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Affordability and Subsidies in Public Urban Transport:

What Do We Mean, What Can Be Done?

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Abstract

Subsidy policies on public urban transport have been adopted ubiquitously. In both developed and developing countries, subsidies are implemented to make transport more affordable. Despite their widespread implementation, there are virtually no quantitative assessments of their distributional incidence, making it impossible to determine if these instruments are pro-poor. This paper reviews the arguments used to justify subsidy policies in public urban transport. Using different tools to quantitatively evaluate the incidence and distributive impacts of subsidy policy options, the paper analyzes the findings of a series of research papers that study urban public transport subsidy policies in developed and developing countries. The available evidence indicates that current public urban transport subsidy policies do not make the poorest better off. Supply-side subsidies are, for the most part, neutral or regressive; while demand-side subsidies perform better—although many of them do not improve income distribution. Considering that the policy objective is to improve the welfare of the poorest, it is imperative to move away from supply-side subsidies towards demand-side subsidies and to integrate transport social concerns into wider poverty alleviation efforts, which include the possibility of channeling subsidies through monetary transfer systems or through other transfer instruments (food subsidies, health services and education for the poor). The general conclusion of the paper is that more effort should be devoted to improve the targeting properties of public urban transport subsidies using means-testing procedures to ensure a more pro-poor incidence of subsidies.

This paper—a product of the Transport Cluster, Latin America and the Caribbean Sustainable Department of the World Bank—is part of a larger effort in the World Bank to increase the understanding of affordability in the transport sector. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at nestupinan@worldbank.org, agomezlo@econ.uchile.cl, rmunozraskin@worldbank.org, and tserebrisky@worldbank.org.

Affordability and Subsidies in Public Urban Transport: What Do We Mean, What Can Be Done?[1]

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1. INTRODUCTION

The attention devoted to the relationship between poverty and transport is increasing considerably. Incorporating poverty issues and pro-poor components into the design of transport projects has become an important priority for multilateral banks.[2] Poverty, air quality and safety are among the most important objectives being pursued by developing countries that have recently embarked in urban transport reforms.

In this context, it is possible to find a wide menu of policies aimed at making public transport "affordable" to poor households, which invariably imply some type of subsidy to benefit these individuals. As a general observation, subsidies are ubiquitous in the transport sector.

In this paper we review the case for subsidies in the urban transport sector, discuss the available policies and the trade-offs involved in choosing optimal policies, and develop a methodology to quantitatively evaluate different policy options.[3] We try to answer the following questions: Why are transport subsidies needed in the first place? If a subsidy is going to be introduced (or an existing subsidy is going to be changed), what considerations should be borne in mind when designing policies? How should we quantitatively evaluate the different policy options available in order to guarantee a pro-poor effect of a subsidy in the transport sector? What have we learned from subsidies in other sectors and past research in the transport sector?

There is an extensive literature in the transport field justifying public transport subsidies on economic efficiency arguments. Most, but not all, of these arguments are "second best" in nature, in the sense that subsidies compensate for externalities in other parts of the economic system, namely, private transport use. In this context, public transport subsidies may reduce these externalities, improving resource allocation in society. Unlike the efficiency argument for subsidies, this paper emphasizes the social and distributive dimension of public transport subsidies. In this sense, it follows papers such as Frankena (1973), Pucher (1981), Guria and Gollin (1986) and Asensio, Matas and Reymond (2003) rather than the plethora of papers dealing with the externalities and efficiency aspect of the problem. Unlike these papers, however, we focus on developing country issues and experience.

This paper is structured in the following way. Section 1 presents an introduction to the paper, the research questions and its structure. In Section 2 we discuss the rationale for transport subsidies. It is argued that in developing countries the case for these policies is not so clear-cut. A careful assessment of the objectives pursued when providing subsidies and the alternatives available—including policies outside of the transport sector—must

[2] See for example Asian Development Bank (2001), The World Bank (2005), chapter 3 of The World Bank (2002), Gannon and Liu (1997) and a number of case studies on the subject commissioned by the World Bank in recent years, including SITRASS (2004a; 2004b), Shuiying, Han, Weili and Dening (2003), Howe and Bryceson (2000), Godard and Diaz Olivera (2000), and ECORYS and NEA (2004) among others.

[3] This paper deals exclusively with urban transport issues, although there are also social and poverty issues related to rural and interurban transport

be made before recommending such policies. In Section 3 we then discuss the concept of affordability, the attempts made to quantify it and the problems found when trying to apply it to policy design. Sections 4 presents a typology of possible transport subsidies, and Section 5 discusses the criteria to evaluate the different design options and the trade-offs involved. Section 6 develops a methodological approach to estimate the distributive incidence of transport subsidies that is simple to use and could contribute to assessing the distributive incidence of virtually all subsidies currently in place. Finally, Section 7 presents a discussion of the lesson learned from research on subsidies in the utility sectors and presents evidence from prior research as well as four case studies in the transport sector completed in 2007 for a World Bank project. This evidence lays the groundwork for posing the critical questions that must be answered before further progress can be made in the area of poverty and transport.

The main message that comes out of this paper is that it is not clear that transport subsidies that operate in isolation from more general welfare programs have been effective in alleviating the problems faced by the poor. Whether they can be made more effective is an open question, but current policies are not achieving this goal. There are reasons to be skeptical on how much can actually be improved. In this respect, it is imperative that affordability policies be designed within the framework of more all-encompassing poverty reduction policies. This is an area that requires greater collaboration between transport specialists, economists and social welfare experts.

2. JUSTIFICATIONS FOR TRANSPORT SUBSIDIES

The study of subsidies in public transport is not a new area. There is an extensive literature that focuses on the design and implementation of subsidies. For the most part, this literature ignores the distributional incidence of subsidies and concentrates on the allocative efficiency case for public transport subsidies. In this section, we summarize the main arguments that support the efficiency and social justifications for subsidies in public transport.

2.1. The allocative efficiency argument

The allocative efficiency argument for transport subsidies can be divided in two complementary explanations.

2.1.1. Underpricing of alternative travel modes

The first is related to the underpricing of alternative modes of transport, particularly private car ownership. Users of these alternative modes do not pay the full cost they impose on society, in terms of infrastructure use, pollution, congestion, road safety risks and other environmental externalities. They are thus being subsidized. Therefore, by subsidizing public transport, competition between these alternative modes is placed on a level playing field and improves resource allocation.

Parry and Small (2005) provide quantitative estimates of subsidies required to achieve allocative efficiency in Los Angeles and Washington D.C., that should cover between 50% and 80% of average operating costs for buses and rail, respectively. For London, estimated figures are even higher (100%) due to the higher congestion attributed to private automobiles in this city.

However, there are two problems with this justification for public transport subsidies, especially as concerns developing countries. First, they are all "second best" efficiency arguments since there are other ways to come closer to correctly price alternative travel modes. Fuel prices may be increased to internalize pollution and traffic risk externalities. Congestion tolls or infrastructure tolls can be used to make car users bare the full cost of their use of exiting road space. Only if these direct policies cannot be implemented, could public transport subsidies justified as a second —less efficient— option.[4]

Second, and more relevant to this paper, many of these arguments may not be as strong in a developing country context as in developed countries. Private car use, although rising, is usually far below the level in developed countries. In fact, in many developing countries, public transport is generally one of the major contributors to pollution, congestion and traffic risk problems. Therefore, it may be that public transport is underpriced as well as private car use. Indirect evidence for this is provided by Estache and Gómez-Lobo (2005) for the case of Santiago, Chile.[5] Similar evidence can be found for other middle and low income countries, where formal and informal public bus transport is a significant contributor to accidents, pollution and congestion.

In addition, the social valuation of a clean environment, the time cost incurred in congested roads and attitudes towards risk are very different in developing countries where many people are still faced with more pressing concerns regarding their basic needs. Therefore, even when the underpricing of alternative modes of transport may sometimes justify public transport subsidies, the quantitative magnitude would most probably be much smaller than in developed countries.

In summary, the efficiency argument for transport subsidies in developing countries, on average, is not so strong and definitely not as relevant as in developed countries. However, for some developing countries it may be argued that the underpricing of infrastructure for private travel may be just as relevant as in developed countries. As economic growth spurs private automobile ownership, governments in developing countries devote limited resources to expand road infrastructure without making users —mostly the richer segments of society— pay for these investments..

[4] Subsidizing public transport will generally be less efficient than a direct solution to the underpricing of private car use, since it may encourage excessive travel and distort residential and commercial location decisions. In addition, taxes needed to fund subsidies create a deadweight loss in the economy.

[5] In Santiago, for example, private cars use gasoline, while buses use diesel. Thus the latter contribute directly to particulate matter pollution while the former do not as much. An interesting natural experiment happened in 2002, when bus operators went on strike. The evidence showed that compared to similar days, in terms of weather conditions, particulate matter pollution fell 50% in the city (see Garreud and Aceituno, 2002).

2.1.2. Scale economies and user cost

Another efficiency argument that may justify public transport subsidies is the Mohring effect (Mohring, 1972; see also Jara Díaz and Gschwender, 2005). This effect arises due to the fact that the total cost of a trip is not just the price paid for the mode chosen, but also includes the time cost of users. As additional supply is introduced into a transport system, average waiting times are reduced for all passengers.[6] However, the marginal unit supplied cannot appropriate the total amount of the higher value it creates, which equals the total reduction in users transport costs. Thus, the marginal private benefit of introducing an additional unit of supply is lower than the marginal social benefit. As a consequence, the private optimal supply level in a deregulated market would be lower than the social optimum. The social optimum supply level could then be achieved through a subsidy.

However, there is doubt as to the material importance of this effect. Gómez-Ibañez (1999) argues that in practice the Mohring effect is small and does not warrant the implementation of subsidies. In regulated systems, supply conditions including frequencies, can be set by a regulator, solving the existence of the Mohring effect. In developing countries, where the time cost of passengers, as traditionally has been estimated, is lower than in developed countries —especially among the poor, who represent the majority of users of public transport—the Mohring effect becomes less important, thus reducing this effect as a justification for subsidies.

Efficiency arguments based on economies of scale and scope in supply cannot be used either as a justification for subsidies in the transport sector for the same reasons that they have been out of favor in the natural monopoly industries. Funds have an opportunity cost, and thus, it could be more efficient to set tariffs at average cost, incurring a small efficiency loss, rather than to use scarce public funds in an effort to set prices at (loss making) marginal costs. Forcing services to be self-financing through average cost pricing of utility services may also have beneficial incentive and control properties.[7]

2.2. The social or distributive case for transport subsidies

The previous section discussed why the argument for public transport subsidies based on efficiency arguments may not be very strong in developing countries. The arguments ignored the practical problems and possible distortions that such subsidies may cause.

In developing countries, the social justification of subsidies seems to be of more concern. The social case for transport subsidies starts by recognizing the importance of accessible, available, and affordable transport for the well being of people. Transport, being a derived demand, becomes a complementary input to the obtainment of other social benefits such as education, health services and employment opportunities, among others. This is sometimes couched in the catch all concept of “social inclusion”, an appealing

[6] This occurs up to a certain scale, after which average waiting time could increase.

[7] Incentive and control issues are very relevant in the transport sector. There is ample evidence indicating that operating subsidies are associated with operational inefficiencies.

term that is unfortunately hard to define in an operationally useful way for policy decisions.

The recognition that transport is important for peoples' lives, especially among the poor, is not sufficient to justify subsidies specific to the transport sector. The main reason is that the same argument could be made for most other goods and services on which peoples' lives depend upon, including water, electricity, telecommunications, food, etc. How are we to judge whether scarce funds should be used to improve individuals' social inclusion through transport subsidies rather than by subsiding other services and merit goods? Or, why not let people decide for themselves by directly increasing their income instead of subsidizing services?

The poor are not just 'transport poor' or 'fuel poor' (to use the UK terminology)[8], they are poor in an encompassing way. All basic needs, such as education, water, food, health and transport have a merit good component which justifies a social preoccupation with their affordability by the poor. Due to this multidimensional characteristic of poverty, a monetary transfer may be the best way to help the poor, rather than having a plethora of sectoral subsidies which are very hard to target correctly. Chances are that policies that operate through the welfare system —whose main objective is to identify and help the poor in a country— will have better distributive properties than sectoral subsidies. In principle then, equity and distributional concerns should perhaps be addressed by the general welfare system of a country and through the use of direct monetary transfers. This way the household decides how to spend this income among the different goods and services, based on their needs and constraints.

As a concrete example, in Chile, rising transport costs due to the increase in the international price of oil during the years 2004 through 2006 were neutralized through direct compensatory payments benefiting 40% of the population rather than through subsidizing transport fares or inputs. This example is discussed in more detail in Box 1.

That a monetary transfer may be better for households compared to a price subsidy can be shown by a very simple microeconomic argument reproduced in Appendix 1. The intuition is that with a transfer a household always has the option to use the additional resources to pay for their travel costs but it can also use these funds for other expenditures. Thus, it has an added degree of freedom which helps to raise welfare. An illustration of this point is given by the fact that in Brazil, many workers who receive transport vouchers from employers ('vale transporte') sell them in the secondary market instead of using them for travel.[9] These workers would be better off by an equivalent direct monetary transfer from employees rather than having to sell the vouchers with a discount in the secondary market.

[8] See DETR (2000) for the use of the first term and Waddams-Price, Bennett and Cooke (2002) for the second.
[9] This subsidy scheme is described in more detail in Box 3.

Box 1: Welfare transfers as a transport subsidy: Chile's compensatory welfare payments due to rising transport costs

With the rise in the international price of crude oil during the last five years there was mounting political pressure in Chile —as in many other countries— to shield domestic consumers from the impact of this rise on domestic fuel prices. Bus fares rose 31% between 2003 and 2006 as a direct consequence of the increase in fuel prices. The consumer price index during this same period rose by only 7.5% indicating a very important relative price increase for public transport.

Starting in 2004 authorities chose to give a direct monetary transfer to poorer households to compensate for rising fuel and public transport prices. It was argued that this policy was much more progressive and better targeted than policies aimed at reducing retail fuel prices. Similar transfers were again granted in 2005 and 2006 for the same reason.

In the Presidential address for the budget law that conceded the 2004 transfer, the Executive declared that the transfer was sufficient for a poor beneficiary to fund higher domestic kerosene prices and *nine months of higher public transport fares*. Rising fuel prices was also explicitly mentioned as the motivation for the 2005 and 2006 transfer.

Starting in 2005 eligible households included pensioners with government guarantees or support, households in the poverty-alleviation "Chile Solidario" program, families receiving the Family Subsidy, and workers who were receiving a family supplement subsidy and who earned less than Ch$180,000 (US$350) per month. The eligible population was close to 2.2 million households, representing 40% of Chilean households.

The fiscal cost of the 2005 and 2006 transfer was US$ 63 and US$42 million, respectively. It is important to note that in 2006, pensions had already been increased for poorer people and they were thus excluded from this special transfer. This explains the lower fiscal cost in 2006. All transfers were funded from general government budget.

Gómez-Lobo (2007a) shows that in Santiago the transfer policy was much better targeted to the poor than alternative subsidies specific to the transport sector such as subsidizing bus fares or fuel prices. Thus, the social consequences of rising transport costs were countered without compromising the resource allocation benefits of cost reflective pricing for fuels and public transport.

Source: Gómez-Lobo (2007a)

However, there are at least two important qualifications to the general recommendation of using transfers and the general welfare system to address affordability issues.[10] First, it may be that society has a special interest in the actual consumption of certain goods and services. This may be due to externalities in the consumption of these goods or because they are deemed to be merit goods. Potable water is a good example in this respect since public health concerns indicate that people should consume a minimum amount of this good irrespective of their personal preferences. In this case, a monetary transfer may not be a good substitute to a direct price subsidy since part of the transfer will often be used

[10] For an excellent discussion of these and related issues see Alderman (2002).

to purchase other goods and services.[11] It may also be that the intra-household allocation of resources differs according to the way benefits are distributed. A specific subsidy on the consumption of a good may increase the resources available to certain members of the household (women, children, elderly) that would not be available had the head of household received a monetary transfer.

For transport subsidies there may be an argument along these lines in the case of children's education, children and women's access to health services and perhaps other goods and services requiring mobility. Society may value these goods more than the implicit valuation by the head of household or the parents´ interest may not coincide perfectly with children's interest.[12] In this case the direct provision of subsidized transport may be a better mechanism to achieve society's goals relative to a monetary transfer to the head of household.[13]

If the actual consumption of transport services is the justification for sectoral transport subsidies, then more emphasis needs to be placed on measuring the number of trips undertaken by individuals and how certain policy interventions affect this quantity, including studies to determine the elasticity of demand with respect to fare pricing.

The second qualification is when the country does not have a well functioning welfare system. There may be no welfare instrument in place to channel financial resources to the poor, existing mechanisms may be very badly targeted or they may generate distortions worse than those created through sectoral subsidies. Setting up means testing mechanism to screen beneficiaries and the bureaucratic institutions to make monetary transfers on a regular basis may be very costly and cost-inefficient.

Even in this case, some consideration should be given to improving or redesigning the welfare system to benefit the poor instead of relying on sectoral subsidies. Moreover, in the absence of formal targeting mechanisms subsidizing other goods and services besides transport, such as staple foods, may still be a more effective way to channel resources to the poor. This will depend on the consumption patterns of the poor and non-poor households, which is an empirical issue that should be evaluated when designing subsidies.

In general then, the need and justification for subsidies will depend on the local context. The more institutionally developed a country, the less likely transport subsidies are justified on social grounds, as better alternatives to reach the poor are available. It is important to analyze all the available options to channel benefits to the poor and avoid narrow sectoral views on this subject.

[11] For an illustration see Appendix 1.

[12] This usually calls for monetary transfers to be given preferably to female households members who in general are more empathic with children's needs than male household heads.

[13] However, there are other ways to achieve the same goal of aligning household adult members` interest to those of their children; for example, by conditioning monetary transfers on children's school attendance as in the *Oportunidades* program in Mexico.

2.3 Transport subsidies are a ubiquitous reality

Justified or not, transport subsidies are ubiquitous, especially in developed countries and this is not a recent phenomena. For example, in Canada, during the 1960s and 1970s, public transport systems received subsidies between 5% and 30% of their costs in urban areas. These figures were even higher, close to 50%, for light railways (Frankena, 1973). Most of these subsidies were regressive in terms of their distributive impacts. In the United States the public transit services have received significant subsidies for capital expenditures and operation costs (Obeng, Azam and Sakano, 1997; Pucher, Markstedt and Hirschman, 1983).

More recently, Parry and Small (2005) indicate that cost recovery from fares is 29% for US bus systems, 48% for US commuter rail and 25%-29% for transport systems of ten European nations. In the UK, £1 billion are spent annually in subsidizing local bus services (DfT, 2002) excluding the Greater London Authority transport grant. Subsidies in the Metropolitan Region of Madrid exceeded US$1.1 billion in 2005 (Vassallo and Villar, 2007). These are common examples of explicit subsidies, but implicit mechanisms as free parking and provision of infrastructure, are also very frequent.

Similar summary statistics are not available for developing countries. However, case studies indicate that in most cases public transport, especially rail, metro and publicly owned bus companies are subsidized. The main difference with developed countries is that in many developing countries bus services are provided by numerous formal and informal operators (in cars, vans or mini-buses) under cost recovery fares. Thus, it will often be the case that the mechanized transport mode used most intensely by the poor, buses or mini-buses, will not be subsidized, while the modes used relatively more by richer segments of the population are more subsidized.

2.4 Summary

The main conclusion of this section is that in developing countries the need to subsidize public transport is not as obvious as it may seem, even if there are pressing social consideration at hand. This calls for a careful analysis of the objectives behind such policies and an evaluation of alternative subsidy instruments, including the use of welfare policies outside of the transport sector.

However, under certain conditions direct transport subsides can still be justified. They may be the most effective instrument to promote society's interest in the actual consumption of transport services, in particular among certain members of the household such as women, children or the elderly. In addition, there may not be many other alternatives available to channel resources to the poor, especially when a country lacks the resources (technical and human) to set up a general welfare system.

If, for one of these reasons, or due to political considerations, transport subsidies are the chosen option, then it is imperative to analyze how to best design these subsidies and the trade-offs involved. In addition, since subsidies in the transport sector are ubiquitous

around the world, this analysis can also help to provide guidance on how to improve existing subsidies. This is the topic taken up in the following sections of this paper.

3. HOW TO DEFINE AFFORDABILITY IN THE TRANSPORT SECTOR

Given that subsidies are usually justified based on the premise that they increase affordability of low income segments of the population, it is convenient to define the concept of affordability and how it can be used in practice.

Most studies on poverty and transport estimate the percentage of monthly income or expenditure devoted to transport by poor families[14] and compare this figure to a benchmark considered "affordable" to households. Armstrong-Wright and Thiese (1987) consider that there is an affordability problem with public transport when more than 10% of households spend more than 15% of their income on work related trips. According to Venter and Behrens (2005), the South African government has established a 10% of income as a policy benchmark in its 1996 White Paper on Transport Policy (Department of Transport, 1996). Gomide, A., S. Leite and J. Rebelo (2004) use a 6% limit to estimate the affordability of public transport in Belo Horizonte, Brazil.

This approach is not exclusive to the transport sector. Foster (2005) uses 15% of a household monthly income or expenditure as the way to define affordability of three public services (water, electricity, and gas). In the water sector, there is a well established rule of thumb —whose origin is attributed to the World Health Organization (WHO)— whereby a water bill representing more than 5% of monthly household income or expenditure is considered unaffordable.

Although intuitively appealing, there are several problems with this affordability measure. The main one, as noted by Venter and Behrens (2005), is that the relation between welfare and expenditure on transport as a percentage of income may not be monotonic.[15] Therefore, it is not clear that households that spend less than 10% of

[14] Examples of studies are Fouracre (2002) for Lagos, SITRASS (2004a and 2004b) for Conakry and Douala, Gómez-Lobo (2007a) for Santiago, among many others. In formal terms, this affordability measure can defines as:

$$Aff_1 = \frac{\sum_{i=1}^{N} x_i(p_i, y) \cdot p}{y}$$

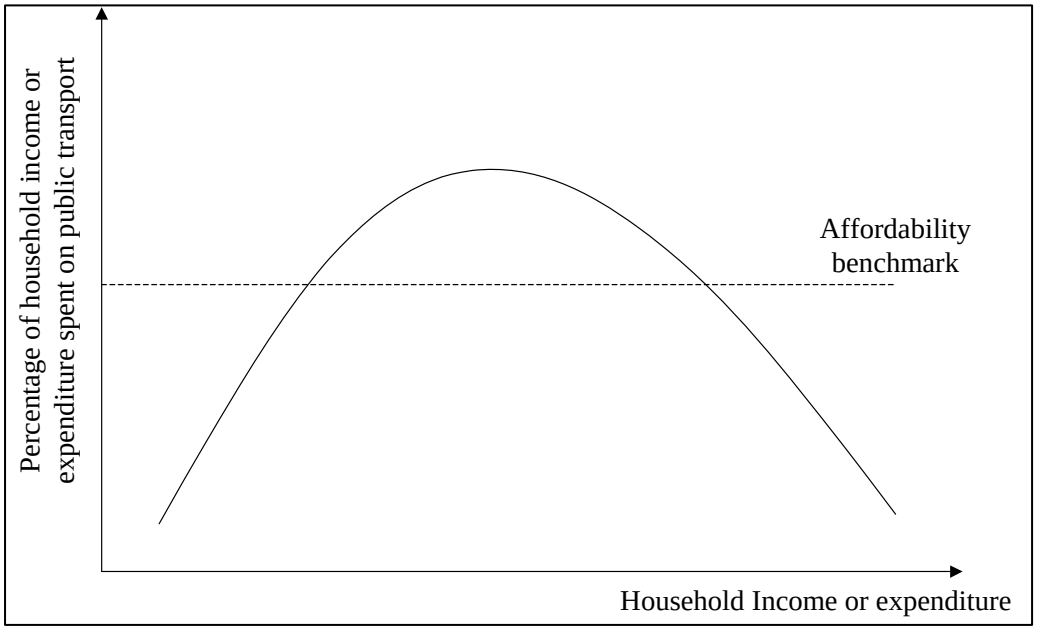
where $x_i(p_i,y)$ are the number of trips —usually public transport trips or work related trips— taken during the month by household member i, and y is household income or expenditure. The number of trips is presented as an explicit function of the price of trips and household income.

[15] Venter and Behrens (2005) also discuss some practical problems with this affordability index. Besides the reliability of survey data, especially income figures, there is the problem that household level indices may obscure access and affordability by non-earners or non-household head members of the household. What is affordable from the household perspective may not necessarily imply affordability at the individual

income or expenditure on transport are necessarily better off than people that spend more. As an example, it may be that due to the high price of public transport very poor people either walk or do not make many trips. Thus, their observed transport expenditure may be low but this is the result of a suppression of trips rather than a high level of income.

Figure 1 presents an example which may be quite typical of cities in poor developing countries. Low income households may actually spend less than middle income households on transport. This is due the prevalence of walking as one of the main modes of travel.

Figure 1: Expenditure on public transport by income level



A naïve interpretation of the affordability data from Figure 1 would indicate that only middle-income households require a subsidy given that they spend more on transport than the predefined affordability benchmark. The reason why the affordability benchmark fails in this case is due to the fact that financial (observed) transport expenditure is not the same as the generalized transport cost. If a shadow cost is used to value walking trips — to account for the relative discomfort, time and energy required compared to other modes of travel— then the expenditure on transport by the poor would increase substantially. In addition, it may be that poor people demand fewer trips due to the high cost of travel.

In order to overcome the above problem Carruthers, Dick and Saurkar (2005) use a fixed basket of trips to estimate an affordability index. They define affordability as "the ability to make necessary journeys to work, school, health and other social services, and make visits to other family members or urgent other journeys without having to curtail other essential activities". Operationally, they use the percentage of monthly per capita income

level. Using personal expenditure and income data to calculate the affordability index does not solve this problem since family resources are shared to some extent within the household unit.

or per capita income of the lowest quintile of the income distribution in a city needed to make sixty 10 km trips per month.[16]

Table 1: Affordability index for different cities assuming 60 trips per person per month

	City	Affordability Index	
		Average	Bottom Quintile
1	São Paulo	11%	107%
2	Rio de Janeiro	6%	63%
3	Brasilia	6%	59%
4	Cape Town	4%	38%
5	Buenos Aires	4%	26%
6	Mumbai	9%	23%
7	Kuala Lumpur	5%	22%
8	Mexico City	3%	19%
9	Chennai	8%	19%
10	Manila	5%	17%
11	Krakow	6%	17%
12	Amsterdam	6%	16%
13	Moscow	4%	15%
14	Guangzhou	4%	14%
15	Warsaw	4%	11%
16	New York	3%	10%
17	Los Angeles	3%	10%
18	Chicago	3%	10%
19	Singapore	2%	10%
20	Beijing	3%	9%
21	Seoul	4%	9%
22	Shanghai	2%	6%
23	Cairo	3%	6%
24	Budapest	3%	6%
25	London	2%	5%
26	Prague	2%	4%
27	Bangkok	1%	4%

Source: Carruthers, Dick and Saurkar (2005).

[16] Formally, Carruthers, et al affordability index is defined as:

$$Aff_1 = \frac{\sum_{i=1}^{N} \bar{x}_i p}{y}$$

where $\bar{x}_i$, a fixed parameter, replaces the observed number of trips taken by household member *i*, which in the case of Carruthers, Dick and Saurkar (2005) is 60 trips per month for each person.

One of the advantages of using the methodology proposed by Carruthers, Dick and Saurkar (2005) is that it makes it easier to estimate comparable affordability indices across cities and countries. Their main results are reproduced in Table 1, where the percentage of per capita income required to pay for 60 trips per month is presented for the average household and for households in the first quintile of the income distribution. Despite its attractiveness, there are problems associated with this affordability measure. In particular, it ignores possible changes in fares due to supply responses needed to accommodate the fixed number of trips considered. For example, if it were the case that every person made 60 trips per month, aggregate public transport demand would probably be much larger than current demand. Therefore, equilibrium fares would also be different unless there are constant economies of scale in public transport supply. The comparison made in Table 1 may be misleading since it does not control for the different scale of each transport system.

There are two possible applications for the affordability index developed by Carruthers, Dick and Saurkar. First, as an indicator to determine whether public transport is too expensive in a given city and therefore that something should be done about it. However, this would require defining a benchmark of what is considered "affordable". Is it 10%, 15% or 5%? Any such benchmark is arbitrary and subject to further criticisms. For example, imagine two cities, one where the transport affordability index is 15% and another where it is 10%. One might be tempted to conclude that efforts should be made to reduce the transport costs in the first city. However, what if an analogous affordability index is estimated for food (or water, land or whatever other good or service one may care about) and it turns out that in the first city is represents 45% of income and in the second 50% of income. Is it still the case that lowering transport cost in the first city is so important? In the end, households would spend the same amount of their income in both transport and food.

A second possible use of the affordability index is to evaluate the results of certain policy interventions. For example, it could be used to compare the affordability of transport before and after a certain policy was introduced. Economic theory does not have a definition of affordability but it does have well developed concepts to measure welfare changes. The use of changes in the affordability measure, as opposed to its absolute level, seems like a much more promising avenue for the practical use of this concept.

In summary, although some notable efforts have been undertaken to measure affordability in the transport sector —especially Carruthers, Dick and Saurkar (2005)— it is still not clear what welfare interpretation can be given to these measures nor how we can use them to evaluate policy interventions.

In spite of this it may still be a useful first approximation to determine the hardships faced by certain groups of the population and as a possible indicator of when further analysis may be warranted or not. As an example, the results of the case study of Madrid, Spain, summarized in Box 2, shows that for all income groups, the expenditure on urban transport is quite low. A possible interpretation of this result is that given current fares and subsidies affordability is not a pressing issue in this city.

Box 2: Expenditure on urban transport in Madrid

The following table presents the percentage of urban transport expenditure per household income in Madrid. It shows that for all income groups this expenditure is quite low. Although for poorer households this result may be partly due to repressed travel, the figures nonetheless do give the impression that distributional concerns are probably not among the most pressing issue related to public transport fares and reform in Madrid at this level of subsidization. This is not to say that there are no outstanding social or distributive concerns in this city, only that these problems perhaps should be addressed by other policies outside of the transport sector.

Monthly income	Inhabitants	% expenditure on food	% expenditure in urban public transport
< 500 €	187,662	16.09%	0.95%
500 € -1,000 €	890,371	16.85%	1.07%
1,000 € - 1,499 €	1,493,780	17.31%	1.01%
1,500 € - 1,999 €	1,269,356	14.66%	1.06%
2,000 € - 2,499 €	632,309	14.47%	1.54%
2,500 € - 2,999 €	416,801	12.57%	0.95%
3,000 € - 4,499 €	601,772	11.36%	0.87%
> 5,000 € [(a)]	123,522	10.49%	0.69%

Notes: [(a)] The results for this level of income have little representativeness.

Source: Vassallo and Pérez de Villar (2007)

4. TYPOLOGY OF SUBSIDIES IN THE TRANSPORT SECTOR

The evidence clearly shows there is a myriad of subsidies being applied to urban public transport. Independently of the reasons that justify these subsidies, a relevant question for a policymaker is, what are the options available when considering, designing or modifying subsidies? Subsidies can be classified along many dimensions according to who receives the financial transfers, the targeting mechanism used to distribute benefits and how they are funded. We will discuss each of these topics in turn.

4.1 Who formally receives the subsidy?

Formally, subsidies can be channeled to transport suppliers (supply side subsidies), or directly to beneficiaries (demand side subsidies). In turn, supply side subsidies can take two forms: infrastructure (or capital) subsidies or subsidies to cover operating costs. In both cases, the objective is to lower the cost of service to final users either by lowering the proportion of costs that must be funded from fares (supply side subsidies) or by lowering the monetary outlays of users (demand side subsidies).

It is important to keep in mind that although the final goal of all these subsidies is to benefit users, in many cases some of the benefits (or costs) accrue to others. This is the case when supply side subsidies are captured by operators in the form of higher costs and inefficiencies. In the case of demand side subsidies, equilibrium changes in the prices of

goods and services and in labor market conditions imply that the cost and benefits of subsidies may be shifted in unintentional ways among agents. These themes will be discussed further below. For now it is important to stress that care must be taken to identify correctly the winners and losers from these policies.

4.2 How is the subsidy distributed?

Subsidies can also be classified according to the method used to target beneficiaries. For example, demand side subsidies can be means tested, if some type of welfare instrument is used to gauge the socioeconomic condition of potential beneficiaries. Or they can be given to certain categorical groups, such as students or the elderly. Another method may be to use certain self-selection mechanisms. For example, if different quality services are offered, then the lower quality one may be subsidized as a way to target low income users who do not have the resources to pay for the higher quality service. Along the same lines, geographical targeting could also be used, targeting benefits and services to areas where the less well off households are overrepresented.

In general, supply side subsidies will be less targeted than demand side subsidies, since they are given to operators who will usually not discriminate between different types of users. The exception is when operating subsidies are conditioned on certain performance targets, or when certain specific services (financially non-viable rural bus services, for example) are subsidized.

4.3 How are subsidies funded?

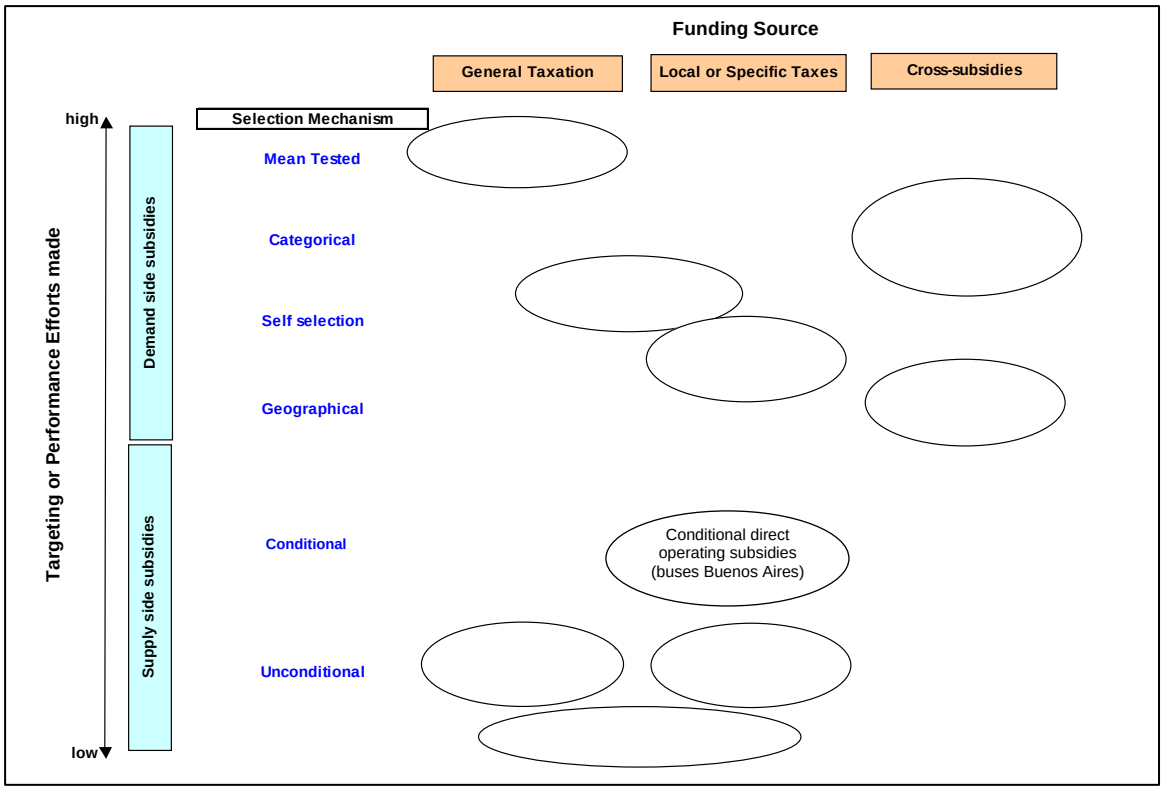
Subsidies can be funded by general taxation (direct and indirect), specific taxes including local taxes or cross-subsidies.

Cross subsidies are internal to a company, mode or to the transport system of a city as a whole. Some passengers pay more than the cost they impose on the system and this surplus allows operators or the authorities to lower the price below costs for other services. For example, in many cities transport fares are a flat rate independent of distance traveled. In this case and under some conditions, passengers on short trips pay more than the cost they generate on the system while passengers on longer trips pay less.

4.4 Examples of the different policy options

Rather than describe each subsidy type in the abstract, in this section we illustrate the options available using real world examples of transport subsidies. Figure 2 presents selected examples of policies implemented around the world classified according to the typology discussed above. Purposely we do not yet evaluate or rank these different options. That is left for the following section.

Figure 2: Subsidy typology



Source: Own elaboration

Means tested transfer funded from general taxation

The case of Chile reviewed in Box 1 is an example of a means tested monetary transfer to compensate for rising transport costs which is wholly funded from general tax sources. Since beneficiaries of this transfer were for the most part individuals receiving some other welfare payment, and eligibility for these payments are based on a sophisticated means testing procedure, it is reasonable to assume that this is a subsidy where a high effort is made to target benefits to households in need.[17]

Concessionary fares

In the UK, Madrid, Sophia, Mexico City and most other countries, special category of passengers travel free or at least at a lower price than the standard fare. This is the case of students or young children in most of these cities, the elderly, unemployed or war veterans (the later principally in Eastern Europe).

[17] The targeting instrument used in Chile is an in-depth interview to the household measuring different socioeconomic and dwelling characteristics. It is responsibility of each Municipality to undertake these interviews. More information on the Chilean targeting system can be found in Gómez-Lobo and Contreras (2003).

Transport vouchers in Brazil

Box 3 presents a summary of the 'Vale Transporte' scheme used in Brazil. This demand side subsidy is considered somewhat less targeted than the means tested transfer in Chile, since the potential beneficiaries are not means tested. However, because of the way the system operates, it does generate a self selection of beneficiaries (see Box 3) that probably keeps higher income formal workers from benefiting from the scheme. Accordingly this system can be classified as a mixture of a categorical subsidy (because it only benefits formal workers) and a self-selected mechanism.

Box 3: The 'Vale Transporte Scheme in Brazil'

This demand side subsidy mechanism was introduced in 1985 and works as follows. Employers retain 6% of formal workers earnings. In return, these workers receive from their employer transport vouchers for the home-to-work and return trips required during a month. Employers buy these vouchers at the beginning of the month from a selling agency (can be a Bank, a union of transport operators or a municipal or state government agency). Transport operators accept these vouchers and trade them in with the issuing agency for money.

Resources spent by firms on Vale Trasporte are tax deductible, thus around 35% of the scheme is funded by general tax revenues. The rest is funded by consumers (higher prices), workers (lower wages or higher unemployment), or owners (lower profits). The incidence of this labor tax needs to be studied further.

One striking characteristic of the Vale Transporte is that it provides an interesting and probably effective self-selection targeting mechanism. Workers can opt out of the system, and higher income earners have the incentives to do so since 6% of their salaries will generally be higher than what they spend on commuting. From 3 minimum wages upwards, public transport costs are below 6% of salaries for workers that take one mode of transport to get to and from work. Thus, workers with higher incomes will usually opt out of the system, helping to reduce leakages to higher income groups.

A substantial number of vouchers are sold by workers in the black market at a discount and these workers then walk, cycle or car-pool to work. Although this does not hurt formal workers, who still benefit from the scheme, it does point to the potential welfare enhancing properties of a direct monetary transfer instead of using voucher that workers later sell at a discount in the secondary market.

Gomide, A., S. Leite and J. Rebelo (2004) argue for the direct transfer of benefits to low income workers in the informal sector or the unemployed, groups that do not benefit from the Vale Transporte scheme. They note that about 50% of workers in Metropolitan Regions of Brazil belong to the informal sector and do not benefit from the scheme, a point also raised by Carruthers, Dick and Saurkar (2005).

Source: The World Bank, Internal Urban Transport Mission Report, Annex IV and Gomide, A., S. Leite and J. Rebelo (2004)

Quality self selection

Another type of self selection subsidy scheme occurs when a low quality service is subsidized and coexists with a high quality non subsidized service. Presumably, higher income individuals prefer to pay for the higher quality service while poorer households benefit from the cheaper low quality service. There are many experiences in the world that can be classified in this category. One example was found in Bogotá, Colombia (prior to Transmilenio reform), where private operators, due to artificially low tariffs set by the authorities, did not renovate their rolling stock and the quality of service deteriorated. Increasing transport fares to improve the quality of service was not politically feasible. Instead a new "executive" service was introduced with new buses but at a much higher fare.

The targeting properties of such a subsidy will depend on how precise the quality filter operates with respect to socioeconomic level. If many higher income households use the low quality service or some poor individuals use the high quality service, then this subsidy will not be well targeted.

In some sense a self targeting subsidy based on quality is analogous to subsidies operating through rising block tariffs in the utility industries. In both cases, beneficiaries are selected based on consumers' behavior, either by choosing the quantity or quality of the good or service consumed. If the experience in the utility industries can be extrapolated to the transport sector then one should not be very optimistic regarding the targeting properties of these types of subsidies.

Flat fare structure

In many transport systems, a flat rate is charged for trips of varying lengths. Since costs differ by distance traveled then an implicit cross subsidy is created whereby low cost users fund part of the travel cost of high cost users. The rate structure may also imply many other cross subsidies. For example, if peak load pricing is not used in the transport system, then off-peak users will be cross subsidizing peak users.

Examples include the case of Nairobi, Kenya, where in the 80s a monopoly service provider (KBS) used to offer commercially non-viable services in the periphery funded by the surplus generated in other parts of the network (Howe and Bryceson, 2000). Another case was Barbados before 1980 where a state owned enterprise provided services in the whole island for a flat rate regardless of the actual unit cost for service provision (Gwilliam, 1996). As we will see below these case are of interest because these fare structures became unsustainable following the introduction of competitive transport services.

Mexico provides another example of flat fare tariff structures. Except for minibuses, all other transport modes (metro, trolley buses, state-owned buses, and the new buses operating in a bus rapid transit (BRT) corridor) have a flat tariff (Flynn, 2007).

Conditional direct operating subsidies

An operating subsidy with some type of conditionality is the case of buses in Buenos Aires, Argentina. This experience is described in Box 4. The conditionality in this case is due to the fact that subsidy levels are partly dependent on the number of passengers transported and the kilometers supplied. Thus, it provides some incentives for performance improvements.

Box 4: Direct transfers to bus operators in Buenos Aires

In Argentina, since the 2002 economic crisis, bus operators receive a direct transfer from the government to keep fares low. This subsidy is based on the number of passengers transported, the firm's gross revenues and kilometers supplied. It is funded from a specific tax on diesel fuel (bus operators do not pay the tax on diesel oil, which in practice implies an additional indirect subsidy). It is interesting to note that the uncertainty regarding the continuity of the subsidy (it has been changed 26 times during the first three years it has been applied), affects investment incentives. (Krantzer, 2005, Bondorevsky, 2007).

Foster (2005) notes that given the excess capacity in the sector, a better choice might have been a demand side subsidy in this case. This would have allowed excess capacity to be eliminated in those routes were there is no demand for the service, increasing allocative efficiency. However, as noted by Krantzer (2005) the 2001/2002 crisis was so dramatic that given the available time frame the only reasonable choice to keep the public transport system afloat was to introduce this supply side subsidy. Furthermore, a demand subsidy would have been ineffective since only 2 million of the 6 million poor in the Buenos Aires Metropolitan Region would have been targeted had social security programs (such as Plan Jefas y Jefes de Hogar) been used as a targeting mechanism. The errors of exclusion would have been very high. However, Bondorevsky (2007) shows that the majority of subsidy resources go to households in the middle of the income distribution and are thus regressive. Moreover, a comparison between 2002 and 2006 indicates that the incidence of subsidies became more regressive, as the economic recovery process has led to a relatively more intense use of buses by households in the middle of the income distribution.

Source: Foster (2005), Krantzer (2005) and Bondorevsky (2007).

Fuel tax rebate

In the UK operators receive a rebate on tax paid for fuel by public transport vehicles. This subsidy is usually referred to as the Fuel Duty Rebate (FDR) but is now formally called the Bus Service Operators Grant (BSOG). This scheme refunds about 80% of taxes paid on fuel. One problem with the scheme is that subsidies are not conditioned on specific performance targets. In addition, as noted by Carruthers, Dick and Saurkar (2005), these subsidies bear no relation to income or poverty. In the DfT (2002) consultation, options were presented to modify the FDR in order to target it better to meet social, economic and environmental objectives.

In Germany, a part of fuel tax revenues is earmarked for public transport improvements and local road network investments (ECORYS and NEA, 2004). This is an instance of an infrastructure subsidy funded from specific taxation.

Infrastructure grants

A very common supply side subsidy occurs when governments fund infrastructure investments without users having to pay for this investment through fares. This is the general rule for most rail or metro projects and —except for the rare cases where roads are tolled— for road infrastructure. Targeting the poor through infrastructure investments is bound to be less focalized than demand side alternatives unless the infrastructure funded is particularly useful to the poor (such as bicycle routes or walking infrastructure, and in general all infrastructure aimed at improving access of the poor to public transport). Given the poor targeting characteristics of infrastructure projects, there are high risks of leakages to the middle to higher income classes[18]. In developing countries, where tax systems are usually regressive, this implies subsidies from low income to high income households.

Unconditional operating and capital subsidies

The last category considered are subsidies given to operators with scant performance conditions. This is often the case with deficit prone public transport operators. Annual projected deficits are covered by government transfers. However, operating subsidies can also be given to private operators.

As mentioned earlier, urban transport systems in the US were and still are heavily subsidized. According to Pucher, Markstedt and Hirschman (1983) these subsidies were not made contingent on performance standards, productivity growth, cost containment, ridership targets or other social, economic or environmental goals. Thus it is not surprising to find ample evidence that subsidies raised costs. According to Obeng, Azam and Sakano (1997) urban transport subsidies in the US are partially funded by dedicated local taxes on property, utility, fuel and sale taxes. In 1989, 17.5% of total transit revenues came from these sources. However, some federal funding is also available.

5. CRITERIA AND TRADE-OFFS FOR CHOOSING SUBSIDIES

Until this point, we have abstained from making normative judgment regarding the different subsidy schemes applied in practice or the options available. In this section we discuss different criteria by which these affordability policies should be evaluated. We also discuss the trade-offs involved. Through this discussion we hope to delineate what may be considered as best practice in this field.

[18] For example, in Washington DC, USA, the profile of metro users shows that 73% of users have annual household income of US$75,000 or more, while for buses, the share is only 34% (Ginsberg and Stanton, 2007).

5.1 Distributive impact

Naturally, an important consideration relating to subsidies motivated by social or distributive reasons is whether or not they are capable of delivering the pro poor impact that justify them in the first place, if that was the policy objective. In the following sections of this paper we will discuss how to measure the distributive impacts of subsidies and some of the available empirical evidence.

Although the targeting of subsidies is an empirical matter that must be addressed on a case by case basis, there are reasons to expect that certain subsides work better than others in this respect. Supply side subsidies will usually be poorly targeted since they do not discriminate different types of users. In part, this is due to the fact that many supply side subsidies operate as a general price reduction. Thus, eligibility and the amount of subsidies received are based on the consumption of the good or service in question. When there are many poor households who do not use a subsidized service or when consumption of the service increases with income, the subsidy benefits will not be particularly targeted to poor households.

As shown further below, the empirical evidence confirms for the most part that supply side subsidies are not particularly pro-poor. Demand side subsidies have a higher targeting potential if some type of effective eligibility criteria is used to screen poor and non-poor households. Unfortunately, there is no guarantee that such a screening mechanism will be well targeted. For example, geographically targeted utility subsidies in Colombia are not well focalized, in spite of the fact that the central government gives very careful instruction to each Municipality on how to determine the socioeconomic category of each dwelling (Gómez-Lobo and Contreras, 2003). A case in the urban transport sector is Mexico City, where Metro riders tend to belong to middle income families, due to its location in mostly middle income areas of the City. In parallel, many low income Metro riders are forced to pay double to transfer from another system to access Metro. In the case of the later, they benefit from the subsidy to ride Metro, but the whole trip becomes significantly more expensive in the absence of tariff integration.

The evidence for categorical subsidies is not very good either. In Madrid, Spain, preferential fares for groups such as the elderly or the young are not related to income (Vassallo and Villar, 2007). In Sofia, Bulgaria, access to preferential passes is to some extent correlated with income, but the targeting properties can not be considered satisfactory (ECORYS and NEA, 2004). In Santiago, Chile, student preferential fares are progressive, but the cross subsidy used to fund them are regressive. The balance is a neutral impact (for details see Gomez Lobo 2007a).

Overall we can safely conclude that targeting subsidies to reach the poor is very difficult and perfect or near perfect targeting is impossible. Therefore, as in most other economic settings, all available alternatives for the transport sector will be imperfect and the challenge is to choose the design option that is “best suboptimal” in relative terms not in absolute terms. This in turn requires some numerical simulation in order to compare possible design options.

5.2 Productive efficiency

Beyond the distributional impact, an important consideration when evaluating subsidies is the effect that a given policy may have on the productive efficiency of operators.

There is ample evidence that supply side unconditional subsidies reduce productive efficiency. In the United States Obeng, Azam and Sakano (1997) show that transit subsidies to operators distort input use and increase costs, especially for smaller firms (less than 500 vehicles). More recently, Obeng and Sakano (2000) show that capital and operating subsidies to transit firm in the US do affect input use and thus affect productivity and the costs of these firms. They find that capital subsidies increase technical change while operating subsidies reduce technical change. However, the net effect of subsidies on technical change was negative. They find that operating subsidies promote the use of more labor and fuel than would be optimal, and that capital subsidies do not wholly compensate for this effect. They also show that in the aggregate transit firms do not minimize cost as a result of the incentives of the subsidy structure.

Supply side subsidies could have other negative effects. They can lead to the provision of excessive quality of service through excessive frequencies, a level of comfort that is too expensive for the system (air conditioning, carpet floors) and permanence of an inefficient routing design. Lowering fares may be an appropriate way to make sure subsidies are not dissipated in the form of excessive service (Else, 1985).

Therefore, care must be taken when designing supply side subsidies. Benefits must be tied to productivity and performance conditions to avoid efficiency problems. The use of specific tendered contracts is an interesting alternative. By forcing operators to compete for contracts reduces the efficiency problems that supply side subsidies may create. Still, the arguments provided would indicate that demand side subsidies are preferable to supply side subsidies.

5.3 Equity, effectiveness and efficiency of the funding mechanism

As argued by Proost (2001) the financing side of a subsidy is important. This relates not only to the distributive impact of the funding mechanism, but also to the economic efficiency of the tax and the possible perverse incentives it may create.

As for efficiency, all taxes generate a deadweight loss on the economic (this is known as the cost of public funds). Ideally, funding should be raised using those mechanisms with the lowest deadweight loss. Although it not possible to generalize, usually local and specific taxes will generate a greater deadweight loss per revenue compared to income or general consumption taxes (such as the value added tax). This is due to the smaller tax based of local taxes. Cross subsidy financing is probably even less efficient.

Cross subsidies also encourage cream skimming of the profitable market niche, which may generate inefficient entry into the system and make the operations of the incumbent

financially unsustainable. This seems to have occurred in Barbados during the 1980s (Gwilliam, 1996). The Barbados Transport Board (BTB) was responsible for providing services in the whole island at the same fare. During the eighties, and minibuses where licensed to operate. The new vehicles operated the shorter more profitable routes, and between 1980 and 1984 took away 33% of BTB's patronage. During the following years, BTB demand continued falling by 3% a year. Besides the financial losses this has generated to BTB, many of the shorter routes are served by vehicles with higher unit costs compared to the BTB fleet. Thus, the flat rate system generated inefficient entry and compromised the financial viability of BTB. Something very similar happened in Nairobi, Kenya, where competition by another bus company and shared taxis forced the main service provider (KBS) to rebalance tariffs, thus eliminating cross subsidies to peripheral areas (Howe and Bryceson, 2000). Cross subsidies are not sustainable under competition.

Incentive issues are also important. When subsidies are funded from cross subsidies, operators may not have an incentive to provide service to low fare groups. For example, in Wuhan, China, poor people are eligible for a card which qualifies them for lowered price public transport. Senior citizens and the disabled have a similar card which gives them the right to free transport. However, operators avoid taking on these passengers, or do not recognize the preferential fare allowed for these groups, reducing considerably the effectiveness of this type of subsidy (Shuiying, Han, Weili and Dening, 2003). Something similar occurred with the student fare pass in Santiago, Chile (before the implementation of Transantiago). Operators avoid taking on student passengers, especially during peak hours. Still another example is in Kingston, Jamaica, where operators do not always honor the obligation to carry schoolchildren at the established concessionary rate (Gwilliam, 1996)

Finally, cross subsidies are often opaque. It is not clear who is paying for the subsidy and how much, nor which are the eligibility criteria for beneficiaries. This lack of transparency does not improve the targeting properties or the efficiency of a transport subsidy.

5.4 Administrative costs

Another consideration for the design of subsidies is the administrative costs. In general, a supply side subsidy will be cheaper to implement, since there are less agents involved and no screening mechanisms need to be setup. However, as discussed above they are also the worst targeted and they may generate inefficiencies reducing the benefits received by final users of the service.

The administrative costs for geographical subsidies are also low, but the targeting properties will depend on the geographical concentration of different social groups. Categorical subsidies probably also have low administrative costs, although some type of card or credential will be required. Therefore, there will be costs associated with the generation and distribution of these cards, as well as in screening potential beneficiaries and controlling fraud.

Arguably, means testing is the most expensive targeting mechanism. Some type of screening mechanism must be devised and applied. It probably does not make sense to set up such a mechanism just for one subsidy, say a transport subsidy. Therefore, the application of this targeting method will depend on the mechanisms already in place in a given country. There are strong economies of scope in this area, in the sense that if the same mechanism is used to target many different government subsidies then the cost can be quite low.

5.5 Transparency, reversible policies and fiscal sustainability

There are also some other issues that need to be considered when evaluating a subsidy design. Transparency is a positive and desirable characteristic. Knowing exactly who gets the benefits and who pays will reduce the rent-seeking behavior by some non-poor groups to capture the available resources. Ideally subsidies should be reversible, in the sense that they can be discontinued once the original justification is no longer relevant. This would tend to favor sporadic direct compensatory payments, as in Chile, instead of regular continuous supply or demand subsidies which once introduced are very difficult to remove.

The fiscal cost of a subsidy scheme needs to be carefully considered. Agencies in charge of the administration of a subsidy should prepare frequent reports detailing the total amount of resources devoted to it and where they come from. This issue is related to the distributive incidence issue. For a limited budget, the better the targeting properties of a subsidy the higher will be the impact on poor people. However, no subsidy can be perfectly targeted and consequently some deserving households will not receive any benefit, no matter how well designed the targeting mechanism used. The point is that to reach all deserving households, one must be willing to tolerate high leakages to non-deserving households. This can be very expensive. Therefore, there will often be a trade-off between the targeting properties of a subsidy and the fiscal expenditure required. Better targeting alleviates this trade-off, but does not eliminate it completely.[19]

6. HOW SHOULD AFFORDABILITY POLICIES BE ANALYZED IN URBAN TRANSPORT?

It is crucial to evaluate the distributive impacts of subsidies in order to evaluate whether they are effectively meeting their social and distributive objective. To this end, in this section we discuss some methodological issues relating to the empirical estimation of these impacts.[20] The proposed methodology can then be used to evaluate different existing transport affordability measures and to guide policy makers in making informed

[19] These issues are discussed in Gómez-Lobo and Contreras (2003) for the case of water subsidies in Colombia and Chile.

[20] Gómez-Lobo (2007b) is recommended for the reader interested in the technical details of a welfare approach to measure the impact of affordability policies, including applications to the transport sector and a discussion of possible alternatives when the scarcity of information precludes the use of the methodological approach presented in this paper.

judgments on reforms in this area. Applied cases of subsidies and their distributive incidence are presented in Section 7.

The ideas presented in this section are well developed in the welfare economics and income distribution literature, but have not been applied to the transport sector It is hoped that this section will clarify the microeconomic basis for many of the approaches used to evaluate subsidy policies and discuss the most useful ways to present the available information.

From a practical point of view, detailed information on household travel patterns and socioeconomic characteristics is ideally required in order to apply the methodology proposed. While in many cases a household survey and mobility study will be available for a given city, in others, especially in developing countries where data collection efforts are less frequent, the information available will be sparser or outdated.

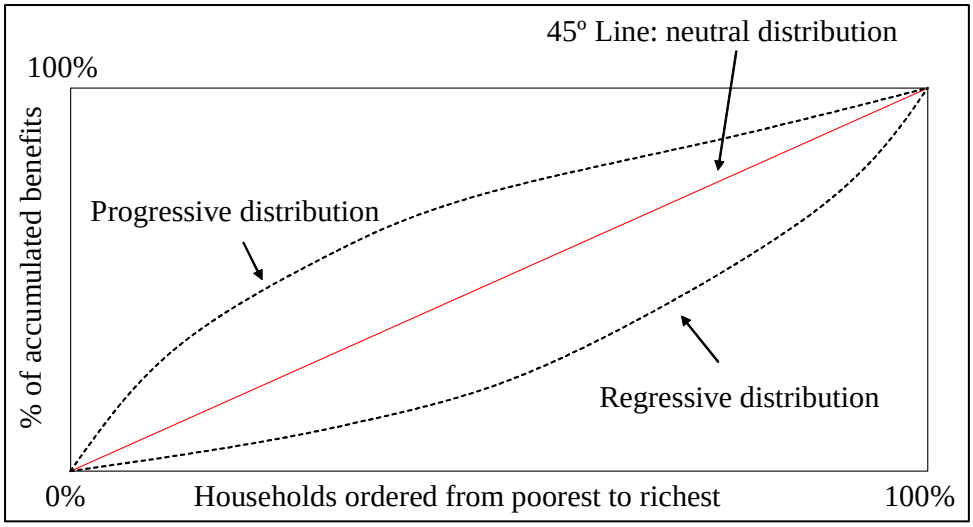
This paper presents an approach consistent with the income distribution literature, and already applied to utility and transport subsidies by Foster (2005), among others. The distributive implications of affordability policies are analyzed by graphing the Lorenz curve or relative benefit curve.

The relative benefit distribution curve (or Lorenz curve) graphs the percentage of a subsidy accruing to the first nth rank of households, according to some measure of income, expenditure or wealth distribution. More formally, the graph of a relative distribution curve can be defined as:

$$r(j) = \sum_{h=1}^{j} \frac{s_h}{S} \cdot 100$$

where h denotes the jth ranked household from the lowest to the highest, r(j) is the value of the graph at the household ranked j, sh is the benefit accruing to household h and S is the total benefit distributed by the policy. Figure 3 gives an example where two curves are graphed. The curve above the 45º line shows a progressive distribution of benefits, since K% of poorest households receive more than K% of the total benefits whatever value of K is chosen. The curve below the 45º line shows a regressive distribution of benefits since poorer households now receive less than a proportional amount of the benefit.

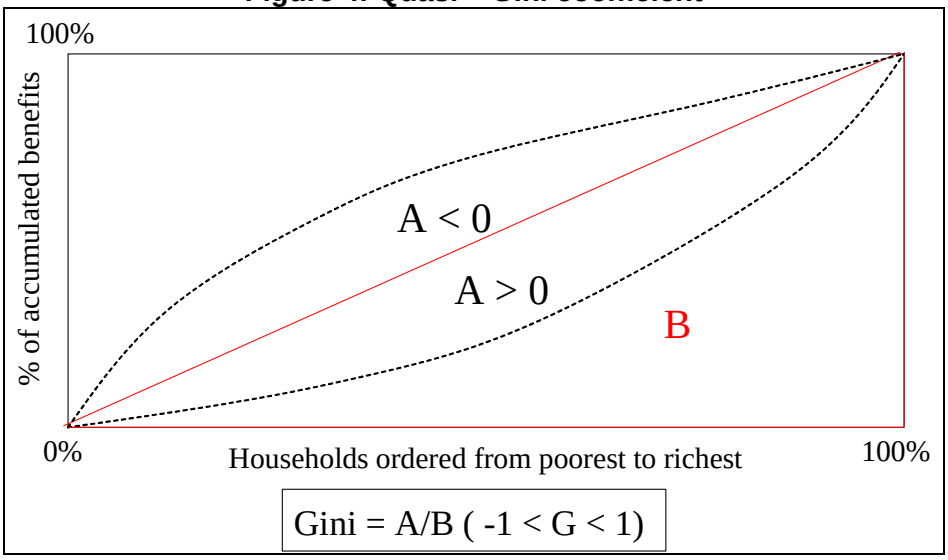
Figure 3: Progressive vs. Regressive distribution



The relative benefit curve is a very useful tool when comparing the distributive impact of different policies since it gives a graphical representation of the relative incidence of benefits. When the curves for different policy interventions are superimposed on the graph it will often be possible to rank them according to their distributive impact. This will be the case when the different curves do not cross each other, in which case the highest curve will dominate the others in terms of progressiveness.

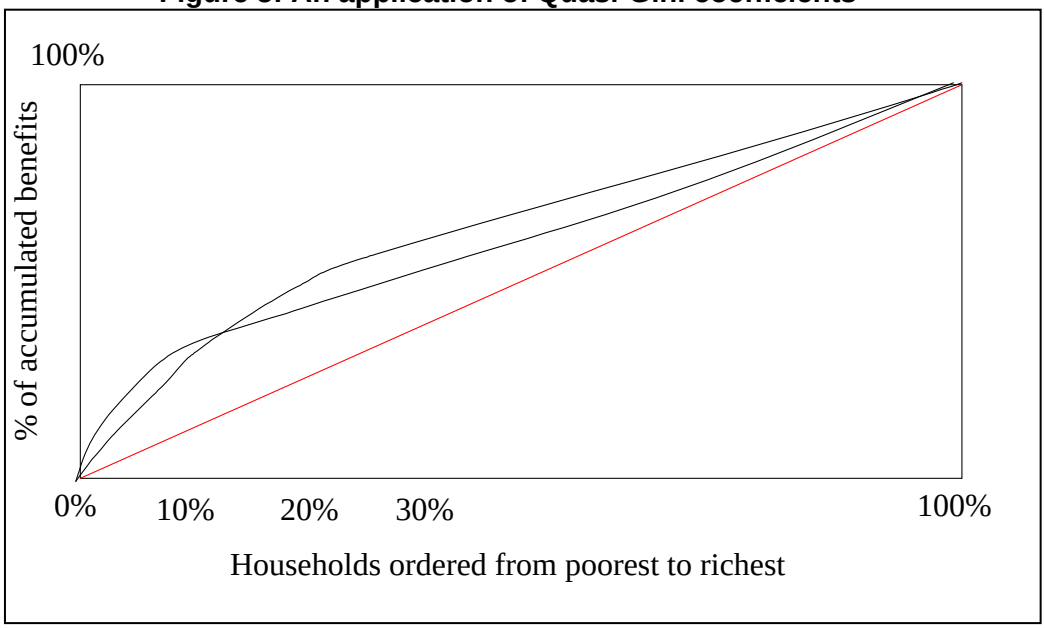
Associated with the relative distribution curve is the Quasi-Gini coefficient which gives a summary measurement of the progressive or regressive nature of the policy in question. This coefficient is calculated as the area between the 45º line and the distribution curve (with a negative value when the curve is above the 45º line) over the area below the 45º line. This is illustrated in Figure 4. The closer the Quasi-Gini coefficient is to -1 the more progressive is the distribution of impacts.

Figure 4: Quasi – Gini coefficient



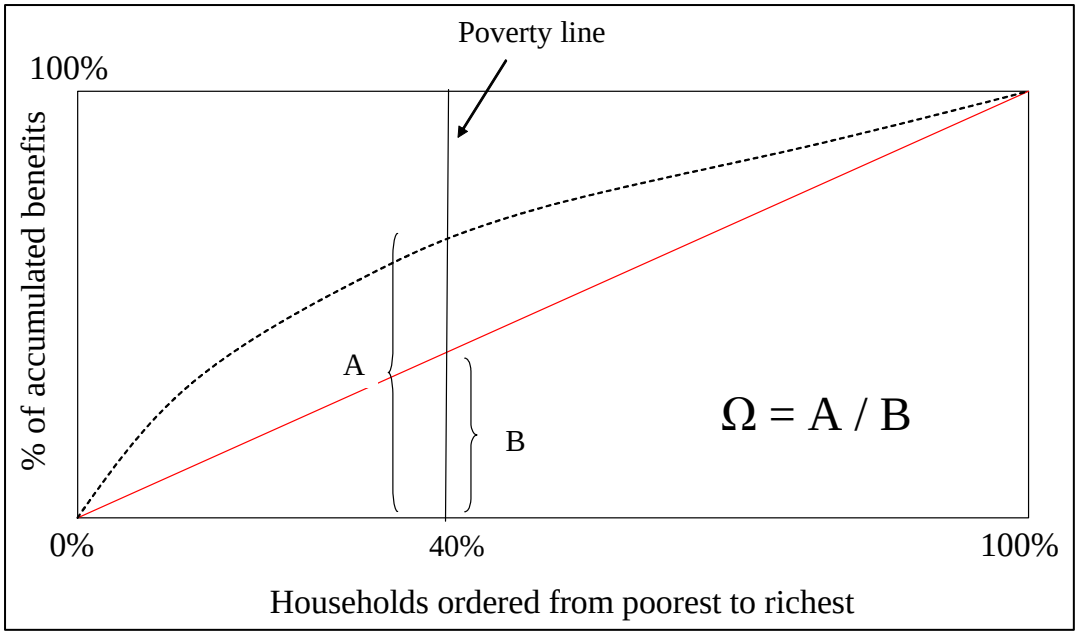
The Quasi-Gini coefficient will also allow an unambiguous ranking to be made of the different policies if their associated distribution curves do not intersect. When these curves intersect then the Quasi-Gini coefficient may not rank policies correctly. For example, the relative benefit curves shown on Figure 5 could have the same Quasi-Gini coefficient, but the first curve shows a higher proportion of benefits to the lowest 10% of households, while the second curve is less generous to this group but more to households in the second and third deciles of the income (wealth or expenditure) distribution. The Quasi-Gini coefficient, being a summary statistic, does not show this last point. Thus, the relative value attached to the welfare of the poorest among the poor may be important when evaluating the merits of different policies. Therefore, in some cases graphing the relative distribution curves will be preferable to just reporting the associated Quasi-Gini coefficients.

Figure 5: An application of Quasi-Gini coefficients



Besides the Quasi-Gini coefficient, another summary measure of the distributive incidence of a subsidy is the percentage of the subsidy accruing to poor households over the percentage of the population represented by poor households. This is the Ω value used in Komives, et al (2005) and is presented in Figure 6. This approach requires the analyst to define the set of poor households beforehand. For example, in Figure 6 it is assumed that poor households are the poorest 40% of the population. The Ω value will be the percentage of the total subsidy accruing to this group, which is read from the relative distribution curve, divided by 40%. It will be above 1 for a progressive subsidy and below 1 for a regressive one.

Figure 6: Ω value assuming 40% as poorest HH

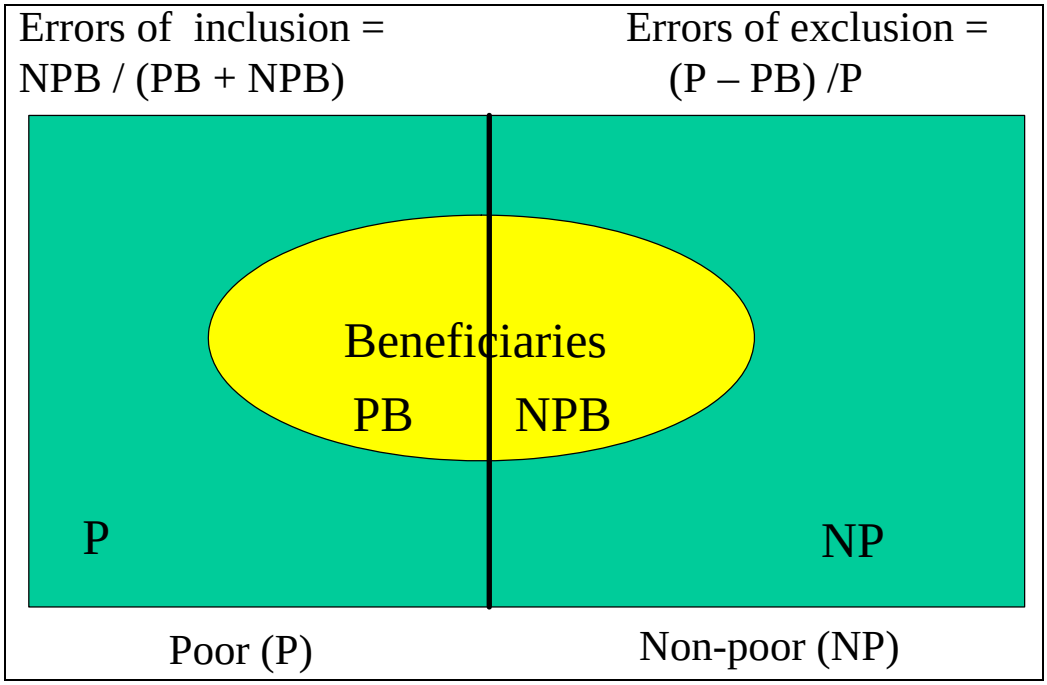


Another approach to measure the distributional impact of policies —and complementary to the relative benefit curves— is the estimation of the errors of exclusion and inclusion. The error of exclusion of a subsidy is the percentage of the target population of the policy (poor households) who do not receive any benefit. The error of inclusion is the percentage of benefiting households who should not be receiving this benefit (do not belong to the target population) and represents the leakage of resources of the policy to non deserving households.

Figure 7, taken from Foster (2005), illustrates these concepts graphically. The population is first divided between poor (P) and non-poor households (NP) and beneficiaries (that is households that receive the subsidy) are divided between those who should receive the benefit due to their poverty condition (PB) and those who should not receive it (NPB). The errors of inclusion are the non-poor who receive the benefit (NPB) over all beneficiaries of the policy (PB+NPB). The errors of exclusion are the poor who do not receive any benefit (P – PB) over the total number of poor households (P).

To calculate the errors of inclusion and exclusion households must first be classified as poor and non-poor. Usually this is done by defining households in the first few quintiles of the income distribution as poor. However, this is somewhat arbitrary. An interesting alternative is to present the information graphically so that these errors can be determined for whatever poverty line the analyst wishes to use.

Figure 7: Errors of inclusion and exclusion



To explain this approach we must introduce another graph, the absolute beneficiary curve. This curve graphs the cumulative number of beneficiaries against the rank of households:

$$B(j) = \frac{\sum_{h=1}^{j} I_h}{N}$$

where Ih is an indicator function that takes a value of one if household h receives the benefit under analysis and zero otherwise and N is the total number of households in the population. The errors of exclusion and inclusion can be determined easily from the cumulative beneficiary curve as explained in Gómez-Lobo and Contreras (2003) and in Figure 8 and 9. The horizontal axis ranks households from poorest to richest, as in the relative benefit curve, but the vertical axis now measures percentages of the population. The curve will cross the right vertical axis at a point equal to the percentage of the population receiving a subsidy.

As an illustration, assume in the graph that the poor are considered to be households in the first two quintiles of the income distribution. Then, a perfectly targeted subsidy will imply that the percentage of the population benefiting from the policy will be equal to 40% of the population and that all beneficiaries belong to the first two deciles of the population. That is, the cumulative beneficiary curve will be a line along the 45º line up to the 40th ranked household and horizontal thereafter.

Figure 8: Targeting – Cumulative curves

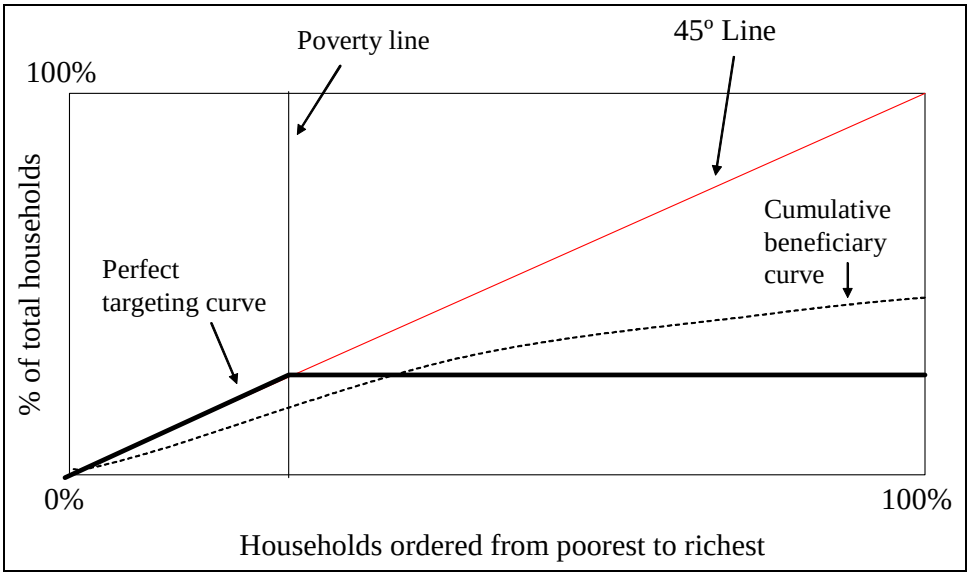
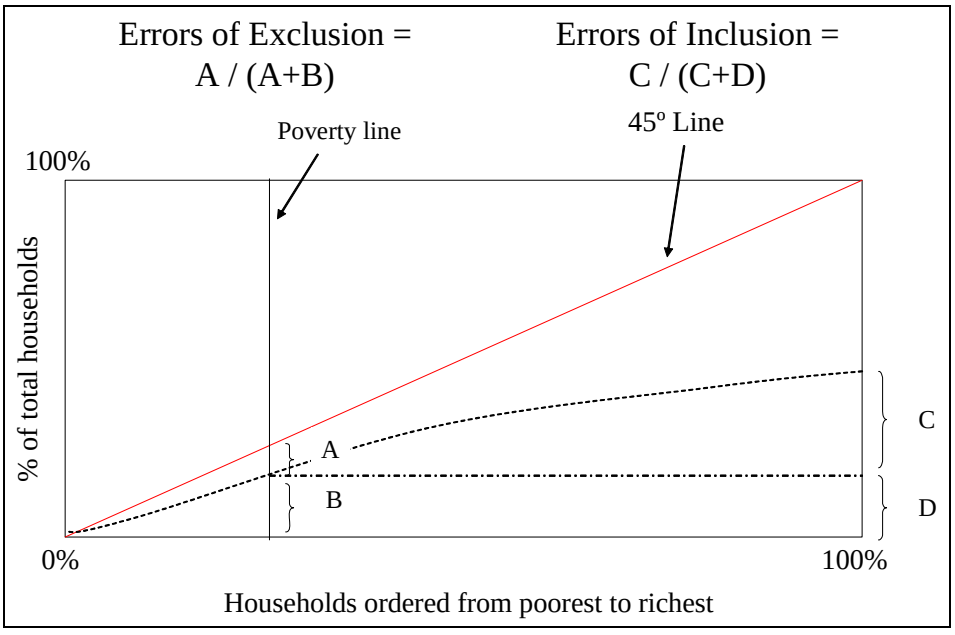


Figure 9 shows how to read off the errors of exclusion and inclusion from the cumulative beneficiary curve. The error of inclusion is equal to the proportional difference between the point where the effective cumulative beneficiary curve cuts the right axis and the projected point on the right axis where the cumulative beneficiary curves cuts the poverty line definition. Likewise, the errors of exclusion can be read off the graph as the proportional difference between the point where the poverty line cuts the 45º line and the point where it cuts the cumulative beneficiary curve.

Figure 9: Errors of Exclusion and Inclusion



The advantage of using this graph instead of calculating the errors of exclusion and inclusion directly is that one does not have to define beforehand who is and who is not in the target population. By presenting this information in graphical form one can read the errors of exclusion and inclusion for different definitions of the target population (e.g. households in the first two deciles of the income distribution or perhaps households in the first four deciles of the income distribution).

In summary, when studying the distributive impacts of policies it is preferable to present the relative benefit and cumulative beneficiary curves. Complementary to these graphs, it is recommended that some summary statistics, such as the Quasi-Gini coefficient and the errors of inclusion and exclusion for a given definition of the target population also be presented.

7. WHAT DOES THE EVIDENCE SAY?

Up to this point the discussion has been for the most part conceptual. In this section we review the empirical evidence available regarding the performance of different transport subsidy schemes. However, we first present a review of the lessons learned from subsidies in the utility sectors. This review will help to put the evidence from the transport sector in perspective.

7.1 Lessons from the utility sectors

Most of the arguments justifying affordability measures in transport are relevant for utility services. As in transport, utility subsidies are ubiquitous. A review of the literature shows there are many studies that analyze the distributive impact of subsidies in utilities, while very few case studies can be found for the transport sector. Therefore, it is important to draw the main lessons from the utilities case studies. In this section we summarize the results and lessons from a comprehensive international study of electricity and water subsidies undertaken by Komives, Foster, Halpern and Wodon (2005), although many other studies are consistent with their results.[21] The lessons are the following:

1) Quantity targeted subsidies in the utility sector are for the most part regressive

Quantity based subsidies are distributed according to the consumption characteristics of the good or service in question. For example, a universal subsidy that decreases the price of electricity or water across all users and for all consumption levels is a quantity based subsidy. The amount of the subsidy received will depend on the units of the good consumed. More sophisticated consumption based subsidies are increasing block tariffs (IBT) or volume differentiated tariffs (VDT). The analogy with the transport sector is a subsidy that lowers transport fares across the board as with most supply side subsidies or untargeted demand subsidies.

[21] See for example The World Bank (2000; 2002) and Foster and Araujo (2004) just to cite three examples.

Table 2 presents the results of Komives, et al (2005) in relation to these types of subsidies. Besides the errors of exclusion, the table presents the Ω parameter introduced in Section 6. It represents the percentage of total benefits accruing to the poor divided by the percentage of the poor in the general population. This parameter will be above 1 when the subsidy has a progressive impact on the income distribution and a value below 1 when its impact is regressive.

It can be seen from the table that out of the 25 real world subsidies analyzed not one of them was distributed progressively. In all cases —except in Gujarat India where the subsidy had a neutral impact on the income distribution— benefits accrued proportionally more to the non-poor than to the poor. This implies that the poor would be made better off if these subsidy were eliminated and the financial resources thus liberated were distributed randomly across the population.

Table 2: Distributive impact of different quantity based subsidies in the electricity and water sectors

Country, city	Type of subsidy	Ω	Error of exclusion
Electricity cases:			
Guatemala	VDT	0.20	55.4
Honduras	VDT	0.49	56.0
Peru	IBT	0.82	59.9
Cape Verde	IBT	0.48	75.6
Sao Tome and Principe	IBT	0.41	76.8
India: average	IBT	0.70	21.0
India, Kerala	IBT	0.65	14.5
India, Andhra Pradesh	IBT	0.78	16.4
India, Tamil Nadu	IBT	0.53	15.3
India, Karnataka	IBT	0.74	18.6
India, Maharashtra	IBT	0.66	13.8
India, Madhya Pradesh	IBT	0.70	12.4
India, Gujarat	IBT	1.00	21.6
India, Orissa	IBT	0.71	40.1
India, Punjab	IBT	0.91	13.4
India, Haryana	IBT	0.66	15.4
India, Rajasthan	IBT	0.84	20.7
India, Delhi	IBT	0.57	9.1
India, Uttar Pradesh	IBT	0.66	25.8
India, West Bengal	IBT	0.62	30.5
India, Bihar	IBT	0.43	47.7
Water cases:			
Nepal, Katmandú	IBT	0.56	53.0
India, Bangalore	IBT	0.66	60.5
Sri Lanka	IBT	0.83	69.5
Cape Verde	IBT	0.24	89.7

Source: Table 5.1, Komives, et al (2005).
Note: Real subsidies reported. Simulated cases not shown.

The evidence seems to indicate that quantity based subsidies are a failure from a distributive point of view. There are several reasons for this negative result. The most important is related to lack of access, that is, many poor households are not connected to these services and thus are unable to benefit from subsidies based on the consumption of these goods. It is important to keep this point in mind when discussing the targeting properties of transport subsidies since something analogous can occur if poor households do not use public transport intensively (they walk, for example) or simply can not use transportation services due to the location of the household beyond the catchment area of the system.

A second reason why these subsidies do not seem to work is that there is a large variance in consumption of utility services among household with the same socioeconomic level. This implies that a rising block tariff that tries to target subsidies based on the consumption level of the household will usually not work. There will be just as many non-poor households as poor households consuming in the low priced block as in the high priced block.

2) Targeting efforts improve the distributive impact of subsidies but only means testing has a significant positive impact

A second lesson is that the targeting performance of subsidies increases if some effort is made to target them to specific users. However, significant progressive distributional impacts are achieved only when beneficiaries are means tested for socioeconomic conditions.

Table 3 shows the performance of water and electricity subsidies where some effort is made to target benefits. Geographical targeting improves the distributive impact over quantity based subsidies. However, they are only mildly progressive and almost neutral in their impact on the income distribution (Ω close to 1).

Means testing performs much better in terms of the distributive impact of subsidies. This implies that most of the resources transferred accrue to the target population, minimizing errors of inclusion. Nevertheless, the errors of exclusion are quite high, showing the trade off between targeting performance and coverage of the subsidy. It is highly probable that the high errors of exclusion are due to the limited budgetary allowances of the programs. At least this seems to be the case in Chile. Consistent with the results of Komives, et al (2005) shown above, Gómez-Lobo and Contreras (2003) find that for the amount of resources spent, the means tested Chilean water subsidy was better targeted than the geographically based subsidy used in Colombia. However, the errors of exclusion were much higher in Chile than in Colombia. The main message from these results is that targeting the poor is difficult and if the policy maker wants to cover all of the target population, she needs to be willing to have high errors of inclusion, which implies spending considerable amount of resources in the program.

3) Subsidy design could be improved but only up to a certain limit

Another important result from studies such as Komives, et al (2005) is that there is a limit to the targeting improvement that can be achieved by improving the design of quantity based subsidies. Their simulations show that the improvements in the distributional impacts of some of the subsidies shown in Table 2 would increase only marginally if the design was improved. For our purposes, it is interesting to analyze the reasons for this last result. The main problem seems to be the access problem. If a significant proportion of poor users are not connected to the service (i.e. do not use public transport services or are not within the catchment area of the transport service), then any subsidy distributed through the price of the service is not going to be progressive.

Table 3: Distributive impact of different subsidies where some administrative selection of beneficiaries is made

Country, city	Type of subsidy	Ω	Error of exclusion
Geographic targeting			
Electricity cases:			
Colombia, Bogotá	Geographically defined tariffs with IBT	1.10	3.7
Mexico	Geographically defined tariffs with IBT	0.60	n/r
Water cases:			
Nicaragua, Managua	IBT plus slum discount	1.18	5.0
Venezuela, Merida	BT plus slum discount	1.09	0.0
Colombia, Bogotá	Geographically defined tariffs with IBT	1.09	1.9
Means testing:			
Electricity cases:			
Argentina	Average of provincial jeans-tested subsidy	1.50	94.0
Georgia, Tbilisi	Limited free allowance of electricity for targeted households	1.20	75.0
Water cases:			
Argentina	Average of provincial jeans-tested subsidy	1.23	76.0
Chile	Discounts of 40-70% on 15m3 for targeted households	1.63	78.0
Paraguay, urban	Discount on 15 m3 for targeted households (means test based on housing characteristics)	1.64	93.1

Source: Table 6.3, Komives, et al (2005).
Note: Real subsidies reported. Simulated cases not shown.

7.2 Evidence from the transport sector

The distributive performance of transport subsidies has been scarcely researched, marking a stark contrast with the electricity and water sectors. This paper summarizes the

available evidence on the incidence of transport subsidies and relies on new evidence provided by case studies of the cities Santiago de Chile, Mumbai, Mexico City, Buenos Aires and Madrid prepared for a World Bank research project and completed in 2007. The evidence seems to point in the same direction as that found in the utility sectors, namely that affordability measures are usually badly targeted. In addition, the fact that in many cases poor people are priced out of public transport creates the same "access" problem as in the utility sectors.

Brazil

Box 3 reviewed the transport voucher program in that country ('vale transporte'). Gomide, A., S. Leite and J. Rebelo (2004) note that about 50% of workers in Metropolitan Regions of Brazil belong to the informal sector and do not benefit from the scheme.Therefore, it seems that the error of exclusion for this subsidy is quite high. Since informal workers will most probably earn less than formal workers, it is highly likely that the poorest workers do not benefit from the scheme.

Sofia, Bulgaria

The preferential fares for students, the elderly and others are an example of categorical subsidies. In the case of Sofia, ECORYS and NEA (2004) show that the distribution of preferential passes were not well related to income, as the following table shows. Although access to preferential passes is to some extent correlated with income, especially for households, the targeting properties are not satisfactory. In addition, these results do not show the impact of the funding side of the subsidy, which could be regressive if it is funded through cross subsidies.

Table 4: Share of preferential passes by income groups, Sofia

Income level	With preferential pass	Without preferential pass	Total	With preferential pass	Without preferential pass	Total
	All household members			Workers		
Low	28%	72%	100%	3%	97%	100%
Medium	14%	86%	100%	14%	86%	100%
High	4%	96%	100%	8%	92%	100%

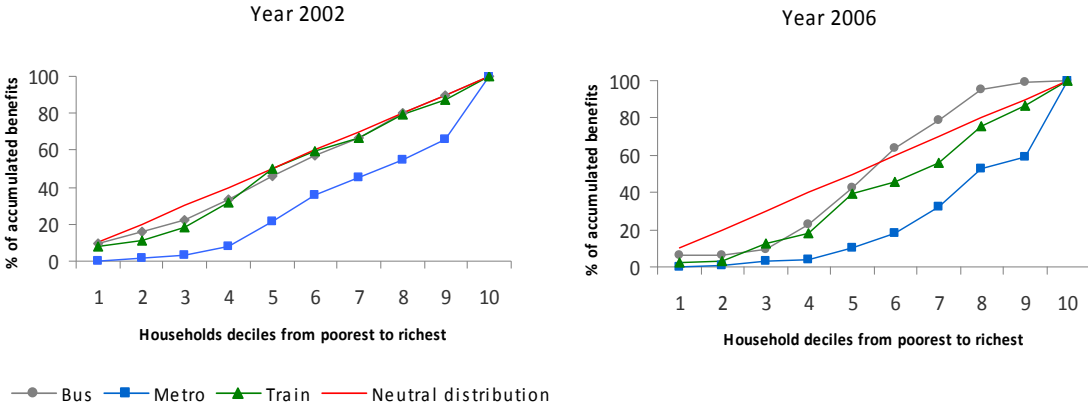
Source: Table 3.5 from ECORYS and NEA (2004).
Note: In Sofia 18% of trips are made with preferential passes.

Buenos Aires, Argentina

Foster (2005) and Bondorevsky (2007) analyzed three transport subsidies in the Greater Buenos Aires area. These included the operating subsidy for the metro (SUBTE) and sub-urban rail (AMBA) as well as the subsidy introduced in 2002 for buses ('Colectivos') reviewed in Box 4. These are all examples of supply side subsidies where scant efforts are made to target benefits to poor households.

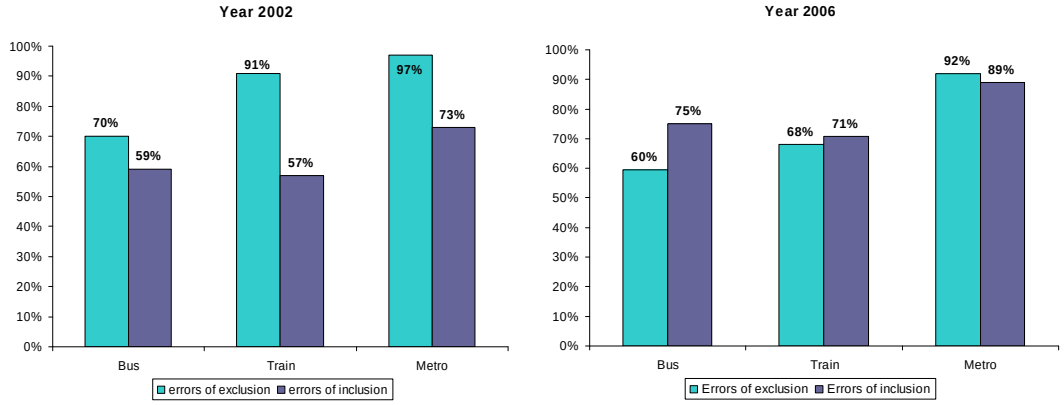
The results show that in all cases these subsidies are regressive. Moreover, when a comparison is made between 2002 and 2006, it is clear that subsidies are becoming more regressive (Figures 10 and 11). Besides, as shown in Figure 12, errors of inclusion increased significantly, another indication of the failures associated with supply side subsidies. Overall, the analysis shows that share of subsidies accruing to the middle and high income households is increasing. The estimated Quasi-Gini coefficients for each subsidy in 2006 was 0.06 for AMBA, 0.2 for Colectivos, and 0.48 for SUBTE).

Figures 10 and 11: Distributive incidence of transport subsidies in Greater Buenos Aires



Source: Bondorevsky (2007).

Figures 12 and 13: Errors of exclusion and inclusion of transport subsidies in Greater Buenos Aires



Source: Bondorevsky (2007).

Mexico City

A recent case study by Flynn (2007) shows that, contrary to popular beliefs, transport subsidies in Mexico city are not particularly pro-poor. Table 5 shows some of the distributive parameters of the different subsidies considered, as well as an estimate of the Ω coefficient based on the information presented in that study.

Table 5: distributive impacts of different supply side subsidies in Mexico City

Subsidy	Distributive impact (Ω)	Error of inclusion	Error of exclusion
Metro	1.00	52%	68%
RTP (Buses)	1.14	45%	68%
STE (Trolleys)	0.96	54%	68%

Source: Flynn (2007).

The three subsidies analyzed by Flynn (2007) are supply side subsidies and with the exception of the RTP subsidy —which is mildly progressive— these subsidies are neutral in terms of their distributive impact. The high errors of exclusion point to the relatively low use of these transport modes by the poor. In fact, the 'colectivos' (small buses) are the most popular transport mode for the poor, but this mode does not receive any subsidies.

Santiago, Chile

Another recent study for Santiago, Chile, shows similar results (Gómez-Lobo, 2007) regarding supply side subsidies and some types of demand subsidies. Table 6 presents the results for different subsidy policies.[22]

Table 6: Distributional impacts of transport subsidies in Santiago, Chile

Subsidy	Quasi-Gini coefficient	Error of inclusion	Error of exclusion
Student preferential pass Buses	-0.16 (benefit) -0.11 (funding)	50.6%	70.0%
Student preferential fare Metro	0.13 (benefit) 0.28 (funding)	75.5%	97.2%
Metro investment grant	0.27	77.7%	88.7%
Direct transfer	-0.34	36.5%	51.6%

Source: Gómez-Lobo (2007a).

The student preferential fares in buses and metro are funded through cross subsidies. Thus the distributive impact of these policies must be analyzed both from the benefit and the funding side. In the case of buses, the distribution of benefits is mildly progressive. However, the funding of the subsidy is also mildly "progressive" in the sense that poorer households pay a disproportionate amount of the tax needed to fund the subsidy. These counteracting effects almost cancel each other out, making this categorical subsidy basically neutral. As discussed in Gómez-Lobo (2007a), this subsidy takes money from poor and rich households without student members and gives it to rich and poor households alike that have student members. In fact, 70% of poor households do not receive any benefit from this scheme.

[22] These results were obtained using data prior to the Transantiago reform of 2005-2007. Thus, they may not be representative of the current situation in Santiago.

The student preferential fare for Metro is regressive both on the benefit and the funding side, implying almost a neutral impact although the net effect is somewhat progressive. However, judging by the error of exclusion of this subsidy it can be seen that very few poor households gain from it.

The only policy with a positive distributive impact is the direct monetary transfers implemented in 2004, 2005 and 2006 described in Box 1. This policy was much more effective in reaching the poor. The error of inclusion is quite low, as far as subsidy policies go.

Mumbai, India

A case study of Mumbai, India, shows similar results for supply side subsidies (Cropper, 2007). Two supply side subsidies are analyzed in that study, one to cover operating losses for bus services (representing around 30% of fares) and another for rail services (a small shortfall of 2% of costs). The incidence of these subsidies is presented in Table 7. This table presents the cumulative percentage of the population by income groups and the cumulative percentage of total subsidies accruing to each group. It is simply a tabulated representation of the relative beneficiary curve. The final column presents the Ω coefficient for two different definitions of the poverty line; one assumes poverty is defined to include households earning less than 5K (27% of households) and the other assumes it includes households earning less than 7.5K per month (54.4% of households).

Table 7: Subsidy incidence in Mumbai, India

Income group	Cumulative percentage of households	Cumulative percentage of bus subsidy	Cumulative percentage of rail subsidy	Ω Bus/rail
<5K	26.6	19.1	15.5	0.72 / 0.81
5001-7500	54.4	44.9	38.0	0.83 / 0.85
7501-10000	76.3	68.0	61.8	
10001-20000	94.1	92.2	88.3	
>20K	100.0	100.0	100.0	

Source: own calculations based on Cropper (2007)

The results show that these subsidies are not pro-poor. More than a proportional amount of the subsidy accrues to middle and higher income households. The errors of inclusion, shown in Table 8 are quite high, while the errors of exclusion are quite low. This is typical of universal subsidies that benefit rich and poor alike.

Table 8: Errors of inclusion and exclusion, Mumbai, India

Subsidy	Errors of exclusion	Errors of inclusion
Bus	10.0	92.6
Rail	26.1	86.2

Source: Cropper (2007)

7.3 Can transport subsidies do better?

With the exception of the means tested direct transfer implemented in Chile, all transport subsidies reviewed show either a neutral or regressive distributive impact. Thus, these policies are not doing much for the poor.[23] We have also seen that this is not particularly unique to the transport sector; most subsidies in the electricity and water sectors have the same neutral or negative impacts.

Can transport subsidies do better? This is an empirical matter that needs to be studied further. Quantitative simulations would probably help in reforming policies to improve their targeting properties. However, there is probably a limit to how progressive subsidies can be when policies are designed and executed within the narrow confines of the transport sector. This will happen for the same reasons that sectoral subsidies do not seem to function well in the utility sectors; first, because of the 'access problem' and, second, because there is too much variance in consumption levels for a subsidy based in consumption to discriminate well between poor and non-poor households.

One of the main obstacles to improve the performance of utility subsidies is the access problem; a significant group of poor people are not connected to these services and thus cannot benefit from utility price subsidies. The analogy of the 'access problem' in the transport sector is the prevalence of walking among the poor due to a lack of affordable fares for services that, if affordable, would be used by the poor.

Table 9: Walking as a percentage of all trips

	Poor	Non-Poor	Source
Mumbai, Indiaa	63%	45%	Cropper (2007)
Nairobi, Kenyab	57%	24%	Howe and Bryceson (2000)
Conakry, Guinea	78%	61%	SITRASS (2004a)
Douala, Cameroon	77%	52%	SITRASS (2004b)

Notes: a work trips, b percentage refers to the first trip (usually work related) reported.

Table 9 presents some evidence on the mode split between poor and non-poor households as regards walking. It is clear that poor individuals walk much more than non-poor households. Thus, subsidies that operate through public transit fares do not reduce the out of pocket cost of the mode chosen by many poor people, and a significant amount of benefits will accrue to higher income households.

One of the main reasons why transport affordability measures are adopted is to allow poor households to change the travel mode, shifting from walking to using motorized public transport. Thus, it could be argued that more subsidies are required so that the worse off in society can take public transport instead of walking. However, it is likely that fare reductions will only have a modest impact on modal split and most of the effort

[23] In addition, it must be borne in mind that urban transport subsidies do not benefit rural areas, where poverty is usually more intense and widespread.

will be wasted subsidizing non deserving households.[24] Focalizing subsidies directly to the poor or using these funds to improve access infrastructure (as it is usually the case that the poor households are located in places with difficult and costly access to motorized public transport) or walking infrastructure would be more helpful to needy households.

Even when the poor do use public transport, the economic characteristics of this service do not necessarily make it a good candidate to distribute benefits. As discussed by Alderman (2002), to distribute transfers in kind or through a price subsidy, the good in question should ideally be an inferior good (consumption decreases with a rise in income) or at least a strong necessity (consumption increases with income but less than proportionally). Subsidizing inferior or necessity goods generates self-selection of beneficiaries since higher households consume much less of the good than low income households.

Unfortunately, the evidence indicates that public transport tends to be a luxury (consumption increases more than proportional to increases in income) or a weak necessity, at least for low levels of income. The data presented in Table 10 gives an example from Ukraine (urban households) showing that public transport is a luxury good up to the highest income category.

It is usually the case that, in many developing countries, the relation between public transport expenditure and income has an inverted U shape, as is shown in Figure 1. This implies that the self-selection mechanism discussed above will not operate well in the transport sector or at least not as well as with other goods. Subsidies transferred through untargeted fare reductions will benefit the poor but will also benefit many middle to high income households, making it, in most cases, a regressive subsidy.

Table 10: Expenditure on public transport per income group

Ukraine (urban households)	
Income per month	**Public transport share in total expenditure**
<4000	1.8%
4000-8000	2.2%
8000-12000	2.6%
12000-16000	3.0%
16000-20000	3.2%
> 20000	2.6%

Sources: NEA and ECORYS (2004) and Godard and Diaz Olivera (2000).

This structural characteristic may distinguish developing countries from developed countries. As income increases and private automobile ownership becomes more widespread, the use of public transport (at least buses) may become more of a necessity and used almost exclusively by lower income households. Of course, one cannot generalize, but this conjecture may explain why public transport subsidies are often found

[24] As an example, Cropper (2007) reports an elasticity of walking to bus fares between 0.06 and 0.08 for Mumbai, India. Thus, a 10% decrease in the bus fares would only decrease walking trip by less than 1%.

to be progressive in developed countries (Frankena, 1973; Asensio, Matas and Reymond, 2003).

Given the structural limitations that impinge on the performance of transport subsidies, it is important to consider broader instruments and policies than those applied in the transport sector. Greater considerations should be given to means targeted subsidies — even when distributed through transport subsidies— and the use of general welfare policies to distribute transport benefits to the poor. The evidence presented above for utility services and transport subsidies shows that only subsidies that are targeted using more sophisticated procedures than mere price reductions have progressive impacts on the income distribution.

In addition, given the prevalence of walking or cycling by poor people noted above, it may be more effective to use resources to improve sidewalks, crossing bridges and other non-motorized transport infrastructure instead of motorized transport subsidies. This point has been made by Badami, Tiwari, and Mohan (2004) for India, How and Bryceson (2000) for East Africa, SITRASS (2004a and 2004b) in Conakry, Guinea, and Douala, Cameroon and Peng (no date) for Chinese cities, among others.

8. CONCLUSIONS

This paper has reviewed the theoretical and empirical literature on public transport affordability. In this section we present the main lessons and discuss options for future research needed to optimize transport policies aimed at making transport more affordable for the poor (and only for the poor).

1) *Transport affordability is an important issue, but current policies are not doing much to improve it*

Transport affordability is an important issue in developing countries. However, the available evidence seems to indicate that current attempts to deal with this issue are not successful. Supply-side subsidies are, for the most part, neutral or regressive—even without considering the possible effects these subsidies have on operational efficiency. Demand-side subsidies perform better, although many of them do not improve income distribution.

2) *More needs to be done to target subsidies better*

It is important to stress the importance of the targeting the performance of subsidies. A policy that has a neutral impact on income distribution is like distributing money randomly in society. If the policy objective is to help the poor by using transport subsidies, it is imperative to move away from supply-side subsidies towards demand-side subsidies. Although this will depend on the policy context, consideration should be given to the possibility of focusing subsidies using some type of means-testing procedure.

3) Can current subsidies be improved?

One of the conclusions of this paper is that there is very scant literature on the incidence of transport subsidies on income distribution. Thus, more research needs to be done to determine how current transport affordability policies can be improved. This requires quantitative simulation of different subsidy options within the constraints of each policy context. For example, in Santiago, Gómez-Lobo (2007a) shows that funding the student preferential pass by general taxation instead of cross-subsidies (from other type of users) would significantly improve the distributive impact of this policy.

However, there are limits to how much can be done to improve the distributive impact of current subsidies. Analogous to the public utility experience, in transport there is an access problem that will structurally limit the success of affordability policies; the reason is that poor households walk (or cycle) relatively more than higher-income groups. Therefore, any affordability policy that operates through public transport fares is bound to miss a significant group of poor households that do not have access to the system.[25]

In addition, even when the poor use public transport, they tend to demand fewer trips than the rich since there is evidence indicating that, for low levels of income, transport demand has the characteristics of a luxury good (demand increases more than proportionally relative to income). This implies that when subsidies are designed to operate through fare reductions, the subsidy as a proportion of income will increase as a household's income increases. In these cases transport is not a very promising good to distribute price subsidies.

4) More consideration should be given to other welfare initiatives outside the transport sector

If public transport subsidies have structural limits, other policies should be pursued. Subsidies could be channeled to the poor through other mechanisms that are external to the transport sector, even if the original motivation is improving transport affordability. An example is the direct monetary transfer used in Chile. This type of policy could certainly be applied in countries like Mexico that have well-developed welfare programs. However, even in countries with less-developed welfare institutions, subsidies may be channeled through other means. For example, transport vouchers may be given through the same distribution channel used to distribute food subsidies, health services for the poor, or assistance to children in poor schools.

If it is assessed that by no means it is possible to use the general welfare system, the use of subsidies to reduce fares would not be the best policy alternative. As was stressed several times in this paper, when access is a problem and low-income households have to rely on walking or cycling as their main mode of transport, the best policy option might be to redirect public transport subsidies to fund infrastructure benefiting these modes, or more generally, all infrastructure that improves access.

[25] Unless the policy in question is able to significantly alter the travel decision of households, which is unlikely given the level of monetary subsidies compared to poor households income levels.

The main principle is to separate the motivation for a subsidy (transport affordability) with the mechanism used to distribute the benefit. To fulfill the objective of a subsidy policy, the most effective and progressive instrument should be used, even if this operates outside of the transport sector.

5) *More cooperation between transport specialist with social and welfare professionals is called for*

In order to improve transport affordability measures, more collaboration is needed between transport specialists and social and poverty specialists in each country. This will enable sectoral policy makers to evaluate the range of opportunities available to implement pro-poor affordability measures, avoid untargeted subsidies and integrate transport social concerns into wider poverty alleviation efforts.

It may well be that the urban/rural income divide is so wide in a country that any transport policy benefiting the urban poor will be regressive. In this case, the whole issue of public transport affordability may be called into question. The general message is that social issues in transport policy should not be analyzed in isolation.

6) *Data-based policy decisions are required*

As an end note, the lack of quantitative data on the sources, distribution and impact of subsidies is alarming, in particular in developing countries. The only way to improve policy design is to use robust estimation techniques to simulate the impact of the available set of policy options. This requires a conscious effort to generate the necessary data (in particular, frequent travel surveys with socioeconomic variables) and a firm commitment to use the data when designing particular policies and openly debate the results of each of the policies being analyzed.

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APPENDIX 1: WHY DIRECT TRANSFERS ARE BETTER THAN PRICE SUBSIDIES

Let's imagine a situation where the price of public transport was initially p_{pt}^{0} and at this price the individual made q_{pt}^{0} trips and consumed q_o^{0} of a basket of other goods. The authorities now wish to decrease the price of public transport. To this end, they subsidize the public transport fare, which decreases to p_{pt}^{1}. At this lower price the individual consumes q_{pt}^{1} trips and q_o^{1} of other goods, and the well being of the individual (as reflected by the utility mapping) is higher than in the original situation.

The cost to the authorities of subsidizing this transport cost of the individual is:

$$S = \left(p_{pt}^{0} - p_{pt}^{1}\right) \cdot q_{pt}^{1} .$$

With the subsidy, the individual faces the following budget constraint (y being his income):

$$p_{pt}^{1} \cdot q_{pt} + p_o \cdot q_o = y .$$

Clearly, the final consumption basket chosen by the individual must be feasible, so that it must be true that:

$$p_{pt}^{1} \cdot q_{pt}^{1} + p_o \cdot q_o^{1} = y .$$

What if the authorities instead of subsidizing the price of public transport just gave the individual a transfer of S? The budget constraint faced by the individual is now:

$$p_{pt}^{0} \cdot q_{pt} + p_o \cdot q_o = y + S$$
$$p_{pt}^{0} \cdot q_{pt} + p_o \cdot q_o = y + \left(p_{pt}^{0} - p_{pt}^{1}\right) \cdot q_{pt}^{1}$$

It is trivial now to show that the optimal basket chosen with the price subsidy is feasible under this new budget constraint:

$$p_{pt}^{0} \cdot q_{pt}^{1} + p_o \cdot q_o^{1} = y + \left(p_{pt}^{0} - p_{pt}^{1}\right) \cdot q_{pt}^{1} .$$

Thus, the individual could choose the same consumption basket with a transfer as the optimal one chosen with a price subsidy, but it may do even better than that as shown in the graph. With the price subsidy, the individual moves from point A to B. With the transfer, the original budget constraint moves to the right until it reaches point B (since we have already shown that point B is feasible with the transfer it must be on the new budget constraint). However, with this last budget constraint the individual will have other options available —such as point C— that increase its welfare from U^1 to U^2.

Thus, for the same amount of resources distributed, the individual is better off with a transfer than with a price subsidy. However, it is also evident that consumption of the good is lower than if a price subsidy was used. Thus, if society would like to promote the actual physical consumption of the good or service, a price subsidy may be preferable.