equivalent of only 1.74 or 2.02, respectively.

The toll structure, by type of vehicle, varies relatively little from one country to another. Generally speaking, when awarding the concession for a highway the government determines the relation between the toll charged for a vehicle of type *i* (e.g., a light truck, three-axle non-articulated truck, three-axle semi-trailer truck, two-axle bus) and the toll for private cars, and then uses the toll per private car as the critical variable for awarding the concession, which is granted to the applicant offering to charge the lowest toll per private car.

TABLE 2

**Argentina: Relation between axle equivalents and tolls on highways under concession. Axle equivalents corresponding to various classes of trucks<sup>a</sup>**

Type of truck	Asphalt highway, Structural No. = 10	Concrete highway 20 cm thick
1. Single front axle, twin rear axles, non-articulated, with total gross weight of 18 tons	0.20	0.46
2. Ditto, with total gross weight of 24 tons	0.97	1.55
3. Tractor unit with two axles and semitrailer with twin rear axles, with total gross weight of 29 tons	1.09	1.37
4. Ditto, with total gross weight of 35 tons	2.39	3.02
5. Type No. 1 above, with trailer, with a total gross weight of 35 tons	1.74	2.02
6. Ditto, with total gross weight of 44 tons	3.21	3.75

Source: Chile, Comisión Nacional de Energía (1981), through ECLAC, 1987a.

<sup>a</sup> Assuming ideal cargo distribution: i.e., with maximum axle load permitted by law.

## 3. The relation between tolls and the marginal costs of using the infrastructure

Clearly, the variation between the tolls charged for the different types of vehicles does not reflect the variation between the corresponding axle equivalent values. Table 3 shows the toll structure for the highways transferred under concessions in Argentina and table 4 gives the toll structure for Brazil; generally speaking, the situation is similar for the highways transferred under concessions in Colombia, Chile and Mexico.

In the case of highways not subject to tolls, apart from the purchase of fuel, maintenance services and the other economic costs involved in the use of any motor vehicle, virtually the only other payment is the fuel tax, the level of which often displays in one way or another an inverse relation with the wear and tear on the road infrastructure, since the tax is higher on gasoline than on diesel fuel.

It may be concluded that, even when tolls are charged, private cars and other light vehicles have to pay excessive charges compared with the cost of the damage they do to the highways. In contrast, the

TABLE 3

**Argentina: Relation between axle equivalents and tolls on highways under concession**

Type of vehicle	Indicative axle equivalent value	Maximum toll at normal times of day, %
Up to two axles and 2.10 metres high, without twin rear wheels	-	100
Up to two axles and over 2.10 metres high, or with twin rear wheels	1.50	200
Three or four axles, up to 2.10 metres high, without twin rear wheels	3.00	200
Three or four axles, over 2.10 metres high, or with twin rear wheels	4.00	300
Five or six axles, with twin rear wheels	4.00	400
Over six axles and over 2.10 metres high, with twin rear wheels	4.00	500

*Source:* Prepared by the author. With regard to axle equivalents, based on Archondo (1989), World Bank (1989, table 6-11), ECLAC (1987a and b) and Chile, Comisión Nacional de Energía (1981); values of relative tolls are taken from FLACSO, 1998.

charges levied on heavy trucks, in terms of their axle equivalent value, are very modest compared with the cost of the damage these vehicles do.

#### 4. Is heavy truck traffic subsidized?

The conclusion reached in the preceding paragraph does not necessarily mean that there is an implicit subsidy for heavy truck traffic, since it may be that all types of vehicles are charged tolls that more than cover the corresponding costs. In other words, there is a possibility that there may be a positive levy (that is to say, a negative subsidy) on the traffic of all types of vehicles, with this levy being relatively higher for private cars than for heavier vehicles. However, this does not appear to be the case.

In table 5, which refers to the highways transferred under concessions in Chile, comparison of the figures in the last two columns shows that only in the case of trucks, and especially those with more than two axles, is the cost of wear and tear on the roads higher than the sum of the fuel tax plus tolls.<sup>2</sup>

It should be noted that in Chile the tax on diesel fuel is higher than in some other Latin American

TABLE 4

**Brazil: Relation between axle equivalents and tolls on highways under concession<sup>a</sup>**

Type of vehicle	Indicative axle equivalent value	Maximum toll at normal times of day (private car = 100%)
Private car, pickup truck or van	-	100
Bus or truck with two axles and twin rear wheels	1.87	200
Private car or pickup truck with semitrailer; three axles and single rear wheels	-	300
Articulated bus or truck with three axles and twin rear wheels	1.66	300
Private car or pickup truck with trailer; four axles and single rear wheels	-	400
Articulated truck with four axles and twin rear wheels	5.00	400
Ditto, five axles	4.00	500
Ditto, six axles	2.00	600
Motorcycle or scooter	-	50

*Source:* Prepared by the author. With regard to axle equivalents, based on Archondo (1989), World Bank (1989, table 6-11), ECLAC (1987a and b) and Chile, Comisión Nacional de Energía (1981); values of relative tolls are taken from Pereira, 1997.

<sup>a</sup> Official vehicles and those belonging to the armed forces and Military Police are exempt from payment of tolls.

countries. Obviously, in countries where this tax is lower than in Chile there will be still more likelihood that the traffic of the various types of vehicles will cause wear and tear on the roads that exceeds those vehicles' contribution through the fuel tax and tolls that they pay.

In the case of trucks and also of buses with two axles, from the concessionaire's point of view the wear and tear they cause to the highway costs more than they contribute in tolls, and it is also obvious that in the case of highways which are free of tolls the traffic of trucks and buses with two or even more axles gives rise to costs in respect of wear and tear on the road that exceed the amounts collected through the fuel tax.

<sup>2</sup> Table 5 should be interpreted as a conceptual example rather than as a faithful reflection of the situation in a specific case. It is likely, for example, that the axle equivalent values of the vehicles using the highways transferred under concessions are not exactly equal to those used in the calculations summarized in the table. It should also be noted that the table does not take account of the value added tax or the variable costs for policing and other aspects.

TABLE 5

**Chile: Relation between axle equivalents  
and tolls on highways under concession**

Type of vehicle	Indicative axle equivalent value	Toll (US\$/km)	Fuel tax (US\$/km)	Sum of previous two columns (US\$/km)	Cost of wear and tear on road (US\$/km)
Private cars	-	0.0231	0.0176	0.0407	-
Pickup trucks	0.10	0.0231	0.0220	0.0451	0.0046
Trucks with two axles	1.87	0.0416	0.0286	0.0702	0.0851
Trucks with more than two axles	4.00	0.0925	0.0400	0.1325	0.1820
Buses with two axles	1.25	0.0416	0.0333	0.0749	0.0569
Buses with more than two axles	1.00	0.0717	0.0400	0.1117	0.0455
Private cars and pickup trucks with trailer	0.10	0.0347	0.0275	0.0622	0.0046

Source: Prepared by the author on the basis of the preceding tables and their respective sources; *Transporte Moderno*, 1996; IMF (several years), and information provided by Alberto Bull, ECLAC consultant.

## 5. Subsidized concessions

Another factor that must be taken into account when deciding whether or not there are subsidies on truck transport is whether or not there is a global subsidy for the concessionaire. It is very difficult to reach definitive conclusions in this respect. In some cases –as for example the Santiago-Talca and Talca-Chillán sections of the “Panamericana Sur” highway in Chile– the concessionaire is obliged to make a net positive payment to the State, but in other sections with less traffic and/or higher investment costs it is the State that makes payments to the concessionaire (table 6).

Subsidies have been given to companies operating highway concessions in Colombia, while in Argentina the government does not charge rent and several highway concessions are eligible for subsidies, although there are arrears in the payment of the latter.<sup>3</sup> Heavy subsidies have been paid to concessionaires in Mexico. In the case of the “El Melón” road tunnel in Chile, however, the concessionaire has to make payments to the government. Obviously, the situation varies considerably from one case to another. Although there are few specific references to the matter, it seems likely that any subsidy paid is intended to help finance the initial investment, expansion of traffic capacity or improvement of the design

<sup>3</sup> According to a source in the bus operators’ association, the arrears of subsidies amounted to some US\$ 45 million in 1998. See Cámara Empresarial de Larga Distancia, 1998.

TABLE 6

**“Carretera Longitudinal” (Panamericana) (Chile):  
Cross-subsidies among the concessionaires of  
different sections of the highway under concession a**

Section	Subsidy to concessionaire (-) or payment to government (+) (millions of dollars)
La Serena-Los Vilos	-147
Los Vilos-Santiago	-20
Santiago-Talca / Expressway	
Santiago-San Fernando	+228
Talca-Chillán	+166
Chillán-Collipulli	-95
Collipulli-Temuco	+91
Temuco-Río Bueno	-94
Río Bueno-Puerto Montt	-129

Source: Friedmann and Hinojosa (undated).

<sup>a</sup> There have been some differences between the values envisaged and those finally included in the contracts.

standards rather than helping to cover the cost of maintaining the highway once the initial investment has been made.

## 6. Some preliminary conclusions

It may be concluded from the foregoing that:

i) truck traffic on toll-free roads is almost always subsidized, in the sense that the amounts collected through the fuel tax and other taxes not directly re-

lated to the distance covered are less than the cost of the wear and tear caused to the roads;

ii) in the case of highways transferred under concessions, there are probably implicit subsidies for trucks with higher axle loads,<sup>4</sup> and

iii) the whole matter is very complex, and there may be significant differences between one case and another, so that a case-by-case analysis is called for.

### 7. The importance of subsidies for heavy trucks in highway financing

An implicit subsidy of the order of US\$ 0.05 per kilometre for a truck with more than two axles using a toll highway operated under a concession corresponds approximately to a net subsidy of some 0.25 cents per ton/kilometre. Is such a subsidy quantitatively significant?

Let us take as an example the "Ferrocarril del Pacífico" (FdP) in Chile, which transports around 800 million net ton/kilometres per year. If it could receive some US\$ 2 million per year extra –i.e., if it could receive a subsidy at the same rate of 0.25 cents per ton/kilometre transported– its income would rise by some 6%. The FdP has currently achieved a delicate balance between its costs and income, and an increase of 6% or so in the latter would strengthen the company's economic situation in the long term.

Another example which could be cited is that of Ferronor in the year 1995 (when it was still in State hands).<sup>5</sup> If it had been able to receive US\$ 0.25 more per ton/kilometre transported, its income would have increased by some US\$ 750 000 and the yield on its net assets would have risen from 0.2% to 1.7%. In the particular case of Ferronor, the highways in its geographical area are not subject to tolls, so that the effective subsidy for its road transport competitors was a good deal more

than US\$ 0.25 per ton/kilometre: probably around US\$ 0.71 per ton/kilometre. If Ferronor had been able to raise its freight charges by the latter amount, its yield would have risen to 4.6%.

In other words, although the impact of the subsidies effectively paid to heavy truck transport on the railway companies' finances is relatively small, especially when tolls are charged and the highways are transferred under concessions, it can nevertheless significantly affect the companies' economic situation. Furthermore, if the financial situation of the railways were improved, this should allow them to compete better in the market and absorb a higher proportion of the volume of cargo transported.

### 8. The feasibility of making heavy trucks pay fair tolls

In practice, the structure of the tolls charged on Latin American highways has more to do with facilitating the collection of the tolls than with seeking to charge tolls that reflect the wear and tear caused to the roads. The employees who collect the tolls would be perfectly capable of noting the number of axles of the trucks that pass through their toll stations, but normally they would not be capable of estimating their axle equivalent value. Consequently, they could apply a toll structure using the number of axles of a truck as an independent variable, but not a structure in which the toll charged depends on the axle equivalent value of each vehicle.

In some countries such as Iceland and New Zealand, the authorities are already selling licences to travel 1 000 (or multiples of 1 000) kilometres over the road network, at prices which depend on the axle equivalent value of the vehicle in question (ECLAC, 1993). For cultural reasons, however, this kind of system might not work effectively in Latin America.

However, it is not technically impossible to provide each toll station with a weighing machine capable of determining the load on each axle of a vehicle passing over it at low speed. Such installations are already used on the main highways of many countries in order to verify observance of the rules on maximum permitted weights. Moreover, modern technology is capable both of determining the weight on each axle and of automatically charging the corresponding toll and deducting it from an amount deposited in advance by the vehicle owner, using a "smart card" inserted in a device placed above the vehicle's

<sup>4</sup> The source of the subsidy varies according to each individual case. If a highway is transferred under concession without any subsidy or rental and the cost of the wear and tear attributable to trucks exceeds the amount they contribute in tolls, there is obviously a cross-subsidy which is financed by motorists and the occupants of other vehicles. If the concessionaire does receive a subsidy, the source of the latter may be the community at large.

<sup>5</sup> Ferronor has been in private hands since early 1997. The year 1995 is used for estimating the impact of the road transport subsidy on the company's finances because more statistical data are available on its operations when it was a public enterprise.



windshield (ECLAC, 1999). In other words, it is already possible to envisage that in the relatively near future it will be possible to apply toll structures whereby every vehicle is charged an amount reflecting the cost of the damage it has done to the road it is using.

In reality, the most difficult obstacle to the levying of efficient tolls on the vehicles which do most damage to Latin American highways may well be of a social or political rather than a technological nature, because of the power wielded by the truckers' federations, which would undoubtedly be against higher tolls.

### III

## How can the inefficiencies in highway toll structures be taken into account in railway privatization processes?

#### 1. The system of compensatory payments made to the "Ferrocarriles del Estado" railway company in Chile

In the short term, when heavy truck traffic will continue to be effectively subsidized even on highways operated under concessions, in order to promote optimal distribution of traffic between road and rail transport compensatory mechanisms should be envisaged in order to promote the use of the railways, as we suggested in a 1992 study dealing with this issue from the conceptual point of view (ECLAC, 1993).

The year after the study in question, a simple system of compensatory payments (per net ton/kilometre) was established in Chile to assist the "Ferrocarriles del Estado" company (but not the other railway companies in that country).<sup>6</sup> It has been announced that this system will be terminated as soon as that company's rail operations have all been transferred to the private sector, which suggests that the real aim of its application was not to improve the modal split of traffic. It has been criticized for various reasons: for example, even after the separation and privatization of freight transport services, these compensatory payments continued to be made to Ferrocarriles del Estado rather than to the company operating the freight trains (FdP), without there being any guarantee that the beneficiary would use them to reduce the charges made for the use of the railway tracks or to improve the quality of the permanent way

used by freight trains (one of the responsibilities of Ferrocarriles del Estado is to maintain the infrastructure of the main lines; the maintenance of branch lines has been delegated to FdP).

Although it has been criticized, however, the system of compensatory payments adopted in Chile (which will be analysed below from the conceptual standpoint) was undoubtedly preferable to not having any system at all. In other countries, not even a scheme of this nature has been introduced, although the Swedish experience is also interesting in this area (Nilsson, 1993).

#### 2. The desirability that compensatory payments to railway companies for freight transported should be offered before the concessions have been awarded

In the study mentioned above (ECLAC, 1993) we analysed the conceptual dimensions of the problem of creating the necessary conditions for optimizing the modal split. In the present article we will limit ourselves to highlighting the importance of recognizing this problem when awarding railway concessions.

If the problem is only recognized at a later date, the government will only be able to solve it by adopting measures that favour a private-sector enterprise: namely, the railway company. These measures could be economic, such as a compensatory payment for every ton/kilometre transported by rail, or qualitative, such as the application of greater restrictions on maximum truck weights. At all events, the proposal of such measures by the political party in office

<sup>6</sup> Very small compensatory payments were also made on the basis of passenger/kilometres.

would give rise to criticism from the opposition parties, because the measures favour a private enterprise, and the trucking sector would assuredly join in the opposition's criticism.

If, on the other hand, the tendering conditions specified the compensation that would be paid to the concessionaire (or purchaser) of the railway, the economic offers submitted by the interested groups would naturally include an estimate of the present value of the income they expected to receive under this heading during the period of the concession. In this case, the government would not be open to criticisms of favouritism.

It would also be desirable to decide on the payment of compensation for freight transported by rail before granting operating concessions for highways competing in the same market. The benefits generated by such compensatory payments, which are the main subject of the present study, are reflected in lower road maintenance costs; clearly, it is preferable that these should be enjoyed by the community in general, through the government that represents it, rather than by a private company holding the concession for sections of the highway system. (There may also be other benefits –such as those connected with the reduction of congestion, of road accidents and of environmental pollution– which will also naturally be enjoyed by the community).

### **3. The disparity between what is conceptually preferable and what can be achieved in reality**

The subsidy effectively received by truckers will naturally vary considerably from one type of traffic to another, depending inter alia on the following factors:

- i) the incidence of tolls on the section of road used by the trucks engaged in the traffic: the greater the proportion of the journey effected over toll-free roads, the higher will be the effective subsidy;
- ii) the quality of the roads used: the greater the proportion consisting of dirt roads, riprap surfaces, or roads which are paved but in poor condition, the higher will be the subsidy;
- iii) the type of truck, with the subsidy inversely related to the number of axles; and
- iv) the load carried by each truck, since the subsidy is directly related to this weight.

Consequently, conceptually speaking the compensation should be determined for each particular

type of traffic. This could be done, for example, according to a methodology described in the study referred to earlier (ECLAC, 1993). According to this methodology, before making its offer of freight services for each kind of traffic to be awarded by the market, the railway company would ask the Minister of the Economy or of Transport how much compensation the government would pay it if it won the transport contract.

On the other hand, at the time of participating in the tendering process for the railway concession and preparing the corresponding economic offers the interested groups will not be in a position to estimate exactly how much traffic they will transport during the period of the concession, nor can they know how much they will receive from the government in each case. Consequently, from a practical point of view it is necessary that the tendering conditions should specify the amount of money that the government will pay the concessionaire for each ton/kilometre transported. Although this value would not be exactly equivalent to the compensation corresponding to a particular type of traffic, it would allow the consortia taking part in the tendering process to make a realistic estimate of the income they would obtain under this heading, which they would include in their final bid.

### **4. The beneficiaries of the proposed system of compensatory payments**

We shall end the present article with some comments on the beneficiaries of a system of compensatory payments to railway companies like that proposed here. Obviously, in all cases the objective should be to maximize the benefits received by the community at large.

Three different situations may be identified, as described below:

- i) When the Ministry of Public Works or an equivalent body administers the road system directly, the lower volume of traffic by the types of vehicles which cause most damage to the roads means a corresponding reduction in the cost of maintaining and reconstructing highways. The reduction in this cost would be greater than the reduction in fiscal income from fuel taxes or tolls (if any). The government could use the increase in its net income for other road projects or projects in other areas, or it could reduce taxes in general. In this case, the transfer of the benefits to the community at large is quite direct.

ii) The transfer mechanism is not so direct when the highways are in the process of being transferred to concessionaires. In this case, the groups participating in the tendering process would recognize, or at least should recognize, that the compensatory payments offered to the railway companies would reduce not only the amount of tolls collected but also the cost of road maintenance and reconstruction. As the reduction in the amount of tolls collected would be lower in absolute terms than the reduction in their costs, they should take into account in their offers the consequent increase in net income that the concessionaires could receive. This could be done in one of two ways, depending on the circumstances. If the values of the tolls are defined in the tender conditions, each applicant would raise his offer, thus increasing the funds available to the government and allowing it to finance other projects or lower taxes. If the values of the tolls are not defined in the conditions, each applicant would reduce the value of the tolls he proposed to charge, in which case the beneficiaries would be the users of the highway transferred under concession, rather than the community at large.

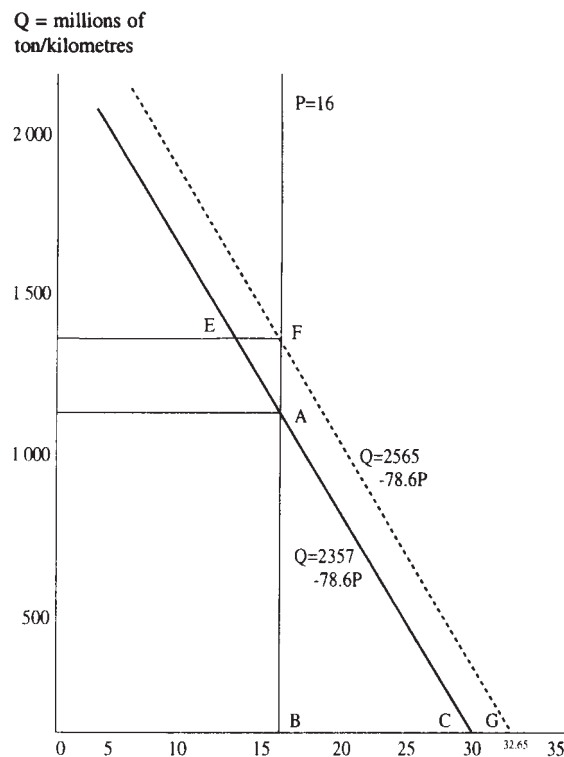
iii) The most difficult situation is when the highways have already been granted in concession, in which case a renegotiation process between the government and the concessionaire would be needed. Generally speaking, the transfer of a cargo flow from road to rail transport means a benefit for the concessionaire of a highway participating in the same market as the railway. In this case, however, the benefits would assuredly have to be divided between the community (represented by the government) and the concessionaire.

In all three of the above situations the economic cost of the transport would go down, because each type of traffic would be directed to the form of transport which could handle it at the lowest marginal cost.

### 5. Compensatory payments to the railway company only in respect of "new" traffic

As already mentioned, in 1993 the Chilean government decided to pay the Ferrocarriles del Estado (EFE) railway company a subsidy of 2.65 pesos (US\$ 0.0066) per ton/kilometre in order to compensate it for the effective subsidy received by the heavy trucks with which it competed.

FIGURE 1  
Diagram of effects of different criteria regarding payment of compensation to a railway company for the subsidies enjoyed by heavy trucks<sup>a</sup>



Source: Prepared by the author.

<sup>a</sup> Based on the case of the Chilean railway company "Ferrocarriles del Estado".

In 1993, EFE transported approximately 1 100 million ton/kilometres of freight on its Southern Network. Figure 1 shows the effects of making compensatory payments to an enterprise for each ton/kilometre transported, based on the case of EFE. It was assumed in the figure that the marginal cost of transporting cargo was around 16 pesos per ton/kilometre, and as EFE had a good deal of idle capacity it was also assumed that the marginal cost was equal to the average cost.

Assuming that EFE negotiated specific contracts with its various clients, charging them the maximum freight rates they were willing to pay, the volume transported by its trains would be given by the equation  $Q = 2357 - 78.6P$ , where  $Q$  represents that volume in millions of ton/kilometres per year and  $P$  is

the freight rate per ton/kilometre. Before receipt of the subsidy, the net operating income from freight transport would be given by the triangle *ABC*: i.e., it would be 7 689 million pesos.

Thanks to the compensatory payment received for each ton/kilometre transported, EFE would begin to receive not only the freight rates paid by its clients but also the 2.65 pesos per ton/kilometre contributed by the government, so that the function relating its income to the volume transported would be  $Q = 2565 - 78.6P$ . The volume transported by the company would have risen from 1 100 to 1 307 million ton/kilometres and its net operating income would have risen to 10 881 million pesos, equivalent to the area FBG.<sup>7</sup> The government would have paid it a sum corresponding to the area EFGC, that is to say, 3 464 million pesos (US\$ 8.66 million). If EFE had been a private company it would have been politically unacceptable to pay it such a large subsidy, but it must be recalled that in actual fact EFE was and still is an enterprise belonging to the public sector.

The compensation based on the traffic of 1 100 million ton/kilometres that EFE already transported would not have caused a shift in the modal split from road to rail transport: it would simply have increased EFE's operating income from freight transport. The company would not have renegotiated existing contracts at lower freight rates but it would have quoted lower rates for new business from new or existing clients in order to obtain traffic. It could have made various kinds of investments to improve the quality of the product offered, which would have increased the volume it could transport in the future, but in the short term the respective sum (some 2 915 million pesos) was merely a transfer from the government to the company. In any case, EFE was not under any obligation to invest its resources in this way, and it would only have done so if the yield were higher than that from investing them in other projects.

Obviously, in principle the government could have offered EFE the unit compensation in question, i.e., 2.65 pesos per ton/kilometre, only in respect of new traffic transported by it. In this case, the total amount transferred to the company would have been only 549 million pesos (US\$ 1.37 million), which would have been politically more acceptable if EFE had been a private company.

But, is it feasible to offer compensation only in respect of new traffic? Above all, this would raise the problem that, with the passage of time, it would be increasingly difficult to distinguish new traffic from existing business. Take, for example, a two-year contract between the railway company and a mining or industrial concern: in its negotiations with the government the railway company could maintain that this traffic should be considered "new" as from the end of the existing contract, so that from then on the government should pay the corresponding compensation, provided that a new contract was signed. The distinction between new and old traffic will also become increasingly unclear because of the relocation of plants or installations generating transport needs, changes in the quality of the road network, and other factors.

Another item which would create difficulties is that the railway company would receive the full value of the subsidy (2.65 pesos in the Chilean case) for the first unit of the new traffic transported (in figure 1, the 1,100,000,001st ton/kilometre), while the net income it would derive from the last unit of the existing traffic (the 1,100,000,000th ton/kilometre) would be virtually nil, so that it might tend to use its resources preferentially to transport types of traffic whose transport by rail might generate fewer benefits for the country than others.

It may therefore be concluded that, in practice, it will not be possible, and might not be desirable either, to pay compensation solely in respect of new traffic.

(Original: Spanish)

<sup>7</sup> In reality, the volume transported went down in 1993 because the market was shrinking for such reasons as the decline in the output of the coal mines.

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