Urban Transport Policy: Colombia

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Our knowledge of urban transport in Colombia comes in great part from transport and urban finance studies made during the past thirteen years in the big cities and especially in Bogotá. Discussions have centered on two main themes: public versus private transport, and choices in public transport.

Operations

The less efficient use that private vehicles make of road space and fuel per passenger has been identified as one of the causes of the transport problem (see World Bank 1975, pp. 84–85; Urrutia 1981, pp. 12–13). To improve resource allocation, two kinds of measures have been suggested: taxes and subsidies to shape the transport market, and quantitative restrictions to limit use of the roads.

A proposal that relies on market mechanisms is the use of a fuel tax to control urban congestion (Republic of Colombia 1973, pp. 99–111). McClure (1974) has proposed a parking tax. Although the government has not accepted either proposal, it has adopted some measures that clearly favor public over private transport, including sales and import tax exemptions for public transport vehicles, bus fares that are set below average cost, and lower fuel prices for commercial vehicles. The main restriction designed to favor collective transport is the prohibition of private vehicles on Carrera 10, one of Bogotá's principal streets. (In contrast, the local transport authority in Cali has set restrictions on bus access to the traditional center.)

The considerable amount of investigation that has been devoted to the subject of collective transport is explained by the high percentage of trips made on public transport and the low rate of private motorization (see Pachón 1981c; Westin 1980). The main elements of what is known about collective transport in Colombia are summarized below.

State Intervention in Collective Transport

The state has recognized collective transport as a public service and a basic need. Inability to charge directly for road use leads to excessive use of private vehicles and inefficient use of road space, and additional inefficiencies are created in a system of free competition when drivers do not consider the negative effects of their behavior on other vehicles on a congested road. Collective transport can reduce some of these problems. As for transport as a basic need, under free competition, low-income consumers may not be served when the cost of providing service is above what they can afford, and state intervention may be warranted. Intervention may be direct, through production or pricing of the basic need, or indirect, through income transfers. As high-income classes seldom use buses, direct intervention is likely to use less resources to meet the basic need objective and hence is preferable to indirect intervention.

Organization of Collective Transport

There are two types of ownership of collective transport firms: ownership of the vehicles by the municipal government—the predominant arrangement in the United States—and ownership by private organizations, as in Argentina, Brazil, Chile, and Colombia. Colombia has a basic system of affiliating companies which coexist with state transport companies and cooperatives. In Bogotá's system of affiliating companies the state assigns the routes and gives some rights to the private company. In some cases the company owns some of the buses, but generally bus owners affiliate with a company which distributes the routes and charges its associates a rolling charge for use of its routes. The managers of this type of organization are the strongest group in the transport system because they maintain a close relation with the official sector, through which they obtain operating licenses and route authorizations.

In the state companies, the state administers and owns the transport equipment, as in the case of the Empresa Distrital de Buses de Bogotá (District Bus Company of Bogotá). This company's importance has decreased; in 1980 it accounted for less than 1 percent of public transport buses and busetas (minibuses). Cooperatives, which own their transport equipment, with the associated drivers having shares, predominate in some cities, such as Cali, and occupy a second place in others, including Bogotá.

In 1980 Bogotá had thirty-eight public transport companies, of which twelve were cooperatives, one was state-owned, and twenty-five were limited liability companies (affiliating companies). In Cali in 1979 there were 1,426 buses distributed among sixteen private companies with forty-two routes and 181 busetas distributed among three companies with seven assigned routes. There has been considerable debate about the organization of public transport. Defenders of a public collective transport system have pointed out the inefficiencies in resource allocation associated with the existing system in Colombia, while the defenders of the present system emphasize the low costs of private companies. In Leibenstein's terminology (1966), the defenders of a statal system focus on efficient resource allocation, while the defenders of the present system focus on the inherent X-efficiency of private property. Interconsult Ltda. (1970) and Urrutia (1981) have documented the existing system's low operating costs, the good maintenance level of the vehicles, and the system's ability to adapt to changes in the demand for transport. A 1980 study by the Administrative Department of District Planning shows the high levels of X-inefficiency of Bogotá's public company. Walters and Feibel (1980) and Urrutia (1981) also show that in other parts of the world private companies have lower cost levels and are more X-efficient than public companies. As an exception, Nelson (1972) shows that in the United States in 1960 and 1968 public companies had costs 10 percent lower than those of private companies.

The inefficiency of resource allocation, especially as concerns congestion, has been documented by, among others, Interconsult Ltda. (1970) and Departamento Nacional de Planeación—Instituto Nacional de Transporte (INTRA) (1974). By means of a route simulation model, these studies bring out the savings, in operating costs, of a centralized collective transport system.

Economic evaluation of the two types of organization requires a simultaneous analysis of the two types of efficiency that takes into account the variations state ownership introduces in the operating costs and considers the benefits and costs associated with trip duration and waiting and transfer times. In addition, political considerations are relevant. Which type of organization better promotes the satisfaction of basic needs? Which type is more reliable and less affected by strikes? (Although strikes are prohibited in government services, slowdowns are often used for the same purposes.)

The Route System

The route systems in Colombia and especially in Bogotá have been frequently studied. Cifuentes (1978) notes that authority to assign routes has been delegated by INTRA to the mayoral offices in the principal cities. The resulting separation of functions has made control of the public transport system more difficult.

To assign new routes, or to extend existing routes, the Administrative Department of Transit and Transportation (DATT) studies the potential demand and opens a tender to assign the new route. The tender specifies the number of vehicles required and the frequency of service during peak and nonpeak hours. The assignment process has been much criticized. It has been argued that the system does not respond to the real needs of the population because the decisions respond to pressure by the Juntas de Acción Comunal (community action boards) of the districts and do not take into consideration the needs of the whole population. It has also been argued that the prevailing system of routes and route assignments produces high levels of congestion in the central area because all the companies prefer to serve areas where demand levels are high. The existence of parallel routes and the information problem caused by the great number of routes have also been criticized. To remedy some of these problems the Interconsult Ltda. and INTRA studies proposed the consolidation of routes on the basis of the results of a simulation model.

It has, however, also been established that the existing route assignment system in Colombia produces a network with wide coverage that has adapted to changes in trip demand patterns. The efficiency with which owners, drivers, and users process the existing information to obtain a satisfactory allocation has been noted.

Discussion of the route system in Bogotá leads to some important conclusions. First, a series of incentives is bringing about a satisfactory solution. The urban transport market is processing a great deal of information at a low cost. If there were no externalities, the result produced by the market would be the same as would be obtained in a model for the whole transport system. Second, given the existence of such externalities as congestion and buses' stopping on demand, the present system of decentralized decisionmaking may be faulty. Third, since there is no charge for road use in the central area, the income from scarce road space is transferred to the private sector, probably to the affiliating companies. Fourth, although the existing data allow the use of simulation models developed for Colombia, it is probable that more effort is needed to collect and analyze data and to refine the models if their results are needed to assign a route system. Fifth, to ensure good service to areas with difficult topographic conditions and high operating costs, it is necessary to specify differential fares or subsidies for routes that serve those areas. Sixth, if the state established a fee for the right to operate routes that serve the central areas, resource allocation could be improved and funds could be generated to provide subsidized service to the low-income districts that have unfavorable cost conditions.

Public Service Vehicles

The initial investigations by Interconsult Ltda. and INTRA considered it desirable to define the technical characteristics that would assure more efficient and comfortable service. It was thought that metropolitan buses like those in the United States should be used and that the school-bus type of vehicle should be taken out of circulation. The success that microbuses and busetas were having at the end of the 1960s was acknowledged, however, and was attributed to their greater speed, privacy, and comfort.

In Colombia as in other developing countries it was soon recognized that although the metropolitan bus had favorable technical attributes, the system of school buses, minibuses, microbuses, and collective taxis offered many more advantages (see Owen 1973; Walters 1979). First, a small vehicle allows more intensive use of the most abundant factor in developing countries, labor, and because the level of investment is lower, vehicles are easier to obtain, more drivers can own their own vehicles, and there are greater incentives to maintain vehicles in good condition. Second, conditions on the demand side make the use of low-capacity vehicles attractive: because the waiting and travel times are shorter and there are fewer stops, this type of service is more like that of a private vehicle and is more attractive to middle- and high-income groups. All these arguments have contributed to legitimize the persistence of diverse vehicle sizes.

To balance supply and demand for urban transport, the state has enunciated policies which are sometimes contradictory. For example, it has established a financial intermediary, the Financial Transportation Corporation (CFT), with credit lines for financing body work and chassis for buses and busetas. This credit has been subsidized to stimulate investment in public service vehicles and to facilitate the purchase of vehicles by the drivers. The subsidy, which amounts to nearly a fifth of the vehicle's value, has undoubtedly made investment in public vehicles more attractive.

The state also wants to maintain an adequate transport supply and assure an adequate income yield for new vehicles. Differential fares were established during the late 1960s according to the age of the vehicle, with higher fares for newer vehicles. Since this system did not work, a differential subsidy by age was tried. The existing subsidy system does not fulfill the initial objective of favoring investment in new buses.

Moreover, the government has established a license—known in Bogotá as a *nota opción*—for new public service vehicles. This entry restriction has artificially limited the size of the vehicle stock and has created some income for those who already own public service vehicles. Also, because in some cities the procedure for granting licenses is stricter for small vehicles, the mix of vehicles in the stock is artificially distorted.

Remuneration of Drivers

The public companies pay drivers a monthly salary for a normal eight-hour day; the private companies pay a commission according to the number of passengers transported. The private companies' system has been criticized because it may lead drivers to compete to pick up passengers without regard to traffic laws. It has also been pointed out that the driver is being exploited and has long working days and unfavorable working conditions. The public companies have also been criticized: the fixed salary, which does not take into account the number of trips or passengers, destroys the incentive to pick up passengers and to maintain the vehicle in optimum condition.

The private system appears to decrease the information costs required for efficient operation. That is, since the driver has an incentive to pick up as many passengers as possible, less planning and monitoring are required to ensure that bus schedules and operations are meeting passengers' needs. This does not mean that a fixed salary scheme cannot establish information and control systems for efficient operation.

The incidence of the subsidy is often misunderstood. The user obtains an economic benefit from the lower fare or better service even though the subsidy is given to the bus owners. The short-term effect is also sometimes confused with the long-term effect. In a system with no restrictions on the entry of new buses, an excessive subsidy can lead to large temporary profits for the vehicle owners. Free entry ensures, however, that in the long term automotive stock will increase, the service level will improve, and profits will become normal. Finally, transfers are often confused with economic costs. A transport subsidy is a transfer. Even though a subsidy decreases consumer surplus—because resources are being used at a higher value than what consumers are willing to pay—a public transport subsidy tends to correct the inefficient resource allocation caused by the absence of a price system for use of road space.

The absence of empirical research on the economic effects of government intervention in the transport sector is beginning to be remedied. Pachón (1981b) has found that the effect of a transport subsidy is essentially redistributional; the benefits reach mainly lower-income households. The maintenance of low fuel prices has also contributed to a better income distribution by decreasing the buses' operating costs. A preferential subsidy for bus users has fewer leakages than a general subsidy for all public transport users. Further research is needed to quantify the effects of transport subsidies.

Fares and Subsidies

While the managers press the government for increases in fares whenever they consider that their investment yield has reached unsustainably low levels, workers and students protest when bus fares are increased. In an effort to lower costs to the public, the government establishes a fare below the cost of service, maintains low prices for gasoline and diesel fuel, controls the prices of such inputs as tires, and establishes subsidized credit lines through the CFT. To guarantee an adequate profit, it specifies a subsidy for bus owners and sets unsubsidized fares for means of public transport other than buses.

Some operational parameters have been defined, and an index of input costs is maintained that allows the government and the bus owners to recognize when periodic adjustments to public transport fares are needed to reflect increases in costs. Thus, adjustments were made in response to increases in world fuel prices. There is great confusion, however, regarding the economic effects of such measures. Transport subsidies are sometimes blamed for an exaggerated urban dispersion, but in a flat fare system, as in Bogotá, the marginal cost of a kilometer traveled is zero no matter what the fare, and since decisions on residential location depend on the marginal cost of transport, a transit subsidy has no effect on housing location. Thus, the cause of urban dispersion is the flat fare, not the subsidy, and dispersion can be reduced by making the fare vary according to distance traveled.

New versus Old Buses

Preferential treatment for more recent models was initially provided through differential fares by age of vehicle and, more recently, through differential subsidies by model. In October 1980 monthly subsidies were 42,812 pesos for 1974-and-later models, 30,443 pesos for 1970–73 models, 26,687 pesos for 1965–69 models, 25,811 pesos for 1960–64 models, and 24,917 pesos for 1959-and-earlier models. The CFT also favors the financing of new vehicles in granting credit.

The Rationale for Differential Treatment

Differential fares and subsidies by age are defended as a means of stimulating the demand for new domestically produced vehicles. Furthermore, if it is desirable to augment the capital stock rapidly, preferential treatment for new vehicles is helpful. The operating costs of vehicles of different ages can also be relevant: to the extent that the operating cost of a new vehicle is less than that of an old vehicle, the former will be used more intensively.

There are also reasons for giving equal or similar treatment to old and new vehicles. Only 7.5 percent of the stock of vehicles in Bogotá is less than two years old. The high proportion of old vehicles with lower capital costs offers drivers the possibility of owning vehicles and thus broadens the base of ownership. A balanced treatment for used buses could be defended, since it promotes capital formation, widens to some degree ownership of the means of production, and allows people whose opportunity cost of time is lower to maintain older vehicles.

Operational Costs, by Age of Vehicle

The Interconsult Ltda. study found no statistical difference in operating costs between new and old vehicles, but since such variables as routes served, distance traveled, and drivers were not isolated, more analysis is needed. Merewitz (1977) cites two studies which show that the operating costs of a company are independent of the average age of the fleet. As in the Interconsult Ltda. study, the estimation procedure and the data used have limitations.

A regression analysis of costs and revenue in relation to age has been carried out with the use of assumptions for the estimation of operating costs by ranges of bus models and data on the monthly operating costs for different bus models as estimated for October 1980.[1] The following relations were calculated with the use of ordinary least squares.

$$\text{(12-1)} \qquad \ln Y_a = \ln Y_0 + Ba$$

where Y is the variable whose behavior is to be analyzed, a is the vehicle's age, and $\ln Y_0$ and B are the function's parameters.

The number of trips made, which varies inversely with age, influences the number of kilometers traveled and the monthly cost. To isolate the effect of trips made, the variable cost per kilometer (*VCK*) was calculated and a regression was run, with the following results.[2]

$$\text{(12-2)} \qquad \ln VCK_a = 27.925 + \underset{(4.807)}{0.0024} + a. \qquad R^2 = 0.9001$$

Although the *VCK* changes very little (it decreases 1 percent for every four years of age), the hypothesis that it is independent of age cannot be accepted because the t-statistic value is greater than the critical value.

The results of monthly cost and revenue regressions were as follows, where *VC* is variable cost, *FC* is fixed cost, and *ING* is operating revenue. (The subsidy is not counted as revenue.)

$$\text{(12-3)} \qquad \ln VC_a = 11.3088 - \underset{(8.37)}{0.01806} + a \qquad R^2 = 0.9589$$

$$\text{(12-4)} \qquad \ln FC_a = 8.8097 + \underset{(14.13)}{0.02771} + a \qquad R^2 = 0.9852$$

$$\text{(12-5)} \qquad \ln ING_a = 11.2157 - \underset{(6.65)}{0.02167} + a \qquad R^2 = 0.9365$$

The results show that both monthly cost and revenue are negatively affected by age and that the coefficient of the age variable is statistically different from zero. According to these results, monthly income decreases more rapidly than monthly variable costs, and the intercept of the variable cost function is slightly greater than the corresponding value of the income functions. Thus, operational revenue does not cover the variable costs, and the gap between revenue and costs increases in percentage terms as the vehicle gets older because income decreases faster than costs.

Table 12-1 presents results for each model between 1959 and 1980. The adjusted values were calculated using equations 12-3, 12-4, and 12-5. To obtain capital return, the estimated income and the subsidy received were added and total costs were subtracted.

The evidence on operating costs suggests several conclusions. First, variations in the operating costs per kilometer of buses of different ages are relatively small. Second, because the monthly operating revenue by age decreases faster than the monthly variable costs by age, older buses tend to be less competitive. Third, the number of monthly trips decreases with age—new buses seem to be used more intensively. Fourth, additional research is needed on the cost and income structure by age of the vehicle, with the effect of such other variables as route conditions, driver characteristics, and the make of the vehicle isolated.

Prices and Profitability

For used vehicles the present value of future income is basic to the price determination and in turn to evaluation of the effects of fare and subsidy policies. The price pattern of buses by age is satisfactorily approximated by an exponential functional form for cars in Colombia (Pachón 1981a). Data on the value of the vehicles have recently been assembled by the Center for Economic Development Studies (Centro de Estudios para Desarrollo Económico, CEDE) in Colombia, and these data are used to estimate the following form.

$$\text{(12-6)} \qquad \ln P_a = \ln P_0 - b * a$$

where P_a is the price of a vehicle of age a. The results of the regression are

$$\text{(12-7)} \qquad \ln P_a = \underset{(141.1)}{14.3961} - \underset{(8.28)}{0.06887}a \qquad R^2 = 0.7742$$

20 degrees of freedom

The t-values are in parentheses.

The interpretation of the age variable coefficient in a regression of the price logarithm against the age of the vehicle is the yearly depreciation rate. According to the results given here, for each year of use the price of the bus decreases by slightly less than 7 percent. The value obtained in equation 12-7 is less than that used in the cost studies made by the transit companies, which show a useful life of seven years and a salvage value of 30 percent.[3] Thus the depreciation rates chosen in the studies on defining the fares tend to produce real profit rates higher than those agreed on between the government and the bus owners.

The economic profitability of used vehicles is affected by three sources of economic rent: depreciation (the loss in value owing to age), the opportunity cost (the monetary interest rate multiplied by the price of the good), and the appreciation of the good because of inflation and changes in relative prices. Given estimates, by age, of depreciation and the price of vehicles, a nominal profit-

Table 12-1. *Buses: Adjusted Costs, Estimated Income, and Capital Return, October 1980*
(pesos)

Model	Age	Estimated variable costs[a]	Adjusted variable costs[b]	Total costs	Estimated income[c]	Subsidies	Capital return
1959	21	55.800	3.743	59.543	47.126	24.917	12.400
1960	20	56.817	3.848	60.665	48.158	25.811	13.303
1961	19	57,852	3.957	61.809	49.213	25.811	13.215
1962	18	58.907	4.068	62.975	50.292	25.811	13.127
1963	17	59.980	4.182	64.163	51.393	25.811	13.041
1964	16	61.074	4.300	65.374	52.519	25.811	12.956
1965	15	62.187	4.420	66.008	53.670	26.687	13.749
1966	14	63.320	4.545	67.855	54.845	26.687	13.667
1967	13	64.474	4.672	69.147	56.047	26.687	13.586
1968	12	65.649	4.804	70.454	57.275	26.687	13.508
1969	11	66.846	4.939	71.785	58.530	26.687	13.431
1970	10	68.064	5.077	73.142	59.812	30.443	17.112
1971	9	69.305	5.220	74.525	61.122	30.443	17.039
1972	8	70.568	5.367	75.935	62.461	30.443	16.968
1973	7	71.855	5.517	77.372	63.829	30.443	16.900
1974	6	73.164	5.672	78.837	65.228	42.812	29.202
1975	5	74.498	5.832	80.330	66.657	42.812	29.138
1976	4	75.856	5.996	81.852	68.117	42.812	29.077
1977	3	77.238	6.164	83.403	69.609	42.812	29.018
1978	2	78.646	6.337	84.984	71.134	42.812	28.962
1979	1	80.079	6.515	86.595	72.693	42.812	28.909
1980	0	81.539	6.698	88.238	74.285	42.812	28.859

a. $VC_a = 81{,}539\ [\exp(-0.0180^a)]$ $R^2 = 0.9589$
b. $FC_a = 6{,}698\ [\exp(-0.0216^a)]$ $R^2 = 0.9852$
c. $ING_a = 74.285\ [\exp(-0.0216^a)]$ $R^2 = 0.9365$

ability rate can be established once the rate of increase in bus prices is known. Estimated prices, capital return (current revenue minus current cost), and profitability yielded by the calculation are presented in table 12-2. The estimated values are based on regressions in which the only explanatory variable is the vehicle's age and which therefore may differ from real values.

The estimated profitability (i_a) shown in table 12-2 is inversely related to age. This finding is quite unexpected. Under competitive conditions, profitability might be considered to be independent of age. A casual observer, however, might expect higher profitability for the new buses, since larger owners tend to own newer buses. Two possible explanations may be offered for the results in table 12-2. First, the difference could be a result of an underestimation of the operating costs of old models. The maintenance costs of old vehicles exclude the value of the time of the driver, who often owns and repairs the bus. Second, the difference could be a consequence of an underestimation of the price of older vehicles. Because the estimated prices are calculated on the basis of a regression whose only explanatory variable is the vehicle's age, these prices cannot capture the distortions caused by the subsidy and thereby tend to underestimate cases in which the subsidy is unnecessarily high. As this occurs for the older buses, the adjusted prices underestimate the prices of the older vehicles and consequently overstate their profitability.

To show that many of the distortions in prices and profitability are a result of the subsidies, data for busetas, which are not subsidized, were used. With the use of the buseta price data from the CEDE survey, an exponential function was estimated:

$$\ln P_a = \underset{(141.1)}{14.0933} - \underset{(8.63)}{0.06943} * a \qquad (12\text{-}8)$$

$R^2 = 0.8515$
14 degrees of freedom

In table 12-3 the buseta's profitability is nearly the same for 1970-and-later models; for previous models profitability decreases with age. Thus, in the absence of a subsidy the estimated profitability is more in line with an expectation that profitability is independent of age.

Buses or Busetas?

Government policy appears to have favored busetas, as is reflected in their rapid growth. Between 1971 and 1976 the number of buses is estimated to have grown by

Table 12-2. ***Buses: Prices, Capital Return, and Profitability***
(pesos)

Model	Age	Price in 1980	Estimated price[a]	Capital return[b]	Profitability[c]
1959	21	200,000	420,759	12,499	44.15
1960	20	540,000	450,758	13,303	43.92
1961	19	640,000	482,896	13,215	41.34
1962	18	656,000	517,325	13,127	38.96
1963	17	666,000	554,209	13,041	36.74
1964	16	600,000	593,723	12,956	34.69
1965	15	635,000	636,053	13,749	34.44
1966	14	109,000	681,402	13,667	32.57
1967	13	650,000	729,985	13,586	30.84
1968	12	719,000	782,031	13,508	29.23
1969	11	650,000	837,788	13,431	27.74
1970	10	894,000	897,520	17,112	31.38
1971	9	893,000	961,511	17,039	29.77
1972	8	733,000	1,030,064	16,968	28.27
1973	7	1,100,000	1,103,505	16,900	26.88
1974	6	1,400,000	1,182,182	29,202	38.15
1975	5	1,342,000	1,266,469	29,138	36.11
1976	4	1,382,000	1,356,765	29,077	34.22
1977	3	1,480,000	1,453,499	29,018	33.33
1978	2	1,475,000	1,557,130	28,962	30.82
1979	1	1,617,000	1,668,149	28,909	29.30
1980	0	1,933,000	1,787,084	28,859	27.88

a. $P_a = 1{,}787{,}084\ [\exp(0.0688a)]$
$\ln P_a = \ln P_0\ 14.391 - 0.06887a$
(141.10) (8.28) $R^2 = 0.7742$
where depreciation (∂) = 6.9 percent.
b. Capital return (RK) = income − costs.
c. Assuming that $RK_a = (\partial + i_a - \pi)P_a$, then $i_a = (RK_a/P_a) - \partial + \pi$, where i_a is profitability, ∂ = 6.9 percent (see equation 12-8), and π = 15.41 percent.
Source: 1980 prices: Jaramillo (1981).

2.6 percent annually; for busetas in urban areas the rate was 30 percent. Between 1971 and 1980 the average growth rates were 6.2 percent for the bus stock in Bogotá and 25 percent for the buseta stock; in Cali the growth rates were 2.4 percent for buses and 21.93 percent for busetas.

Walters (1979) has indicated that in developing countries minibuses are more efficient than buses with respect to costs, waiting time, and trip frequency. Pachón (1981c) concludes that the demand for busetas increases with income. Furthermore the income elasticities of demand for busetas based on time series are higher than those obtained from cross-sections (see Pachón 1981b). During the period considered, the number of microbuses, which are smaller than busetas, decreased.

Profitability of Buses and Busetas

For 1967-and-later models, the busetas' profitability is higher than that of buses of the same age.[4] This implies that policies regarding public transport fares and subsidies favor intermediate-size vehicles. This, together with the preference for these vehicles on the demand side, explains their rapid growth in Colombia.

The difference in the profitability of each type of vehicle not only is consistent with the rapid growth of the buseta stock but also reflects restrictions on the addition of busetas to the stock. If there were no restrictions, the profitability of both types of vehicles could be expected to be equalized. As mentioned above, a license, or *nota opción*, is required before a vehicle can be affiliated to a transport company. To the extent that obtaining this license is more difficult for busetas than for buses, a higher profitability for busetas is ensured.

Data on the prices of used vehicles confirm the existence of greater restrictions on the entry of busetas. Automotive vehicles show rapid depreciation in the first year and a constant rate of depreciation for the remaining useful years (see Wykoff 1970, pp. 171–72). With such a pattern the adjusted value based on the regression would be less than the value charged by the distributor, since the owner of the vehicle has to pay a penalty to take the vehicle from the distributor. When, on the contrary, there are supply restrictions it is to be expected

Table 12-3. *Busetas: Capital Return and Profitability*
(pesos)

Model	Age	Price in 1980	Estimated price[a]	Capital return[b]	Profitability[c]
1959	21	n.a.	307,202	3,588	23.65
1960	20	n.a.	329,289	4,326	25.40
1961	19	n.a.	352,965	5,098	26.97
1962	18	n.a.	378,343	5,906	28.37
1963	17	n.a.	405,545	6,752	29.61
1964	16	n.a.	434,703	7,636	30.72
1965	15	566,000	465,958	8,560	31.68
1966	14	624,000	499,459	9,526	32.52
1967	13	475,000	535,370	10,535	33.25
1968	12	550,000	573,862	11,580	33.87
1969	11	495,000	615,122	12,688	34.39
1970	10	678,000	659,349	13,836	34.82
1971	9	605,000	706,755	15,034	35.16
1972	8	789,000	757,570	16,283	35.43
1973	7	650,000	812,038	17,585	35.62
1974	6	900,000	870,423	18,944	35.75
1975	5	965,000	933,005	20,359	35.82
1976	4	994,000	1,000,087	21,834	35.83
1977	3	n.a.	1,071,992	23,370	35.80
1978	2	1,375,000	1,149,067	24,971	35.71
1979	1	1,321,000	1,231,684	26,637	35.59
1980	0	1,270,000	1,320,240	28,372	35.42

n.a. Not available.
a. $P_a = 1{,}320{,}240\ [\exp(-0.0694a)]$
$\ln P_a = 14.0933 - 0.06943a$
(141.10) (8.63) $R^2 = 0.8515$
where depreciation (∂) = 6.9 percent.
b. Capital return (RK) = income − costs.
c. Assuming that $RK_a = (\partial + i_a - \pi)P_a$, then $i_a = (RK_a/P_a) - \partial + \pi$, where i_a is profitability, ∂ = 6.9 percent (see equation 12-8), and π = 16.54 percent.
Source: 1980 prices: Jaramillo (1981).

that the owner will obtain a bonus for taking the vehicle from the distributor. In the first case the adjusted price (using the regression) will be less than the list price; in the second case the adjusted price will be greater than the list price. If the relation between the estimated price and the list price is defined as a premium factor, the degree of restriction in the market can be inferred because the bigger is the premium factor, the higher is the degree of restriction in the market.

For Bogotá in 1980 the bus premium factor, B_b, is 1.02; the premium factor for the buseta, B_{bt}, is 1.28. Both vehicles receive a bonus for leaving the distributor. This factor, for both buses and busetas, tells us that the government, through INTRA, still imposes severe restrictions, in relation to the demand for public transport, on the entry of these vehicles to the stock. In the case of busetas the restriction is even clearer, which is in accordance with their high profitability, and the supply of this mode should be even higher to obtain equilibrium between supply and demand.

If the rapid growth of the buseta stock is seen in perspective, it can be inferred that in the beginning there were more restrictions on the entry of busetas and that the gap between the profit rates for buses and busetas was larger. Kozel (1981) has shown that supply restrictions decreased during 1972–78. Essentially, busetas have been allowed to operate on the same routes as buses, and a greater adjustment of the buseta supply has been facilitated.

The Load Factor

From the point of view of economic efficiency, where there are different types of transport vehicles the equipment should be assigned in order of efficiency, with the most efficient assigned first. The most efficient vehicles would be expected to work all day and the least efficient only during peak hours. Where there are two types of equipment with different fares, assignment would generally be in order of increasing break-even load factors: the equipment with the lowest break-even load factor would be assigned first and that with the highest break-even load factor last. Such an operating rule causes the vehicle with the lowest break-even load factor also to have the lowest observed load factor.

In Colombia, since the bus owner receives a monthly subsidy and the buseta owner receives no subsidy, the buseta's break-even load factor should be lower.[5] In consequence the buseta would tend to be used during both peak and nonpeak hours and to have a lower load factor.

With the use of assumptions for calculating the bus and buseta load factors in Bogotá, and cost data for some periods when fares were changed, the effect of these changes on the break-even load factors can be seen. For example, the bus break-even load factor increased from April 1978 to May 1980, which reflected the slower increase in fares than in variable costs. After the most recent fare increase studied, in October 1980, the break-even load factor decreased, since fares had increased more than costs. It can be inferred that the use of buses had been decreasing between April 1978 and October 1980, perhaps because the use of busetas increased.

The results show the dilemma between efficiency and equity which the government confronts in fixing fares. If the government wants to decrease the impact of the growth of operating costs by moderating the increase in fares and increasing the subsidy, the result may be stimulation of the use of vehicles that occupy more road space and that consume more fuel per passenger transported.

It can also be seen that although the load factor for the buseta increased between May and October 1980, there is a great difference between bus and buseta load factors. Whereas a bus must fill 78.5 percent of its capacity to cover its operating costs, the buseta needs to fill only 43.2 percent of its capacity. This great difference in load factors explains why a bus owner prefers to wait for peak hours to operate his bus. Only during those hours is there enough demand to guarantee that operating costs will be covered and a profit made. The buseta, in contrast, can operate on routes with low demand and during nonpeak hours because it needs to use only 43.2 percent of its capacity to cover its costs. This low factor suggests that the buseta's trip frequency will be greater than that of the bus because it does not have to wait for peak hours to operate profitably.

If we compare the observed load factor with the required load factor as in the table below, we find that the load factor for the bus is too low to cover operating costs, while that of the buseta is distinctly above the break-even load factor. This result tells us that the buses are incurring losses or that their operating costs have been overestimated.

Vehicle	*Observed load factor (percent)*	*Break-even load factor (percent)*
Bus	69	78.5
Buseta	66	43.2

The results obtained in this section show that the fare and subsidy policies encourage a more intensive use of busetas, which favors the buseta supply in both the short and the long run.

Summary and Conclusions

In Colombia the state has tried to favor public over private transport. Given the absence of policies—other than the subsidy for buses—to remedy the externalities of private transport through the price system, it may be necessary to increase the use of quantitative restrictions. For example, some lanes may be dedicated to the exclusive use of public transport. Simultaneously with these quantitative restrictions, other policies that use the price system to discourage the use of private vehicles should be investigated. The proposals for a fuel tax and a parking tax to reduce congestion should be studied further. In addition, the possibility of establishing a license for access to the central zones, as in Singapore, should be examined.

The combined effect of the bus subsidy, the implicit fuel subsidy, and the vehicle tax has been to favor the lower-income classes. But since the private companies have much lower operating costs than does the district government company, it is probable that increases in allocational efficiency attained from a system with all government vehicles would increase operating costs. The route assignment process is flexible and has been able to adapt itself to changes in the location of activities.

Such problems of public transport as slow operating speed can be eliminated by such measures as establishing posted bus stops on all lines, reserving some roads for exclusive use by public transport, and charging, by tender, for the use of roads dedicated exclusively to public transport.

The credit established by the CFT has made investment in public service vehicles easier. The availability of credit, together with the fare and subsidy scheme, has assured an adequate profit rate for investment in different types of vehicles. The driver's remuneration system creates incentives for the efficient operation of the vehicles but can also contribute to traffic control problems. As has been proved in Cali, the authorities can make substantial improvements through campaigns directed at users.

The elaborate system for setting fares and subsidies has been described above. The adoption of a methodology to calculate a transport cost index and the periodic collection of the required data have permitted relatively frequent adjustments that have maintained adequate profits for the investment in public transport vehicles despite inflation and changes in fuel prices. The flat fare scheme was identified as a possible cause of excessive urban dispersion. It was shown that the subsidy policies unnecessarily increase the price of old vehicles and artificially raise the prices of models at the lower end of the range to which the subsidy applies. It was further shown that fare and subsidy policies favor investment in busetas and a more intensive use of these vehicles. The restrictions on the entry of busetas into the stock in 1980 were greater than was the case for buses, and it was noted that this fact is compatible with a decrease in restrictions for buseta entry during 1972–78.

The results of the research on the economic effects of the fare and subsidy policies lead to the conclusion that the present scheme is causing distortions in the supply of transport vehicles. Some simple reforms of the subsidy scheme could eliminate the distortions and at the same time solve other problems. A first proposal is to change the basis for the subsidy from model to age, to avoid the model effect and the price distortion of old vehicles. The same profit rate would be adopted for buses and busetas. As in the present system, only buses would be subsidized.

In this analysis the values for buses and busetas were calculated. In both cases a 40 percent annual profit rate in monetary terms was fixed. The bus fare covers operating costs, and the subsidy covers capital and fixed costs. Given a 40 percent profit rate, a uniform fare for a bus of any age is 3.50 pesos. The present subsidy is unnecessarily high for older buses. It is possible to fix a flat fare of 7.80 pesos for busetas, a little higher than the present fare (7.50 pesos), to ensure a nominal profit rate of 40 percent, equal to that of buses.

A second reform would allow additional benefits. There is a desire in Colombia to maintain the price of fuel used by public transport below that of fuel used by private transport. The authorities have wanted to change all the public stock to diesel and to maintain low prices for that fuel, but this policy has not had much success. A possible measure is a subsidy that is related to the average fuel consumption for each type of vehicle used in public transport. If the proposal to adopt a subsidy scheme that would eliminate some of the distortions created by the present scheme is accepted, additional research on the vehicle's costs, income, and price by age will be needed. A better level of information would permit subsidies to be based on the costs of different ages of vehicles without incurring serious distortions.

Along with improvements in the definition of fares and subsidies, market forces should be permitted to reduce the distortions from information problems or methodological limitations. For example, by eliminating restrictions on the entry of public transport vehicles, the same profitability would be ensured for all types of vehicles, and transport would be as profitable as other sectors of the economy. Similarly, some fares, such as night service charges, could be freed from controls.

Considerable knowledge exists concerning urban transport in Colombia, and the use of models to simulate routes is fairly well established. Government transport policies have been, in general, in the right direction. Policies have sought to give priority to public transport and have, by and large, favored lower-income classes.

Notes

1. The information on costs may be overestimated because of the nature of the data and their relation to fares. The FEDESARROLLO (Urrutia 1981) study used the operating costs of its buses and obtained lower operating costs.

2. The t-values are in parentheses, there are three degrees of freedom, and the critical t-value for three degrees of freedom is 3.182.

3. The t-value to prove the hypothesis $b = 0.1$ is 2.846. It is greater than the critical value 2.086 with a 95 percent confidence level and 20 degrees of freedom.

4. The profitability of buses can be less than that observed to the extent that there are delays in the payment of the subsidy by the CFT, the entity in charge of the payment.

5. The buseta owner must cover both variable and fixed costs from fares, while the bus owner covers his costs out of the subsidy and the fares. The buseta owner therefore needs a lower load factor to cover his variable costs.

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