Considering poverty impact of fare policy studies for urban public transport

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ABSTRACT: This paper intends to discuss the impacts of the urban transport fare policy on poverty reduction. A study for the metropolitan area of Belo Horizonte has taken into account the elasticity concept (demand vs. fare) and the impact of fare structure on poor inhabitants. Both aspects represent a great progress on transport fare policy in Brazil. Nevertheless, the mobility of poor people has been decreased. Therefore, a more complete study should consider both direct and indirect subsidies.

RÉSUMÉ: Ce papier a le but de discuter les impacts de la politique tarifaire du transport urbain sur la réduction de la pauvreté. Une étude pour la région métropolitaine de Belo Horizonte a pris en considération le concept de l'élasticité (demande contre prix du billet) et l'impact de la structure de tarification sur les habitants pauvres. Les deux aspects représentent un grand progrès sur la politique tarifaire du transport au Brésil. Néanmoins, la mobilité des pauvres a été diminuée. Par conséquent, une étude plus complète devrait considérer des subventions directes et indirectes.

1 INTRODUCTION

The main objective of this work is to discuss possible impacts of the transport to decrease poverty, and to show how the fare policy planning of urban public transport could affect mobility of the poorest citizens. A novel study of possible alternatives of fare structure for the metropolitan area of Belo Horizonte is used to promote that discussion, based on simulation which calculates the impacts.

This article intends to call researchers' attention, as well as members of governments, companies or nongovernmental organizations, for the importance of assessing, in each transport project, its impacts in either increasing or decreasing social inequalities.

Fare policy on urban public transport can be simplified as the fare structure, as the existence or not of subsidies, free of charge users or discounts to certain categories of users. Even so, rarely one thinks immediately and directly on the social role that a transport fare policy should play, and on its power to minimize poverty.

Poverty indicators are, in that way, seldom considered in the definition of those policy. In the other hand, economic indicators, as the annual growth of the Gross Domestic Product (GDP), are often used to forecast the future demand of a project. However, economic growth does not inevitable mean poverty decrease. In India, for instance, it was realized that their economic growth is no indicator of human development (Sharma, 2000).

In Brazil, despite the increasing per capita GNP (from US$ 1,170 in 1975 to US$ 4,630 in 1998), the poorest 20% of all households have earned an increasingly smaller percentage of the total national income. By the other hand, the wealthiest 20% of households have earned an increasingly greater percentage. The Gini Index was 59.1 (Gini index measures inequality over the entire distribution of income or consumption; a value of 0 represents perfect equity and a value of 100 represents perfect inequality) in 1999 (UNDP, 2001).

Table 1: Overall income and income distribution in Brazil

year	1975	1998	75-98
	income		
GNP per capita (US$)	1,170.00	4,630.00	+296%
	income distribution		
poorest 20%	2.8%	2.5%	-11%
richest 20%	62.0%	63.8%	+3%

(World Bank, 2000)

Table 1 is useful to question the assertion which associates GDP growth directly to the development of a country. Even if the per capita income had not grown three times in the period, due Real, the Brazilian currency, in 1998 was overvalued in relation

to US Dollar, it is reasonable to accept as true the income distribution data, that comes in percentage. Thus, it is absurdly patent the low share of the lower class in the overall Brazilian income.

Brazil has a population of 170 million inhabitants (5th. inhabited country in the world), being 81,2% urban (national average), distributed in an area of 8,5 million square kilometres (5th. largest country in the world), with 27 states and 5,500 municipalities (IBGE, 2001). Brazilian GDP has been growing in an average of 2.7 % per year during the last decade, and has been among the ten countries with biggest GDP in Earth (8th. in 1999, with US$ 750 billion). Despite that, the country stands at the 69th. ranking position of the Human Development Index (HDI) of United Nations (2001), among 162 countries. More than 40 Brazilian cities have more than 400,000 inhabitants, and it is in those cities both social and transport main problems concentrate.

A more consistent analysis lying on Brazilian development certainly should take into account several other indicators, so much economic as social, including the ones that obtained significant improvements (from 1975 to 1998), as infant mortality, infant malnutrition, registration in primary school, illiteracy, life expectancy, etc. But one of the greatest current economic challenges in Brazil is to promote a just income distribution or, at least, to decrease poverty and hunger. For such, it is necessary that the several public policy, guided by socially-sensitive economic orientations, focus on poverty reduction. Projects in transports, in that sense, should also play a social role, considering the impacts to the poor caused by the project – either of infra-structure or of transports planning/operation.

Transport represents about 10% of a ordinary family budget. It could seem little, but actually it is the third highest expenditure category, after housing (21%) and nutrition (17%), with a comparable value of all taxes and contributions and bigger than health care or education (IBGE, 1996).

An broader analysis of the social role of transports should consider other groups whose mobility is well-known as in disadvantage, such as seniors, children, women, handicapped, unemployed, etc, but this work concentrates on the consequences of the fare policy definition on a single category: the poor.

2 POVERTY IMPACT STUDY

2.1 *Poverty Definition*

In order to the transport planner figure how could be his/her spectrum of action, it is necessary to define Poverty. In general, poverty can be defined in three terms (Hicks, 1998):

1 money measurement - deficiency in reaching a minimum level of consumption. It is better to define poverty in consumption terms rather than in income's because one could measure a family capacity to support basics needs;
2 basic needs - consumption deficiency or lack of access to basic needs as education, health, sanitation. That deficiency for itself defines poverty, and the increase of the access in itself it reduces the poverty;
3 social capital - deficiency in the ability of participating in society or being discriminated or even denial of basic human rights, by the lack of the community's support, or violence and crime rate in the community, or other that may cause different levels of well-being within people with similar income.

The World Bank considers that the best way to measure an improvement in a family's quality of life is increasing their purchase power, that is to say, of their purchasing power measured by the expenditure level.

That is a simple and debatable approach, since it does not consider the family access to essential public (mainly free) and private services as education, health, leisure. This is a financially-focused concept, instead of a macroeconomic approach which comprehends other measures of the quality of life.

The second of the three basic concepts of poverty seems to be more appropriate to support analysis on this paper, since the mobility itself is also a basic need and, more important than that, with a good mobility policy one can promote democratisation and increase of the poor's access to other basic needs.

2.2 *World Bank: Poverty Reduction and Transports*

The World Bank tries to promote a discussion on the importance of the evaluation of the transport projects financed by the institution under the focus in the poverty. That because the contribution of the transport services in the decrease of the poverty is seen, in a general way, as insinuation and coming of the global economic development (Gannon & Liu, 1997). With little exceptions, the impact of the transport projects on different social or income groups, by measuring the benefits and costs by assigning different distributional weights, and their potential in playing a more active part in the attendance to the poor has been receiving little attention.

"Typically, indirect approaches operate at the level of improving overall mobility, while direct approaches operate at the level of improving basic access for the poor" (Gannon & Liu, 1997). As a mean, transport can reduce the absolute poverty mainly for increasing the economic efficiency, when decreasing costs and fares and promoting opportunities for the marginalized people of the society.

A transport project guided only by the efficiency – measurement of benefits and costs on monetary willingness-to-pay – can benefit more the wealthy ones than the poor and, even, to harm the poor. If the

benefits and the costs be quantified in possibility terms or desire of using the service (as it can be identified in stated preference polls), a project will tend to favour groups of higher income.

The exclusive focus in the general efficiency of the transport system tends to neglect the needs of the poor displacement, and it tends to increase the dependence in the motorized transport. In the transport infrastructure projects, if one do not consider nonmotorized transport (on foot or by bicycle mainly), there will be disadvantages for the poor, certainly less motorized.

Transport modes that present high operational costs mean for the poor a geographical, social and economic isolation. A low capacity transport mode accomplished by vans, very discussed in Brazil during the last three years, most of the time is not faced as a real possibility of attendance the poor needs. Those who live in *favelas* (slums) would be the most beneficiaries, since *favelas*' narrow streets do not offer geometry adaptation for bus traffic or even minibus' one. The contrary regulation to those services or the imposition of rigid operation rules can turn unviable the access of the poorest population to services potentially cheaper.

A good example of transport service in *favelas* happens in Belo Horizonte. In 1999, a round route special service of minibus began to operate in *favelas* with reduced fare (US$ 0.12 on March/2002). Some street enlargements were made in order to allow minibus traffic.

The operational deficit generated by that service is compensated by revenue of bus lines that serve rich areas of the city. The vehicles are painted yellow, and for that they have already received tender nicknames from the citizens, that identify them as "little blondes", and they narrate excited facts involving the service, during meetings with the local transport authority (BHTRANS, 2000).

Gannon & Liu (1997) stand that it is difficult to reach the poor with subsidies, so they should be studied carefully. The market structure is a crucial determinant of the effectiveness of transport subsidies, because the more competitive the markets for transport services, the greater the retention of subsidy by low-income users. The authors affirm that unfortunately transport is rarely considered in an explicit part of World Bank's direct poverty alleviation strategies. Thus transport tends to be treated as having only an indirect relationship to poverty, primarily through improvements in technical and allocative efficiency. They alert, also, that there are no systematic approaches to poverty issues in transport sector operations.

3 FARE POLICY PLANNING IN URBAN ENVIRONMENT

The improvement of the poor's access to essential services reduces poverty, even if there is no improvement on their income (Hicks, 1998). A project whose goal is to define the fare policy of metropolitan public transport may have as main and explicit objective to promote larger mobility to the lower social classes. This will contribute to decrease poverty levels, if: (i) poverty location is considered, that is where poor people live (not only on slums, but also ones who live in popular settlements or even homeless locations) and (ii) the trip desires of that portion of the population, with special attention to those motivated by the satisfaction search of basic needs, as access to the health, to the education and to the work (Hicks, 1998).

It is difficult to establish a location pattern of the poor settlements and, even if concentrated on some very dense places, as in *favela* hills, they are randomly dispersed on the urban territory of Brazilian cities.

3.1 *Fare Policy Objectives*

The objectives of a project to define the fare policy in transport can be many but, attempting to relate the most important, they can be classified in four categories: Social, Environmental, Economic and Financial, and Operational. Among the five Social objectives, the two first stand out:

"1st.) redistribute income from rich to poor people;

2nd.) improve travel opportunities for disadvantaged groups such as the old, the young, the poor, the handicapped, and those without full time access to a private car." (Grey, 1975)

These highlighted objectives are a good résumé of what one could expect from a transport project (either infrastructure or service) focused on populations, with financial, social, or even physical disadvantages.

Cadaval (1993) has identified the fare policy objectives of the following Brazilian cities: Belo Horizonte, Recife, Curitiba, Salvador, Brasília, São Paulo and Vitória. Among those, the "social function of transport" explicitly appeared only on the federal capital's fare policy, Brasília.

3.2 *Flat Fare vs. Differentiated Fare*

In agreement with Molinero & Arellano (1996), basically there are three possible fare structures: the only or flat fare; the zonal fare; and the section fare. Grey (1975) calls the last one as graduated fare (based on distance travelled). Other authors consider the last two structures as being one, called "differentiated" fare.

Even in the first type of fare structure, with only fare, the structure is never completely "flat" or equal for everybody. For the urban public transport, following Brazilian federal laws, free access for seniors (minimum 65 years old) is granted and employees must receive monthly transport tickets with discounts (limited to home-work trips). According to the local policy, there are reduced or free fares for students, handicapped, postmen, policemen, etc. This happens similarly in other countries.

Thus, a flat fare structure is the one with doesn't differentiates trips through travelled distance or period of the day, and there is not any increment due to special services (such as express lines or lines with more comfortable vehicles) or separation zones, and no discount for off-peak trips.

In the great majority of Brazilian cities, there is a tendency for rather flat than ring fares.

The differentiated structured, being for zones or for section, is viable mainly in cities that already has advanced electronic ticketing systems available, like smart cards, due to larger flexibility of prices changing, in accordance with several possibilities and detected needs, for example, to encourage public transport use on off-peak periods.

The relative advantages and disadvantages among flat and differentiated structure have been debated for years. Researchers discuss differentiation benefits while transport managers continue opting predominantly - and growing - for flat structure. Main arguments in favour of differentiation base on considerations about efficiency and justness. They can be summarized like this:

- Higher operational costs are associated to longer trips and, obviously, to the need of seasonal offer, since peak period is decisive to set minimum fleet requested for route operation, as well as to rapid mass transport (subway and/or express bus). Those costs should totally be contemplated in the fare. Otherwise, the users that use those more expensive trips (long, on peak, by subway or express bus) would be benefited, by the concept of crossed-subsidy, for the users of the cheaper trips (short distance, off-peak, in short-haul services or feeders). Hence, deficit from expensive trips would be covered by cheaper trips in flat fare system. Groups of higher income can use one or other type, according with its residences location, usually in suburbs in North America countries, and close to the cities' CDBs in most of municipalities of developing countries.
- Users of more expensive services tend to react with lower elasticities than the ones which use lower cost services. Hence, the differentiated fares have better potential of revenue generation.

Despite those arguments, most of American transport agencies have not implemented fare structures based on distance or on time. Zonal fare increments are adopted by 108 among 291 (37%) bus systems researched in 1993 by the American Association of Public Transportation - APTA, and only 5% adopt differentiated fares along the day. 5 of 13 railway systems only adopt fares based on the travelled distance, and just one of them gives discount on off-peak periods. Just for commuter railway trips there is a tendency for differentiated fares, with 15 of 17 systems adopting fares based on the distance, and almost a quarter of them has also differentiation according to period of the day.

However, the fare differentiation adopted at a developed country, especially United States and Canada, can not be directly applied in Brazil. Here financially disadvantaged community's location doesn't follow a strict rule. Distance based fares, unless if it is very well studied for each case, can, in that way, contribute to worsen the poor's access to public transport.

Discounts for off-peak trips certainly bring advantages for the lower income people, including, for example, construction workers. A bricklayer that usually takes its conduction at 6 a.m., to begin working at 7 a.m., could be motivated to wake up 30 minutes earlier by discounts on first-hour morning fare. That, medium time period, would also contribute for flattening demand curve in morning peak (with the enlargement of its time range). That peak generally is the one considered to calculate minimum fleet needed for the service.

NTU (2000) gets attention for the origins of flat fare preference, and it points out as current tendency adoption of differentiated fare:

"In compensation to the maintenance of low levels of government subsidies, mechanisms of crossed subsidy were spread among users, mainly through adoption of flat fare in the majority of capitals and of concessions and discounts expansion, supported indirectly, most of cases, by payer users.

Even with benefits on operational simplicity and easier understanding for users, flat fare places serious problems for the financial administration of transport systems, for land use and urban economy and the social justness of its distributive mechanisms still stays uncertain. The return to multiple fares systems seems to be a very concrete possibility in a medium time period, face to the conveniences of the administration of subsidy systems that expand and that tend to be more selective and to the reduction in the costs of advanced computerized fare equipments."

That current tendency can already be verified in some cities that possess smart card fare systems, and offers discounts along the day and on weekends.

4 BELO HORIZONTE'S CASE

The Brazilian Company of Urban Trains - CBTU hired Tectran consultancy to elaborate a study that would serve as basis to conceive the Metropolitan

Area of Belo Horizonte – MABH transport fare policy. That study had the goal of "understanding demand behaviour face to integrated alterations in the fare policy of MABH".

Other five transport public authority agencies of MABH's major cities are working together with CBTU to define an unified fare policy for Belo Horizonte city and its surroundings.

In Belo Horizonte, recently, some alternatives on fare levels were lifted up. Some alternatives of tariff values were developed and tested, based on concentric zones fare, for which two possibilities of onus integration were simulated: (a) fare increment by a constant - in that policy the fare of each line (bus or subway) would suffer a constant value increment according to the number of border crossings of rings or sections (plus US$ 0.10 per crossing); (b) fare increment by fixed rate - in that alternative, to each border that the line crosses its fare would be multiplied by a constant rate (1.25 in that case).

4.1 *Particularities of the Accomplished Work for CBTU*

The study financed by CBTU (2001) innovates basically in two points: the first is the application of the economic concept of demand elasticity to the price, that is resultant from geographical lines configuration and of fare discounts of integrated trips; and, the second, it is the analysis of fare values impacts on poor population, according to different policy application.

Both innovations represent a great qualitative progress in fare policy conception in Brazil. The elasticity analysis is not accomplished commonly not only in our country. A recent research accomplished in European cities by CERTU (1999) confirms that assertion. Technical speaking, it should be expected and desirable that all plans of fare structures took into account that type of economic analysis. Practical applications, however, show that a lot of times fare studies makers are not supported or they don't have resources for *in loco* elasticity assessment.

Studying 41 delegation contracts of urban public transport public services, mainly of France, CERTU (1999) reached the conclusion that the elasticity analysis of the demand front fare increments are "relatively rare".

Anyway, there is ways to find out elasticity values for each bus line, for example, analysing temporal series of demand and fares. External factors can interfere in that sense, for instance high population growth happened in a new building plots area can provoke a positive elasticity rate (when fare increases, demand also increases), which *a priori* could be considered as an absurd.

That and other problems must be taken into account, such as interferences on fares defined by different jurisdictions (e.g. metropolitan bus, municipal bus of the capital or of a dormitory city). Stated preference researches can be also considered to define demand elasticity.

Subsidized fares are independent from general calculation of elasticity. But one can research demand elasticity of low income groups that would be favoured. If elasticity is not considered, there is a risk of dropping into the vicious circle of fare increase, as showed on Figure 1.

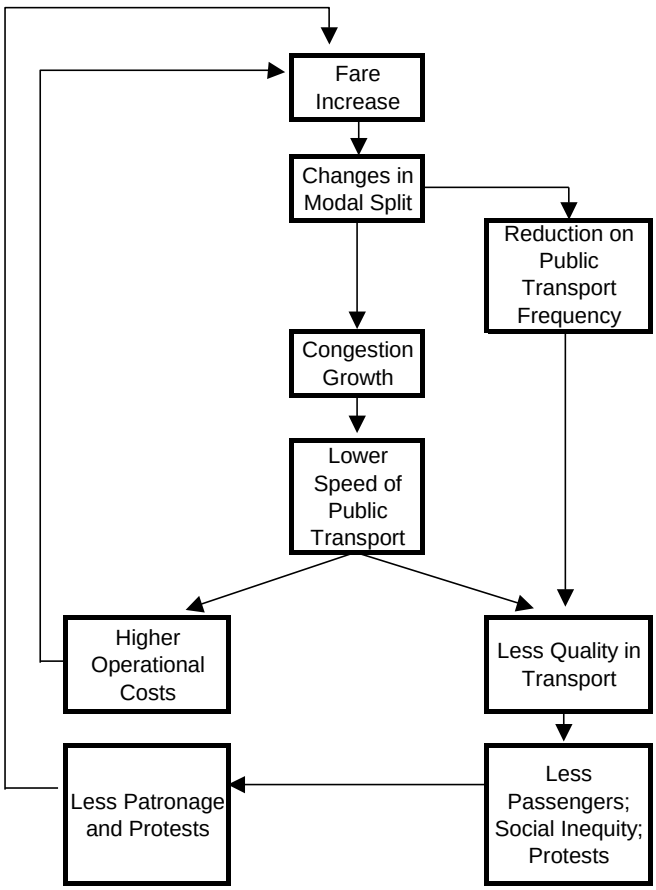

Figure 1: Vicious circle caused by increasing fare. Molinero & Arellano (1996)

Telling about social fares, less expensive than regular tariff, destined to specific portion of the population, CERTU (1999) stands that "evidently elasticity can not be considered in operator's compensations calculation for revenue losses when values of social fares are established, because it is not the classic balance between offer and demand". That is to say, the value of social fare is assumed in agreement with the beneficiary's population purchasing power, so the financial balance of the system must be reached by considering demand elasticity to the basic fare.

The larger progress reached by the Belo Horizonte study was the poverty impact calculation produced by different fare levels of studied alternatives.

4.2 *Evaluation of the Study and Possible Alternatives on Poverty Impact*

The poverty impact module of the CBTU (2001) study initially creates a reference matrix of poor population trips, considering that people with smaller income than 0.5 minimum salary of each zone have a trip desire similar of all population in Origin-Destination (O-D) matrix. Hence, the total number of the poor of each zone was distributed among the O-D pairs in accordance with the trip generation given by O-D matrix.

That reference is necessary, justified by the authors, because the O-D matrix used in the work, produced by the previous studies of BHTRANS and of CBTU, can't be segmented into income categories, once she is the result of a generation model. Even if it doesn't represent actual trip pattern of poor population, it can be used as comparison base to the several fare policy alternatives.

That reference matrix is then combined with the basic fares by O-D pair for transport authority and of the alternative in test, and it calculates total payment of the poor population in both alternatives. The accessibility rate of low income population to the studied alternative is given by the relationship among the payment calculated for basic and for the alternative. Larger rates than the unit means that the impact is smaller than the basic situation.

For the definition of the fare policy to be adopted, were considered:

- several possibilities of price composition and the integration approaches, having as basic guideline and condition that each of the 5 major municipal systems of MABH must be individually profitable, including intercity buses;
- simulation of possible alternatives derived from the chosen fare policy;
- determination of revenues and global costs of RABH transport system;
- selection of the alternative that makes possible the system economic-financial balance: Ri > Ci, where Ri is the revenue for each transport authority i, and Ci is the operational cost.

In the indicated alternative, there would be a loss of 2% in the poor's accessibility to the public transport system. That is to say, seeking the economic-financial balance of the lines, it was not possible to get a smaller negative impact, for that alternative.

Usually, the vision of the operator is for maximum profit, what would make unfeasible the adoption of social policy whose objectives would be to increase level of service and, consequently, to decrease business profit, if service operation of passengers' transport was not regulated. That vision can be compensated with a pro-user perspective, usually represented by the government, in that case, by the transport authority.

Even so, when transport authority has full power for route planning, definition of timetables and even fleet assignment (number of vehicles per line), bias that harm the system can happen. Thus, the ideal would be to consider both user's perspective and operator's. One can use the same criterion to define the fare policy, always remembering to consider trip desires of the poor, and as they can pay for the service.

5 CONCLUSIONS

In Belo Horizonte, the initiative of studying the impact of the fare policy definition of its Metropolitan Area was valid. However, this approach didn't show totally appropriate, since there was a decrease of the poor accessibility, in the best solution found.

A more consistent approach would take in consideration both physical and fare integration of the attendance services to *favelas* to the general system, as well as purposing new services for attendance in peripheries whose resident population can be identified as of low income. Obviously, for the economic-financial balance of the system, one should consider higher prices for wealthier classes up to elasticity limits. For such, it is crucial that special services are created (with smaller and more comfortable vehicles, with air conditioning installed) and circular lines linking downtown to the south area, that presents larger income.

Fare differentiation along the day would be also interesting to increase demand and to decrease vehicle idleness in off-peak period and during weekends.

As stated by Rebelo (2001), most bus systems do not receive subsidies, however metropolitan railways and subways have an operating deficit which must be covered with a government subsidy.

An including study should also consider direct subsidies (government budgets being injected on road system, as well as on rail's) or indirect (differentiated local taxation for gas stations, reverted integrally into the public transport, or urban toll facilities, or even public parking's fare increase).

Gannon & Liu (1997) ponder that direct subsidies must be justified, and require very careful design, since they may weaken public transport operators' incentive for cost control and become unsustainable. Subsidies are now under discussions in São Paulo city, but there is no consent yet.

Those subsidies should be simulated on the whole metropolitan system, as for the attendance of certain poverty locations.

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