BASIC ACCESS TO PUBLIC TRANSPORT IN A LATIN AMERICAN CITY. THE CASE OF MONTEVIDEO

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ABSTRACT

To assess mobility in cities from developing countries, it is indispensable to consider basic dimensions of access. Unlike industrialized countries, the discussion on individual motorized mobility is not central because these cities still present an important public transport percentage of modal share. Taking into account the captivity of some social sectors one of the main threats to accessibility is to reach the network and affordability issues. This paper explores the network proximity, density and affordability for different social groups in Montevideo (capital of Uruguay).

I use GIS data of public transport system stations in order to get proximity measures and also to get the actual coverage of the network. Besides, from household survey's data I compute an average income and motorization levels for each census tract. After computing spatial measures of proximity through buffers at block level I estimate three distance thresholds for each social group. To calculate affordability for each income group I use Income and Spending National Survey and I dissagregate between spending in public and private transport for each social group. Using the whole household expenses I compute an index to weight transport spending regarding other basic goods.

The evidence indicates that demand governs public transport supply both spatially and temporally. Thus, the dense network penetrates in areas of high density and travel attraction. Those low density areas with deficient supply are inhabited by low income population. Regarding household expenditure, this variable shows a regressive distribution in terms of access to transport similar to those that might be encountered in other cities. In this item, composed overwhelmingly by public transport consumption, households in the lowest quintiles spend a higher proportion of their income than higher quintiles.

The results of analysis indicate that basic access is a key dimension to understand accessibility in developing countries environments. It also poses some challenges for urban growth models regarding transit network limits and sustainability. In the same token, expenditure analysis results show that wealthier social groups have better access for lower expenditure (proportional to their income).

INTRODUCTION

More often than not, urban and regional analyses study the geographical distribution of goods and services. For instance, research work that accounts for the quality of schools attended by children living in different areas. In general, spatial distribution of urban opportunities and services merely reflect the social spatial distribution of these goods: areas with low performance schools are also those neighborhoods in which lower income households reside.

Accessibility –related to transportation opportunities- or in its simplest version, the distance is generally considered as a collateral factor. In many cases it is not considered at all, giving for granted the ability of individuals to reach places. In these cases, access is a synonym of quality of service provision on place (the education provided to children who attends to a given school) but no attention is paid to an earlier stage of the supply side which is the obstacle to reach places (e.g. schools).

Indeed, this paper concerns about that point traditionally to which not enough attention is paid, that is, the territorial accessibility, the ability to reach opportunities where they take place. I argue that this variable is a capital to be activated by households in order to take advantage of other opportunities such as labor market, health or education.

Specifically, this paper analyzes the socioeconomic distribution of two basic dimensions: coverage of the public transport network and the ability to pay for this service. In this sense, the paper analyses how these variables behaves among different socioeconomic groups.

To fulfill its objectives, the paper is divided into three sections. First, the conceptual-analytical framework on public transport and accessibility from a social welfare and protection perspective is developed. Second, empirical evidence is analyzed. In this section I describe territorial coverage of the public transport network in the city and the payment capacity of the various socio-economic groups. This analysis is complemented by the description of tariff structure and the role of subsidies as compensatory devices. The final section summarizes and discusses the main findings of the paper.

THEORETICAL FRAMEWORK

Accessibility concept

Miralles and Cebollada claim that accessibility: "... refers to the ease with which each person can overcome the distance between two places and thus exercise their right as a citizen (...) accessibility along with a territorial dimension, is also a individual characteristic in relation to the number of options available to citizens to access different places and activities ... "(2003 pp. 14)[1].

It is noteworthy that an individual may have very little ability to move long distances in space and yet have very good accessibility by proximity. Conversely, it can be very easy to move to many parts of the city, but not to the one a person needs to get, so that, despite their high level of mobility, accessibility remains low. A person may show a lot of displacements during a day –to be very "mobile"- but only because he must travel long distances so his accessibility is really lacking. In this regard, opportunities urban location plays a significant role. Theoretically, to overcome distances there are two possible solutions: moving individuals to the activities or "moving" activities towards them (nearest location). For example, accessibility to employment issues could be resolved in two ways: with an adequate transportation system that takes people to areas with high density of job opportunities or through placement of opportunities closer to where they live. The motility concept (Kaufmann et al., 2004) is similar to the accessibility one and points out potential mobility as the key factor. This theory estreses the need to consider structural and cultural dimensions to study mobility.

One of the key components of these definitions is related to the notion of ability to "reach". It also underlies the idea of potentiality, that is, that this capacity refers to which places the individual can reach and goes beyond the known or observable movements.

Accessibility, welfare and equity

The definition of accessibility gives a prominent role to notions such as rights, citizenship and inclusion. Ultimately, what stands out is the public nature of mobility and accessibility, recognizing the fact that it is an asset that should be protected from the whole society. In terms of Ascher, "... today, mobility is a key condition of access to employment, housing, education, culture and leisure, family. The right to work, to have

[1] Own translation from spanish.

a home, to training, now involving the right to mobility (...) in a sense this right to mobility is a precondition of the other rights ... " (2005: pp.19)[2]. Of course, this apparent political statement has a very strong conceptual counterpart. It implies the existence of a causal relationship between mobility and access to other goods and opportunities with direct impact on the quality of life of people.

Indeed, this relationship has been tested and described relatively frequently, especially by authors from industrialized countries. The central questions of these approaches refer to the mobility and accessibility of the people -especially from low-income sectors. By the same token, this literature warns about the impact ability to overcome geographical distances between one point and another has in the odds of people to participate in the city life and benefit from the opportunities and resources that urban space offers.

First, mobility and accessibility is not a matter of free personal choice and can have very strong structural constraints (Massot and Orfeuil, 2005; Wenglenski and Orfeuil, 2006). It is therefore important not to fall into the "temptation" to think that mobility reaches all levels of society equally. In this sense, Kaufmann (2002) argues that it should not be confused between higher transport speeds and movement as an imperative of modern societies with adequate accessibility for the whole population (see also Urry, 2007). In short, the starting point for thinking about mobility, accessibility and welfare is that they cannot be taken for granted. Moreover, accessibility is an attribute that is not distributed equally among individuals and households. There are people who are more likely to move than others, some people can do it much faster than others, some may do it into much more directions than others.

Several research works reveal a number of factors hinder or foster people access diverse geographical locations. Beyond a wide array of operating concepts and dimensions with slight differences (Cass et al., 2005; Flamm and Kaufmann, 2006; Kaufmann et al., 2009, 2004; Paulley et al., 2006; ver Social Exclusion Unit, 2003; Titheridge, 2006; Urry, 2007) Hernandez (2012) builds on this background and points out four dimensions that should be considered: a) Supply: related to the good that is provided: among others, network extension, quality in terms of both comfort and information available to individuals, b) Institutional : it refers to the components that define the degree of monetary commodification of that network. The fee structure and regulation, the introduction of subsidies and which are under design and usage rules relating to the payment of the fee, c) Individual characteristics: income, available time, skills and abilities to take advantage of the system, physical capacities, and d) Urban form: related to socio-territorial dynamics that are more responsive to structural factors and individual decisions the location of activities and the residential location of the different socioeconomic (2012: pp. 123-124).

Public transport as a social policy

Why should we put public transport at the center of the discussion? First, because there is an assumption that the public transport policies could be considered as part of the systems of social protection (i.e. those policies that aims to deepen the social

[2] Own translation from spanish.

development and equity). Additionally, and as mentioned above, this is the most relevant device to decommodify accessibility and mobility in general.

Esping-Andersen (1990) defines decommodification as the individual's ability to access welfare regardless of their performance in the market. Shall we represent a decommodification continuum, the ends could be synthesized in two defining features: in the case of high decommodification payment capacity of the individual is virtually indifferent to the ability to use the system. In a minimal scenario, their ability to move from one point to another in the city depends almost exclusively to be able to pay. The ability to pay, in turn, is linked to the performance of individuals in the market, in the labor market generally. Assuming the status of an unemployed individual with no income, in a context of very low decommodification motorized mobility capacity is negligible. In the opposite scenario, this will not be a relevant factor as long as mobility will not demand pocket expenses. In a high decommodification scenario, funding the provision of good would come from general revenues, so that elements such as taxation and subsidy structures and targeting become relevant. In this sense, in CEPAL (2009) explicitly recognizes public transport as one of the policies that could be considered part of the "neighborhood" of social policies with other basic services such as water, energy and telecommunications.

As with other social policies, three questions should be answered regarding public transport: who pays (how much and with which funding source), who has access to good and what is the service quality. If an important share of the financial contributions to fund the system comes from higher-income sectors even when less affluent sectors are frequent users of the system, the capacity to decommodify accessibility is very high as well as the potential to redistributive. For instance, a single tariff system (in which the user is not charged according to the traveled distance) tends to favor sectors located in the suburbs and outlying areas of the central areas of the city. Indeed, passengers traveling shorter distances pay a somewhat higher rate than they would if the rate was set according to distance.

To reflect on these questions allows us to assess some indicators related to two of the relevant dimensions for accessibility: one related to the network (coverage) and the institutional (tariff structure and subsidies). While not exhaust the relevant questions about commodification, will cast light on some dynamics of inequality in access to this right, and general welfare, as well as possible mechanisms that attempt to reverse these dynamics. In the next section I illustrate this discussion with empirical evidence.

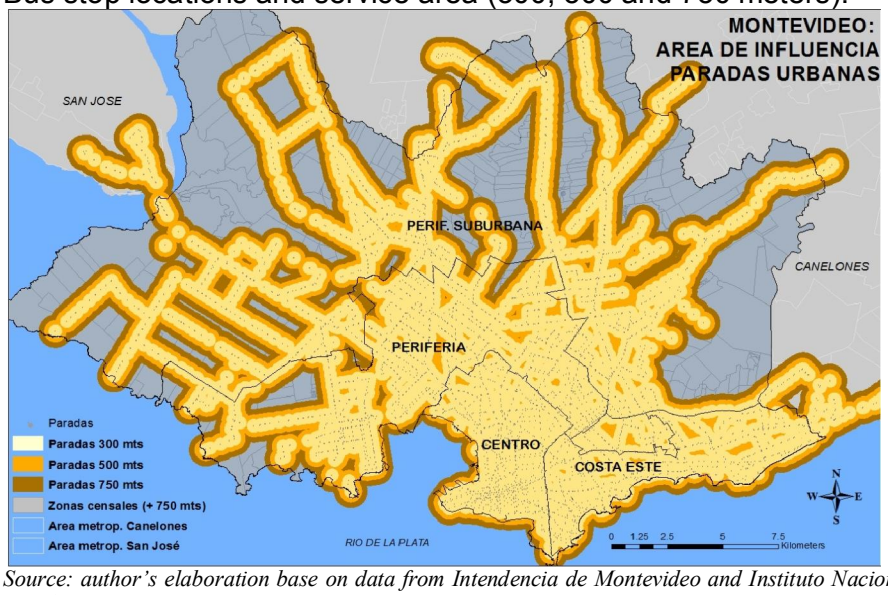
ACCESS TO THE NETWORK AND AFFORDABILITY

Basic access

The public transport network in Montevideo (with about one million trips a day) operates 136 routes and comprises approximately 1500 buses, 4792 stops and 3 transfer stations. The vast majority of them are of a regular (non-local or differential) and is a source or destination downtown.

Montevideo's network density is very high for the whole city, leaving very few populated territories without transit supply. With varying number of services, this network seems to reach all areas of potential demand in the city. In that sense, one could argue that Montevideo is a city with a very high connectivity from public transport. By observing its catchment area, it is salient that the center and the east coast seem to be uniformly painted with the color corresponding to 300 feet away. In suburban areas (towards northern region) the network starts to "follow" the "fingers" logic as it developes in the territory.

Figure 1
Bus stop locations and service area (300, 500 and 750 meters).



Source: author's elaboration base on data from Intendencia de Montevideo and Instituto Nacional de Estadistica.

Through the computation of public transport service areas it is also possible compute the population within that area. This allows to weight areas with basic access deficit by the amount of people that live there[3]. As shown in the table below, it is marginal, in proportional terms, the number of people facing very significant obstacles to simply

[3] I adopt the same methodology as Gutierrez and García (2005). They compute area proportion covered by the transit service area and they use the same proportion to calcúlate the population actually served. For instance, in a census tract with 100 persons given that the buffer from bus stop covered 50% of that area, it is assumed that 50 persons are within that distance to the network. When the proportion is 90% or higher, the assumed population coverage is 100%.

access a transit station (i.e. that is located over 750 meters from the nearest stop). Regarding the percentage of the territory of the city that lies at that distance, it is easy to deduce that the very low population density areas are the ones which suffer severe obstacles to basic access. This is an example of the supply side effectiveness to meet demand, and its ability to prevent spread to areas of low potential demand.

These results constitute a positive element, one way or another, the system has reached almost any territory portion with demand for transportation. When it refers to still moderate barriers to access to public transport (stops at over 500 meters) the number of people increases, reaching only about 2% of the population of Montevideo. Again, the land area in this situation suggests a very low population density, which is nevertheless clear that in this case these are sectors with substantially higher population density than the previous situation. It is worth having in mind that in this stratum are beginning to register cases in all regions, with somewhat greater intensity in the periphery and in the southern fringe of the suburban periphery.

Table 1
Montevideo: area and population under distance to network thresholds. In percentages, number of persons and meters.

Distance to network (*)	% área	% persons	People (n)	Average distance (**)
More than 300 meters	53.70	8.83	117,045	604 mts
More than 500 meters	38.72	2.17	28,752	1006 mts
More than 750 meters	26.48	0.70	9,348	1322 mts

Source: own calculations based on GIS data from Intendencia de Montevideo and census data from Instiuto Nacional de Estadística (2004).
(*) Each group includes the people of the adjacent category (e.g. "More than 300 meters" includes people in a census track with "More than 500 meters").
(**) Euclidian distance from blocks' centroid within each threshold (300, 500 y 750 meters).

In short, one of the most important findings is that in Montevideo, almost 9 out of 10 people live in a census tract with a bus stop within 300 meters or less. This indicates a very high connectivity of the territory in the city and its people, but also indicates that some territories, because of their location, generates some minor obstacles to about 9% of the population (which is more than 300 meters away from network) and pretty significant obstacles to 2% of the population (just under 30,000 people). Probably these basic access deficit enclaves are the product of previously uninhabited land to which the system has not respond to the new demand yet.

Disaggregating the above information by socioeconomic status, we can see how, while maintaining very high levels of basic access to the network, it is also true that moderate or severe costs are paid by residents in areas with higher concentrations of low-income households. Thus, in cases where there is a moderate obstacle distance to access the network (location over 300 meters) all of the areas in such a situation are those of lower socioeconomic status. Similarly, when the distance threshold rises to 500 meters, once again the tiny minority with basic access barriers are almost exclusively from the lower stratum.

Table 2
Montevideo: area and population under distance to network thresholds by SES. In percentages, number of persons and meters.

Distance to network (*)	High concentration of low income hh	Middle concentration of low income hh	Low concentration of low income hh	Total
More than 300 meters	16.1	3.1	1.4	8.3
More than 500 meters	4.0	0.1	0.0	1.8
More than 750 meters	1.1	0.0	0.0	0.5
Average distance (**)	204	118	114	162

Source: own calculations based on GIS data from Intendencia de Montevideo and census data from Instiuto Nacional de Estadística (2004).
(*) Each group includes the people of the adjacent category (e.g. "More than 300 meters" includes people in a census track with "More than 500 meters").
(**) Euclidian distance from blocks' centroid within each threshold (300, 500 y 750 meters).

Households expenditure in urban transport

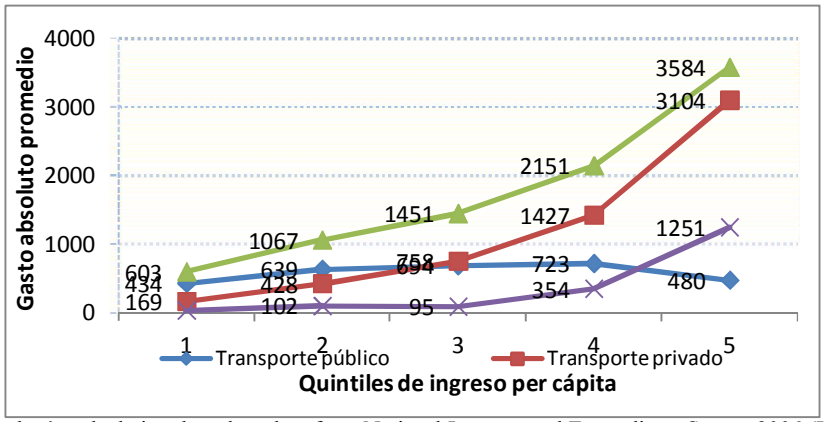
So far the paper has presented evidence on a basic version of spatial availability of the network, which does not necessarily guarantee its use. One of the elements which affects actual ridership is the ability to pay for the service. Of course, this capability is non-spatial and also defines the basic access to public transport. Therefore it is relevant to include the financial burden as one dimension of the access to service.

As stated by Thompson (2002) urban transport represents a high cost to Latin American region, and not just for countries but also for families. For this author the types of cost are twofold: a "forced" one related to mandatory trips (e.g. to work) and an "optional" one that has to do with the choice of modes of varying quality and thus cost. Financial burden on families provide clues about the ability of households to pay for public transport as well as how those costs are distributed among different social economic status (Carruthers et al., 2005). One way to assess these costs is to analyze households' expenditure structure and to measure the share of urban transport.

This assessment should consider on the one hand the percentage of income that is effectively used to consume products and services related to transportation. On the other, it is also necessary to consider which goods the transport "competes" with in terms of expenditure.

To begin, it is worth analyzing the absolute households' spending on urban transport. As expected, higher-income households spend, in absolute terms, more than households in the lower income strata. The only category where this is not true is spending on public transport, which appears quite stable for all quintiles and is even somewhat lower in the highest quintile regarding the three intermediate lower. Nevertheless, looking at overall urban transport expenditure an association between income level and spent money exists. It is noteworthy that most of all spending responds to the use of private options in two most affluent quintiles.

Chart 1
Montevideo: Average household expenditure on transport sub-items of item as per capita income quintile. In pesos (current values of 2005).



Source: author's calculation based on data from National Incomes and Expenditure Survey 2006 (Instituto Nacional de Estadística)

Of course, to compare between SES groups, it is relevant to consider the relative costs in different areas. The following table shows the structure of household expenditure of Montevideo on their total income discriminating between per capita income quintile groups. The items nutrition, housing, health are salient in household expenditure structure for the whole population.

However, when considering the information discriminated by household income, expenditure structure is disrupted. Indeed, the case of food is notorious. Among households in the first quintile this sector undertakes on average over a third of their income. Meanwhile income quintile increases, its importance decreases to almost a tenth of the current income of households in the top quintile. As for the other significant items as a share of household income, transport also has a stable distribution with low income levels somewhat higher figures than the richest households.

At the same time, in the case of health association is more obvious and is straightforward: the richest households tend to spend a higher proportion in this area that the poorest. This difference responds to the fact that low quintiles –specially first and second- use free health services provided by the state. On the other quintiles, market based solutions affects that involves the payment of specific fees and copayments for certain services affects expenditure.

Table 3
Montevideo: expenditure over total household income by item and income quintiles. In percentages.

ITEM	1	2	3	4	5	Total
Housing	28.2	28.4	27.5	24.7	24.9	26.7
Food and soft drinks	34.8	23.7	18.6	15.3	10.6	20.6
Transport	**7.7**	**7.8**	**7.8**	**8.4**	**8.6**	**8.1**
Health	3.2	7.9	10.0	10.1	8.7	8.0
Leisure and cultura	4.7	4.5	4.7	6.0	6.4	5.3
Other godos and services	5.8	4.3	4.0	4.0	4.1	4.5
Communications	4.5	4.7	4.7	4.2	3.9	4.4
Furniture and household ítems	4.3	3.0	3.1	3.2	4.5	3.6
Clothing and footwear	4.5	3.1	3.2	3.2	2.9	3.4
Restaurants and hosting services	1.6	1.8	2.8	3.3	4.3	2.8
Education	.5	1.1	2.2	2.5	2.2	1.7
Alcoholic beverages	2.3	1.8	1.7	1.3	1.0	1.6
Not consumption expenditure	1.0	1.2	1.4	1.7	2.6	1.6
Savings	-2.5	7.1	8.9	12.4	16.2	8.4

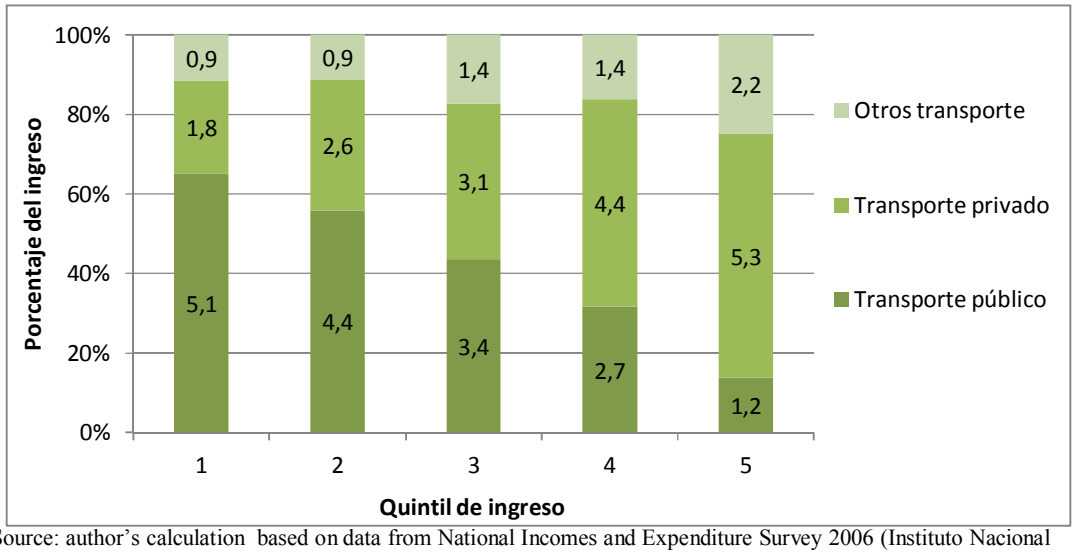
Source: author's calculation based on data from National Incomes and Expenditure Survey 2006 (Instituto Nacional de Estadística)

Between the two lower quintiles -particularly in the first one- priority to food goods coupled with housing expenditures (in this case with very similar weight to all strata) is remarkable. Of course, the reasons for this situation can be found in the amount of income on which the expenses are divided and, in the case of food especially in the fact that they are in the lower quintiles with concentrations of larger households. This leads to a "fixed" budget in these households since the remaining income is extremely scarce. Put otherwise, in the poorest households, disposable income by deducting the cost of food, rent and maintenance of housing is very small. Transportation spending must accommodate to this small financial space competing thus with basic goods.

As stated earlier, beyond food and shelter, other expenditure items (i.e. health and education) express the trace of Uruguayan social protection template. Indeed, the poorest households do not seem to have to devote a significant portion of their income to health and education. Meanwhile richer households must spend in these goods as they do consume it from the market. Of course, in these cases, the differential investment results in quality differential as well. Urban transport item does not fit with the logic mentioned above in which spending share appears to be stable across all quintiles.

So far we have analyzed transport category as a whole. This sector includes though a number of components that goes beyond urban transport, many of which could even be considered luxury items (e.g. foreign travel). Therefore it is necessary to disaggregate these consumptions. Within this broader category, and as with the rest of consumption, those related to leisure or recreation are much more prevalent among higher-income households. The graph below shows that the general label "transportation" for poor households is synonymous with urban transport, namely the costs incurred in urban commuting.

Chart 2
Montevideo: internal composition of transportation item by income quintile. In percentages.

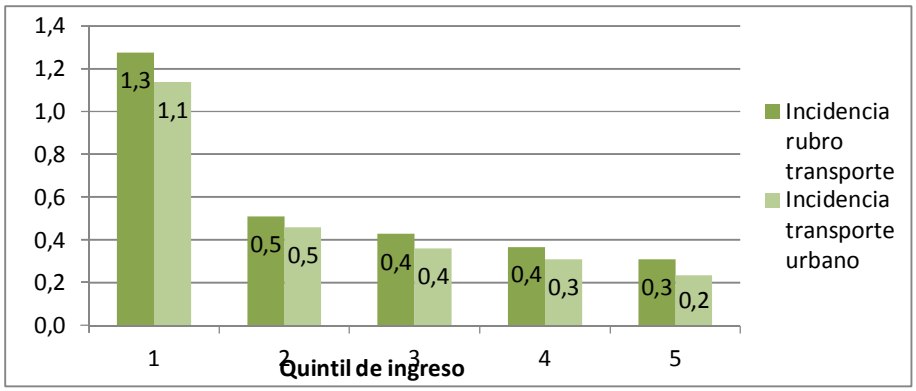


Source: author's calculation based on data from National Incomes and Expenditure Survey 2006 (Instituto Nacional de Estadística)

Within urban transport expenses, the most significant portion focuses on public transport. This situation reverses as one moves up the income strata until it is almost reversed in quintile 5. In the same way, is in the upper quintiles, particularly in the fifth, where there are large cost percentages in the sub-heading "Other transportation". So when referring to lower-income households relative to consumption in transport, must note that, at the lower end, almost 9 out of 10 monetary units were used for commuting in the city, while almost 7 out of 10 was devoted to pay the costs of public transport. As with other goods, one could speculate with some confidence that wealthier households consume higher quality services using private transport, among other things, greater convenience, speed and flexibility of destinations and schedules. The difference in the case of urban transport for these goods is that poorer households pay the same proportion of their income than the rich. Moreover, focusing on urban transport, stability ratios between quintiles slightly reversed. In fact, the bottom quintile has a proportionally higher cost to the richest quintile (and is the second of the five).

It should be added the fact that in these aforementioned homes "competition" is clearly with basic goods such as food or housing. The following chart presents the notion of "competitive impact" of transport on goods as an attempt to capture this phenomenon. This measure provides an accurate picture of many of the tensions faced by low-income households and how transport spending threats other basic consumption items. As already mentioned, the greater the pressure will be more threatened consumption of some goods if the need to consume transport is inexorable. And, of course, a high incidence of competitive value will mean a deficit of transport provision. This deficit will consist of suspension of activities that require expenditures or in the search for alternatives without monetary cost (e.g. Walk over long distances).

Chart 3
Montevideo: Competitive impact measure by income quintile. As a proportion of transporte expenditure on replaceable expenditure (*)



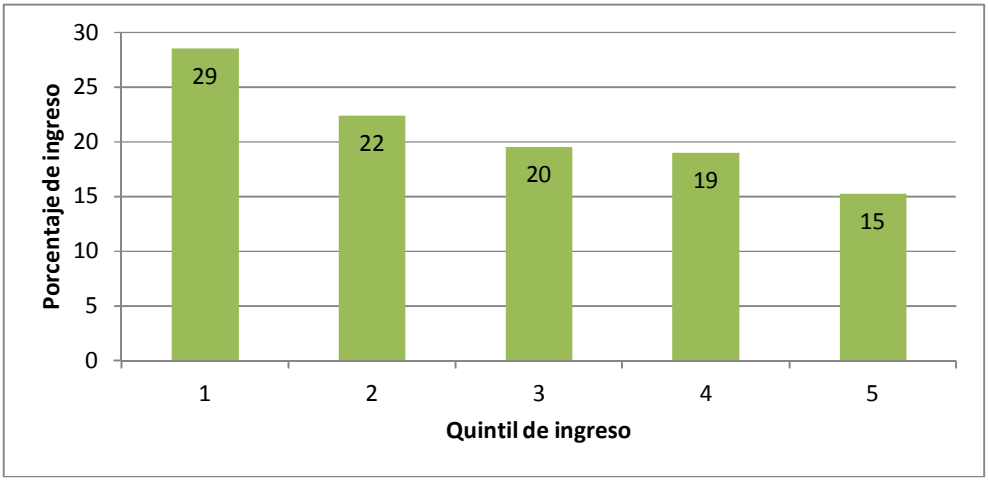
Source: author's calculation based on data from National Incomes and Expenditure Survey 2006 (Instituto Nacional de Estadística)
(*) Repleaceble expenditure consist of spending on items other than housing, food, furnitures, health and education.

The data are categorical about the regressive distribution of this measure, particularly in the case of households in the first quintile. Among them the proportion of revenue for the category "urban transport" is 110% of replaceable income by these households. This figure drops to less than half since the second quintile households and continues to do so with affluent households.

An additional element should be considered when analyzing transport costs. It has to do with the number of persons living at home. In fact it is a different way of looking at the same phenomenon as the number of people is associated with the cost of food and, as a result, to the disposable income in the household. To do so, I standardize the transport expenditure as a proportion of per capita income.

Looking at the distribution of this variable by quintiles, transportation spending for first quintile households is almost double the one for the most affluent quintile. In other words, when considering number of persons in the households, poor sectors devote a bigger share of money available for each member.

Chart 5
Montevideo: Transportation expenditure by income quintile. In percentages on household per capita income



Source: author's calculation based on data from National Incomes and Expenditure Survey 2006 (Instituto Nacional de Estadística)

FINAL REMARKS

The empirical evidence presented in this paper leads to raise some points on the two dimensions under analysis. First, regarding spatial coverage, Montevideo counts on a heavily dense public transport network and, thus, a very high coverage. The system has proven to be very well adapted to the demand. Put otherwise, the supply of public transport has been shaped by the demand spread in the territory. Indeed, public transport network penetrates in a dense manner in areas of high population density and travel attraction, and does so in a radial way (with relatively isolated linear axes that leave large territorial interstices without network coverage) in the lower-density areas. While still irrelevant, it is noted that the last growth process in the city (towards suburban areas) has moved people –the poorest- to city districts with the worse public transport supply.

However, the main weakness in terms of stratification and social inequality regards to affordability issues. Household expenditure exposes a regressive distribution on access to transport similar to those that could be found in other cities (ver PNUD, 2008; Thompson, 2002). This item, composed overwhelmingly by public transport consumption, represents a greater proportion of poor households income when compare to the most affluent ones. Also, considering the "competition" for basic goods and the amount of people living in these households, these differences are much more significant. In this context, the consumption structure indicates that for socially vulnerable sectors, more often than not spending in transport can take place only at the expense of other basic goods. This severely influences the quality and the quantity of transportation consumed as it becomes an item liable to be cut or replaced for alternative strategies such as extensive walking or bicycle commuting.

Shall we make this analysis on the health system, we would be studying the so-called pocket expenses, that is, the amount of money that households should pay for access to health. In this field, the most affluent access to private better quality options, which is reflected in a higher proportion of expenditure in relation to income. In the case of transportation that does not happen, while the middle and upper private options also access better quality (and probably as many trips to various destinations in the city), in proportional terms use less –or the same proportion- of their income than the other homes.

This situation takes place regardless of public authorities' efforts to step down rate and maximize affordability. These efforts focus on general aspects of the regular rate, that is, a strong investment for stabilization and eventual decline.

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